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INTEGRATING COMPUTER-BASED METHOD INTO DIETARY INTERVENTION IN CHILDREN AT SETIU WETLAND: A PILOT STUDY

MADIHAH SHUKRI[1]*, ZAMZAHAILA MOHD ZIN[2,3], MOHAMAD KHAIRI ZAINOL[2], SYAHRIN SAID[3], AMIR NGAH[4] AND SITI SALINA ABDULLAH[1]

[1]School of Social and Economic Development, [2]School of Food Science and Technology, [3]Centre for Fundamental and Liberal Education, [4]School of Informatics and Applied Mathematics, Universiti Malaysia Terengganu, 21030, Kuala Nerus, Terengganu, Malaysia.

**Corresponding author: madihah @umt.edu.my*

Abstract: While computer-based interventions have been shown to effectively improve eating behaviours of children and adolescents in Western countries, to our knowledge, studies exploring the effectiveness of such interventions are unreported in Malaysian context. This paper presents the findings from a 3-week pilot study that evaluated an intervention designed specifically to change attitude, intention and dietary habits of schoolchildren in Setiu, Terengganu. The participants in this study were 51 (male N= 27, female N= 24) children, aged 10 years, from a primary school. The present pilot study is unique in combining the use of computer-based method along with PowerPoint presentation, classroom discussion and hands-on group activities techniques. The intervention sessions took place in a school every Thursday for three consecutive weeks. Participants completed a baseline questionnaire (pre-test) about attitude, intention and dietary intake and were re-administered the questionnaire (post-test) after three months to assess the changes. Following the intervention, results suggest that there was a significant change in attitude towards unhealthy food (p <.01). More importantly, a significant increase in vegetable intake (p < .001) and a decrease in fast food consumption (p <.05), soda drink consumption (p <.01) and sweet food intake (p <.01) were seen. The findings of this pilot study suggest that computer-based interventions may therefore, complement other intervention methods and have the potential to help practitioners tailor an effective intervention to address dietary problem in children.

Keywords: Dietary intervention, computer based method, healthy eating, Setiu Wetland.

Introduction

In Malaysia, the Ministry of Education in collaboration with the Ministry of Health has taken action to promote and improve the health and nutritional status of schoolchildren (Ruzita *et al*., 2007). Against this backdrop, the Malaysian Ministry of Education had launched a school health program and the school canteen guideline to protect, promote and maintain optimum health of the students and develop desirable knowledge, attitude and health practices (Tee, 1999). Despite these efforts, studies have shown an alarming rate of childhood overweight and obesity in Malaysia (Khor, 2012; Naidu *et al*., 2013). Naidu *et al.* (2013) found that in Malaysia, one out of five children between the ages of 7 and 12 years were overweight. Childhood overweight has been associated with negative health consequences of chronic diseases such as diabetes, hypertension and negative psychological outcomes including depression, disturbed body image and low self-esteem (Davison & Birch, 2001). At the same time, a number of reports (Khor & Sharif, 2003; Wong *et al.,* 2014) have reported the prevalence of underweight and childhood malnutrition, especially in poor rural communities.

Poor eating habits are known to develop certain risk factors for chronic diseases, obesity problem and malnutrition in people. Given that eating habits are developed during childhood and usually continues into adulthood (Kelder *et al.,* 1994) and children gain greater advantages from nutritional education than adults do (Eipstein *et al.,* 1995), developing a healthy eating intervention targeting primary school students that is appealing, cost effective and capable of reaching a heterogeneous population is of utmost importance. In western countries, computer-based nutrition intervention defined as ‘a program delivered through a computer to

promote health related changes in behaviour' (Hamel and Robbins, 2012, pp. 2) is quite a popular technique in health education (Oenema *et al.,* 2001). Hamel and Robbins (2012) conducted a systematic review of 15 studies by examining the effectiveness of computer-based intervention to promote healthy eating. The authors concluded that such interventions can be effective means to improve eating behaviour outcomes and supplement other methods to promote healthy eating among children. A study by Turnin *et al.* (2001) for instance, evaluated a prospective study of micro-computer nutritional teaching games and their contribution to children's acquisition of nutritional knowledge and improvement of eating habits. Based on the results from 1876 students (aged between 7 and 12 years), they found that children in the game group (intervention group) had significantly better nutritional knowledge and dietary intake compared to children in the control group. In addition to that, studies which compared the effectiveness of different methods for delivery of nutrition education have also indicated that computer-based interventions are more effective in influencing dietary behavioural change than other modalities such as print materials (Oenema *et al*., 2001; Casazza & Ciccazzo, 2007; Silk *et al.,* 2008). For instance, Casazza and Ciccazzo (2007) compared the outcomes of different delivery methods for health education programs (control, computer-based and traditional education) to determine which strategy would elicit a greater behavioural change. Their results showed that the computer-based group showed an increase in knowledge, self-efficacy, social support and the frequency of skipping meals decreased as compared to other intervention methods group.

