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Research Article

Digital Education to Limit Salt in the Home (DELISH) Program Improves Knowledge, Self-Efficacy, and Behaviors Among Children

Carley Ann Grimes, PhD; Alison Booth, PhD; Durreajam Khokhar, MS; Madeline West, BSc (Hons); Claire Margerison, PhD; Karen Jane Campbell, PhD; Caryl Anne Nowson, PhD

ABSTRACT

Objective: To determine the efficacy of a Web-based salt reduction program on children's salt-related knowledge, attitudes, and behaviors (KABs), self-efficacy, and intake of dietary salt.

Design: Pretest and posttest. An online survey determined KABs and self-efficacy and a 24-hour urine collection revealed salt intake.

Setting: Victoria, Australia.

Participants: Child–parent dyads (n = 102) recruited from 5 government schools.

Intervention: A 5-week behavior-based education program delivered via weekly online interactive education sessions.

Main Outcome Measures: Change in KABs, self-efficacy, and daily salt intake.

Analysis: Changes in outcomes were assessed using McNemar test, paired *t* test, and Cohen's δ (CD).

Results: A total of 83 children participated (mean age, 9.2 years [SD, 0.8 years]; 59% girls); 35% to 76% of children viewed weekly education session. Children with complete survey data (n = 75) had improved scores for salt-related knowledge (+3.6 ± 0.4 points; $P < .001$; CD: 1.16), behaviors (+1.3 ± 0.1 points; $P < .001$; CD: 1.08), and self-efficacy (+0.9 ± 0.2 points; $P < .001$; CD: 0.64), but not attitude. Children with valid urine collections (n = 51) showed no change in salt intake.

Conclusions and Implications: Participation resulted in improvement of salt related knowledge, self-efficacy and behavior. Further research is required to confirm these results using a more robust study design which includes a control group. In addition, the long term impact on children's salt intakes of comparable education programs needs to be assessed.

Key Words: behavior, child, dietary sodium, education, Australia (*J Nutr Educ Behav*. 2018;50:547–554.)

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INTRODUCTION

Similar to those in the US,[1] Australian schoolchildren eat more dietary salt (average intake of 6.1 g/d) than is recommended for good health.[2,3] A higher intake of salt during childhood is associated with cardiovascular risk factors.[4,5] The presence of these risk factors in early life is significant because both have been shown to follow a tracking pattern over the life span[6,7] as well as predict subclinical cardiovascular damage in adulthood.[8,9] Additional concerns related to intake of salty foods during early life includes the development of taste preferences that favor foods rich in salt, which may lead to greater lifetime intakes of salt.[10]

To protect cardiovascular health, interventions are required that seek to reduce salt in children's diets. Although product reformulation of lower-sodium foods is considered an integral component of population-wide salt reduction strategies,[11] the success of such initiatives is likely to be maximized if there is also consumer support for the availability of lower-salt foods.[12] As such, education-based programs that raise awareness related to high salt intakes and food sources of salt are a fundamental component of population salt reduction programs. Furthermore, evidence among adults indicates that the use of behavior-based strategies[13] such as

Institute for Physical Activity and Nutrition, Deakin University, Geelong, Australia
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Address for correspondence: Carley Ann Grimes, PhD, Institute for Physical Activity and Nutrition, Deakin University, Locked Bag 20000, Waurn Ponds, Geelong, Victoria 3220, Australia; Phone: +61 3 9246223; Fax: + 61392446017; E-mail: carley.grimes@deakin.edu.au

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reading food labels to select lower-salt foods[14] can reduce salt intake. Currently, less is known regarding the effectiveness of education- and behavior-based strategies to lower salt intakes among children. Accordingly, the authors developed a behavior-based salt reduction education program (*Digital Education to Limit Salt in the Home* [DELISH]) targeting elementary schoolchildren in grades 2–4 (aged 7–10 years) and their parents.[15] The program was Web-based because online technologies provide an important opportunity to reach and engage with children[16] and have been shown to be an effective medium to deliver interventions seeking to alter children's dietary behaviors.[17] The aim of this study was to determine the efficacy of a Web-based salt reduction program on children's salt-related knowledge, attitudes, and behaviors (KABs), self-efficacy, and intake of dietary salt.

