

Story Immersion May Be Effective in Promoting Diet and Physical Activity in Chinese Children

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ABSTRACT

Objective: To evaluate the effect of playing a health video game embedded with story immersion, Escape from Diab (Diab), on children's diet and physical activity (PA) and to explore whether children immersed in Diab had greater positive outcomes.

Design: Two groups, nonrandomized; 3 outcome assessments: at baseline, immediately after the game (post 1), and 8–10 weeks after the game (post 2).

Participants: A total of 179 Chinese children aged 8–12 years.

Intervention: The treatment group played Diab; the control group received no intervention.

Main Outcome Measures: Motivation; self-efficacy; preference for fruit, vegetables, water, and PA; as well as PA behavior.

Analysis: Adjusted changes to post 1 and post 2 by ANCOVA controlling for demographic and baseline variables.

Results: Children who played Diab had increased intrinsic motivation for fruit and water, self-efficacy for PA, and self-reported PA scores at post 1 (all $P < .05$). Children with higher immersion scores (above the median) had increased intrinsic motivation for fruit and water, and autonomous and controlled motivation for PA at post 1 (all $P < .05$). However, these were not significant at post 2.

Conclusions and Implications: Diab provides a promising innovative medium for promoting Chinese children's psychological correlates of diet and PA and PA behavior. However, its maintenance of effectiveness needs to be enhanced and mechanisms of change need to be investigated more thoroughly.

Key Words: video game, story immersion, fruit, vegetable, water, child, self-efficacy, obesity, diabetes (*J Nutr Educ Behav.* 2017;49:321–329.)

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INTRODUCTION

Obesity tracks from childhood into adulthood,¹ which shortens the life span, impairs functional ability, and diminishes quality of life.² Innovative technologies may provide alternative methods to encourage healthy behaviors for childhood obesity prevention.³

Recently, with the growing interest in video games not only as entertainment but also an educational medium,⁴ a steadily increasing number of video games have been developed for serious purposes, called serious games, which are characterized by both their quality of fun (ie, components that entertain players through animation, storyline,

and sound effects) and their seriousness (ie, components that promote behavior modification through tailoring, problem solving, and goal setting). Games for Health (G4H), a type of serious game, were designed to encourage players to modify their health-related attitudes and behaviors.⁵ The G4Hs are interactive and could influence players' cognitions and affect, generate positive emotions, and effect health behaviors.⁶

A narrative is defined as “the framework for the sequence of events that make up the plot we see, and the story we imagine.”⁷ Narrative is considered to be a basic game feature that could universally attract players and create playing enjoyment.⁸ Immersion in the story can be described as a state of mental absorption in which the player is consumed by the narrative.^{8,9} Story immersion refers to the process that a player experiences from active engagement with the narrative. A G4H embedded with

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well-crafted narratives may offer an especially suitable alternative for behavior modification, because players may experience psychological absorption while being fully immersed in games. The immersion could draw their close attention to the provided game context and behavior change components, and subsequently engender a greater health outcome.¹⁰

Escape from Diab (Diab) (Archimage, Inc, Houston, TX) is a G4H designed with story immersion to lower the risk of obesity and type 2 diabetes by changing attitudes and behaviors related to diet and physical activity (PA). In American children, positive changes in psychological correlates were observed in a 1-arm trial¹¹; improvements in behavioral indicators of diet and PA were observed in another study.¹² An individual interview study confirmed the acceptability and applicability of Diab among Hong Kong Chinese children¹³; however, no study comprehensively explored its intervention effect on both psychological correlates of diet and PA and PA behavior in Chinese children.

Thus, the current study conducted the intervention using Diab and examined its effect on improving the psychological and behavioral indicators of diet and PA in Chinese children. The authors hypothesized that (1) playing Diab would improve Chinese children's self-efficacy, motivation, and preferences for diet and PA; and (2) story immersion in Diab would induce a more beneficial effect.

METHODS

Study Design

This study was a nonrandomized trial. Participants in the intervention group played Diab in the school setting. The control group received no intervention. Outcome assessments were conducted at baseline, immediately after the game (post 1: about 8–10 weeks after baseline), and 8–10 weeks after the game (post 2: 8–10 weeks after completion of game playing; follow-up times were kept the same as the duration of intervention for each participating school). Written informed consent was obtained from each participant and parents or guardians. The study

was approved by the Committee on the Use of Human and Animal Subjects in Teaching and Research at Hong Kong Baptist University and was registered with the Centre for Clinical Research and Biostatistics.

Participants

At a significance level of $P < .05$, a power of 80%, and a constant correlation of 0.3 for 3 repeated measures, and taking a 20% dropout rate into account, 176 participants (2 groups, $n = 88/\text{group}$) were required to detect a small to moderate overall effect (Cohen's $d = 0.25$).¹⁴ Students with physical diseases and psychological illnesses that may have prevented their participating in PA and eating a normal diet were excluded. A total of 179 students aged 8–12 years (mean, 10.2 years; 103 males) from 4 primary schools with English as the medium of instruction were included. Four schools had a similar size and were located in different Hong Kong districts that varied in student socioeconomic status (SES) (1 from high SES, 1 from medium SES, and 2 from low SES according to local statistics).¹⁵ Participants in the same school were allocated into either the intervention or the control group to minimize potential moderating effects of SES.

Intervention: G4H: Diab

Diab was designed based on social cognitive¹⁶ (eg, functional knowledge on how to select appropriate portion sizes, self-efficacy to eat fruit for breakfast), self-determination¹⁷ (eg, autonomy to choose 20 kinds of healthy foods independently, competence to perform PA successfully), and elaboration-likelihood models¹⁸ (eg, identifying the problem in setting goals for vegetable intake, and finding the solutions).⁵ Using 3-dimensional scenes and animated characters, Diab tells the story of DeeJay, an athletic and healthy modern-day youth. He accidentally falls through the floor of an abandoned building into a world, Diab, where fruit, vegetables, and PA are forbidden by evil King Etes. DeeJay is befriended by a group of youth who begin to plot their escape from Diab by adopting a healthier lifestyle under DeeJay's guidance. The video game

was composed of 9 episodes. Within each episode were 3–4 action-adventure mini-games. The session-by-session mini-games in each episode were described elsewhere.¹² Behavior change components, mini-games with tailored knowledge, motivational statements, goal setting and review, feedback, problem solving, and behavioral inoculation, were integrated into Diab.⁵ Children were required to set goals at the end of each episode (diet goals in episodes 1–4 and PA goals in episodes 5–8). Goal setting in the game included action goals (ie, select specific foods and number of days to attempt goals) and coping goals (ie, identify the most likely barrier to achieving the goal and choose an effective solution for overcoming the barrier).

Procedure

Participants who had schedule conflicts with play sessions were assigned to the control group. The remaining participants who were available for the playing schedule were randomly assigned into the intervention or control groups. Participants in the intervention group ($n = 95$) were arranged to play Diab in the school's multimedia classroom on single consoles at the scheduled sessions (play session: 2 40-minute morning sessions before classes in 2 schools or 1 90-minute afternoon session after school in the other 2 schools). During each session, participants were asked to play 1 episode. Players could return to the current or previous episode and replay the mini-games if they had time remaining in the session but could not move to the following episode until the next game session. A translation of food and PA vocabulary was provided on the multimedia screen during play. Children in the control group ($n = 84$) received no intervention. The intervention lasted 8–10 weeks depending on the completion of game play. During the session, 1–2 researchers were present to monitor children's progress and provide assistance regarding possible hardware or software problems. After playing, a game controller worth \$50 HK and a game CD were offered to participants in the treatment group as incentives. The no-treatment

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