To date, published research on eating intervention in Malaysia is scarce and most of the existing interventions are non-computer based. An intervention study (Ruzita *et al.,* 2007) had utilised the method of video viewing, comic reading and discussion, aimed to improve nutrition knowledge, attitude and eating practice in eight-year-old school children (n= 237 intervention group, n= 181 control group). The results indicated that nutrition knowledge and attitude increased significantly following the intervention programmes. However, there was no significant improvement of nutrition practice scores in both the groups. A study by Shariff *et al.* (2008) examined the changes in nutrition knowledge, attitude and eating practice between intervention and control groups in 335 primary school students. The intervention group that received hands-on activities, video presentations and exhibitions showed significant increments in knowledge, attitude and eating practice. Focusing on students with special needs, Roszanadi and Norazmir (2011) found that nutrition education has a positive impact on these students. They evaluated the effectiveness of nutrition programs using discussion, printed words, cards and slide shows. Their results showed a significant improvement in the students' nutrition and attitude scores in the intervention group, however, no significant changes were found in dietary scores.

In sum, while the non-computer-based methods of intervention can be a promising means for improving knowledge and attitude related to healthy eating, previous studies have found mixed results regarding the actual eating pattern. Computer-based intervention appears to be a logical choice for children as it allows for a more comprehensive approach to behavioural change and the information can be accessed quickly (Brug *et al.,* 2003). Moreover, children were able to access and assimilate information at their own pace and have an experience that is enjoyable, exciting and effective (Kreisel, 2004). Thus, the main objective of this pilot study was to assess the feasibility and benefits of eating interventions which combined the computer-based method with other methods (PowerPoint presentation, hands on group activities and class discussion) to improve attitude, intention and dietary intake among children in Setiu Wetland. It was hypothesised that: (1) at the end of the intervention, there would be a significant improvement in positive attitude towards healthy food, stronger intention to eat healthily and improvement in the consumption of healthy food and (2) there would be significant changes in the attitude (i.e. negative) towards unhealthy

food, increased intention to avoid unhealthy food and decrease in unhealthy diets.

Materials and Methods

Description of the Intervention and Sample Characteristic

The participants in this study were 51 children (male N= 27, female N= 24) from a primary school, aged 10 years, in Setiu[1], Terengganu. Table 1 shows the demographic information of the participants. Setiu was one of the districts which had the highest number of malnourished children in Terengganu (Wong *et al.,* 2014). Recruitment began by contacting a few schools located in the area of Setiu Wetland. The school which volunteered to participate in this pilot test was categorized as a low enrolment school or *'sekolah kurang murid'* because it had less than 150 students and was characterised by a lack of facilities and trained teachers. It was assumed that technology-based approach has the potential to capture more attention because the children in this rural area usually receive less exposure to technology-based recreational activities (video games, internet) and have lower computer skills than urban children. A pre-test-post-test design was used to assess the effectiveness of the intervention on changes in attitude, intention and dietary intake. Participants completed a baseline questionnaire (pre-test) that assessed their attitude, intention and dietary intake and

Table 1: Demographic background

Characteristics	%	N
Gender		
Male	53%	27
Female	47%	24
BMI		
underweight	25.5%	13
normal	54.9%	28
overweight	19.6%	10
Household income		
< RM 1000	11.1%	7
RM 1001-3000	20%	10
RM 3001-5000	35.6%	18
RM 5001>	33.3%	16
[a]*Caregivers' Education*		
PMR	0	0
SPM	41.1%	21
STPM/ DIPLOMA	31.1%	16
Degree	27.8%	14
[a]*Caregivers' Occupation*		
Unemployed	0	0
Private sector	27.8%	14
Government sector	38.9%	20
Self-employed	24.4%	12
Labour	8.9%	5

Note: [a]caregiver refers to either father/mother/guardian

[1] The area of Setiu is one of seven administrative districts in Terengganu that has a relatively small population size (60,000 residents in 2013)

were re-administered the questionnaire after three months to assess the changes (post-test). Trained research assistants read each question aloud and were present to assist the children during questionnaire completion. The study was approved by University of Malaysia, Terengganu. Permission for data collection was obtained from the Malaysian Ministry of Education and the principal of the respective school.