METHODS

Detailed information on the methodology is reported in the study protocol.[15] This was a single-arm study with a pretest–posttest design in which children completed surveys on salt-related KABs and self-efficacy, together with 24-hour urine collections to assess change in salt intake. The study was powered (90% at $\alpha < .05$) to detect a 20% reduction in daily salt intake (ie, 1.2 g/d), calculated using MLPowSim software (version 1, University of Bristol, Bristol, UK, 2009). To account for a 20% dropout rate, the authors aimed to recruit 122 children across 6 schools.[15] Children of varying socioeconomic levels were recruited from primary schools, which were located in the Greater Geelong region of Victoria, Australia. Ethics was approved by the Deakin University Health and Human Ethics Advisory Group (Project No. HEAG-H 37/2016) and the Department of Education and Training, Victoria State Government (Project No. 2015_002884). Written consent was provided by the school principal and the primary caregiver; the child gave written assent.

Intervention Overview

Three behavioral messages were modeled[15] to meet the targeted 20% reduction in children's salt intake: (1) stop using the salt shaker, (2) switch to lower-salt foods by checking food labels (focus on bread, breakfast cereal, and cheese), and (3) swap processed salty foods (eg, processed meats and takeout and snack foods) with healthier, lower-salt alternatives. Food groups that were previously identified as important sources of salt in the diets of Australian children[18] were targeted.[15] Full details of dietary modeling performed to indicate that a 20% reduction in salt intake was feasible with the proposed intervention strategies can be found elsewhere.[15] The intervention content was embedded within the evidence-based healthy eating tool, the Australian Guide to Healthy Eating[19]; this served as a tool to communicate salt-specific messages as well as place content within a wider healthy eating paradigm. Intervention objectives, content, and strategies were mapped to constructs of Social Cognitive Theory and behavior change techniques.[15] The 5-week intervention included weekly Web-based interactive education sessions designed to take about 20 minutes to complete. Sessions were developed using the electronic learning software Articulate Storyline 2 (Articulate Global, Inc, New York, NY, 2015). Sessions were pilot-tested with 19 children aged 8–12 years and were reviewed for developmental appropriateness and comprehension by a primary schoolteacher. A detailed overview of information presented in the online sessions is reported in the study protocol.[15] In brief, a detective theme narrative that included comic strips at the start of each session was used to deliver content (Figure 1). Children were assigned a weekly detective case file to solve that focused on the key intervention behavioral messages. Sessions were designed to be fun, with interactive games and activities, video content, and sound effects. Goal-setting activities related to the 3 behavioral messages were included at the end of sessions in weeks 2–4, to which the children reported on their progress at the session the following week. A hard-copy detective logbook was provided to track their goals and encourage discussion with their parents about what they had learned. Children were rewarded with fun-themed badges for solving case files and meeting weekly goals. Finally, a study website was accessible with access to intervention materials. Because parents are the gatekeepers of food for children of this age group, the intervention included parental resources (eg, online newsletters, short message service texts).[15] Parental outcomes are not the focus of this article.

Measures

Data collection was completed pre-post intervention. This included completion of online surveys and anthropometry and 24-hour urine collections which were completed on site at participating schools by trained research staff.[15] The child's height and weight were measured using standard protocols[20] and a calibrated stadiometer (Model 220, Seca, Hamburg, Germany) and calibrated scales (UC-321 portable electronic scale, A&D Medical, San Jose, CA). According to their measured height and weight, children were grouped into weight categories using the International Obesity Task Force body mass index reference cutoffs.[21] Demographics were reported at baseline by the primary carer via an online questionnaire; socioeconomic status was defined by parental educational attainment.

Urine collection. The 24-hour urine collection could be completed on either a school or weekend day. When, possible, children were encouraged to complete each measure on the same type of day. The 24-hour urine collection commenced with an empty bladder. Children were instructed to collect all urine passed during 24 hours into a 2.5-L bottle.[15] The collection was finished by providing a final void as close as possible to the 24-hour finish time. Children reported any missed collections or spills. Children received verbal and pictorial written instructions regarding how to complete the 24-hour collection. Urinalysis was completed by an accredited commercial pathology laboratory (Dorevitch Pathology, Melbourne, Australia). The total volume of the sample was recorded and analyzed for sodium concentration using ion-selective electrodes and the Jaffe reaction for creatinine concentration employing a