Intervention Program

The intervention contents were developed specifically for this study by a team of nutrition experts and a health psychologist. Researchers carried out the intervention every Thursday over a three-week period with the help of classroom teachers and computer lab assistants. The intervention took place in the school hall and computer lab. The intervention comprised three modules including the use of a food pyramid and making selection on healthy and unhealthy food. The module also incorporated educational elements to increase children's knowledge and awareness about the effects of eating habits on health and diseases. The method of intervention included two hours of classroom-based teaching, PowerPoint presentations, class discussion and hands-on group activities. The computer-based intervention included interactive games and animated presentations designed specifically to increase knowledge and stimulate children's liking for healthy foods (i.e. increasing the liking for fruit and vegetable) and to reduce unhealthy eating habits (consumption of junk food, sweet food and soft drinks). A few games developed by computer game professionals were introduced to the children. 'Pyramid game' taught the children to classify food according to their food groups (e.g. carbohydrate, protein, fibre). 'Shoot the unhealthy' game helped the children to differentiate between healthy and unhealthy foods. In the 'Eat well' game, children had to plan a nutritional balance for the main meals (breakfast, lunch and dinner) for the day. Each child was provided a laptop available in the school computer lab and was given 15-30 minutes to play the game in every session.

Questionnaire

Data were collected using a self-report questionnaire which assessed respondents' demographic background, attitude toward food, intention and dietary habits.

Demographic Background

The children reported their names and gender. Their BMI was calculated on the basis of their height and weight. Data about parent's backgrounds came from school records.

Attitude and Intention

Questions about attitude and intentions were adapted from Kothe *et al.* (2012). Back translation method was used to translate the scales. Attitudes were measured by 12 items (six items for healthy food and six items for unhealthy food). Respondents had to rate on a 5-point scale (e.g. 'For me, eating healthy/unhealthy food everyday would be…enjoyable–un-enjoyable and harmful–beneficial'). These questions included pictures of the food being asked about. A higher score indicated a stronger positive attitude. The Cronbach's alpha computed for this study showed good internal consistency (α = .79 for pre-test and α = .78 for post-test; six items for unhealthy food, α = .86 for pre-test and α = .87 for post-test). Two items were used to measure intention (e.g. 'I intend to eat healthy food every day and avoid unhealthy food'). Respondents were asked to rate on a 5-point Likert scale ranging from 'strongly disagree' to 'strongly agree'. The alpha coefficients of the items were .82 and .83 for pre-test and post-test respectively.

Dietary Intake

Respondents were asked about their dietary intake using a non-quantitative food frequency questionnaire and made up of nine food items/groups. They were required only to report the usual frequencies of food group without specifying the portion size. The complete list of foods included in the study is shown in Table 3. Two experts in nutritional sciences reviewed the food group lists which included foods typically

consumed by children. The five items concerned with healthy eating were based on the Food Guide Pyramid recommendation for five major food groups—fruits, vegetables, meats, milk and grains (USDA, 1992). Other items assessed unhealthy food intakes and representative items included junk food, sweet food, fast food and soda drinks. Fast food refers to a diet high in processed foods, including burgers, sausages and nuggets. Junk food includes potato chips, corn chips, instant noodles or other salty snacks. Sweet foods include ice-cream, cakes, sugared traditional *kuih*, sweets, candy and chocolate. These food groups have been found to be associated with certain diseases such as type 2 diabetes (Dabelea *et al*., 1999) and are likely to contribute to the rising obesity (Troiano & Flegal, 1998) among children. The scale had point responses format (none, 1, 2, 3, 4, 5 and more times per day).

Results and Discussion

The data were analysed using SPSS statistical software package version 20.0. Paired sample t-tests were conducted to examine changes in attitude, intention and dietary intake. A two-tailed alpha level of significance was set at <.05.

Intervention Effects on Attitude and Intention

The effects of the intervention on attitude and intention are presented in Table 2. The results of the *t* test indicated there was a statistically significant difference between the pre-test and post-test for attitude towards unhealthy eating (t (50) = 2.72, p <.01). This suggests that participants had a reduced liking for unhealthy food after the intervention than the pre-test. However, the mean scores of intention between pre-test and post-test were found to be not significantly different.

Intervention Effects on Dietary Intake

The results of dietary intakes are presented in Table 3. In line with the hypothesis, assessment of food frequency showed that the average score for vegetable group consumption increased from 2.74 to 3.62, (t (50) = -3.86, p < .001) after the intervention. Importantly, the unhealthy food pattern scores decreased significantly, in that, the respondents had reported a decrease in fast food consumption (t (50) = 3.50, p <.01), soda drink consumption (t (50) = 3.15, p <.01) and sweet food consumption (t (50) = 2.71, p <.01).

These results provide preliminary evidence to suggest that the intervention led to a significant change in their attitudes toward unhealthy food, in that, the participants were more likely to report a reduced liking for unhealthy food. More importantly, upon completion of the study, there was a significant decrease in the consumption of fast food, soda drinks and sweet food. The results of this study are consistent with the previous Western studies (Turnin *et al.,* 2001; Casazza & Ciccazzo, 2007) which demonstrated that computer-based intervention using interactive and animated presentations has the potential to elicit greater behavioural changes in comparison to the non-computer-based intervention program. With regard to healthy eating, a significant increase was found for vegetable intake. Overall, the results seemed to suggest that this dietary intervention may have a greater impact on changing attitude towards unhealthy food and foster healthy eating habits. One possible explanation could be that the intervention components were specifically designed to focus more on how high consumption of unhealthy eating like fast food, soda drinking and sweet food was related to diseases and health. However, it is yet to be determined whether these changes can be sustained in the long term.

Conclusion

The findings of this pilot study suggest that the inclusion of computer-based education could help address the issue of poor nutrition among children. However, this small study is subject to several limitations. The statistical power of this study is very little due to its small sample. Therefore, caution should be exercised while generalizing the results to other study populations. The second limitation of this pilot study is the absence of a control group. For the full scale study, the statistical power should be

Table 2: Means for attitude and intention towards healthy and unhealthy food

	Pre-test Mean ± SD	Post-test Mean ± SD	*p* value
Attitude towards healthy food	4.63 ± 0.46	4.79 ± 1.28	.35
Attitude towards unhealthy food	2.39 ± 0.79	2.09 ± 0.68	<.01**
Intention to eat healthy food	4.00 ± 0.79	4.01 ± 0.94	.93
Intention to avoid unhealthy food	3.41 ± 1.04	3.78 ± 0.87	.08

Table 3: Means for dietary intake

	Pre-test Mean ± SD	Post-test Mean ± SD	*p* value
Vegetable group	2.74 ± 1.86	3.62 ± 1.38	<.001**
Fruit group	4.12 ± 1.34	4.14 ± 1.26	.90
Milk group	3.24 ± 1.69	2.86 ± 1.59	.10
Grain group	4.48 ± 0.81	4.88 ± 1.21	.10
Meat group	3.44 ± 1.46	3.24 ± 1.55	.42
Soda drink	1.48 ± 1.49	0.82 ± 0.96	<.01*
Fast food	2.30 ± 1.45	1.46 ± 1.23	<.01*
Junk food	1.64 ± 1.35	1.42 ± 1.25	.23
Sweet food	2.24 ± 1.66	1.58 ± 1.44	<.01*

increased by increasing the number and diversity of the sample (urban vs. rural areas) and a control group should be included. In addition to that, it would also helpful to include the covariate variables (gender, body mass index (BMI) and school factors) in the study and analyse their influences on the intervention outcomes. Finally, the application of an appropriate theory to explain the behavioural changes should improve the likelihood of effective intervention.

This is the first study conducted in Setiu Wetland that evaluated the effect of dietary intervention among school children by incorporating computer-based method with traditional classroom method. The findings of this pilot study suggest that the intervention is feasible and could be effective in addressing nutritional issues among children in the respective school. More evidence from a full scale study with an improved methodology is needed to better determine how dietary intervention which integrates the computer based method could have a positive impact on children's eating behaviour.

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