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Acceptance of a Test Vegetable after Repeated Exposures among Preschoolers

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ABSTRACT

Introduction: Low vegetable consumption in children is always a matter of concern. The aim of this study was to determine the effect of multiple exposures on acceptance of a test vegetable among preschoolers aged 6 years. **Methods:** This study was conducted in two phases. The first phase was a cross-sectional study among 68 Malay children (37 boys; 31 girls) from 6 kindergartens in Muar, Johor. This phase was aimed at determining the selection of the most suitable vegetable as the test vegetable. Data on demographics, usual preparation methods of vegetables, frequency of vegetables served and consumed by the children at home and parents' perception of the children's liking towards vegetables were obtained through the questionnaire. In phase 2, 42 preschoolers (20 boys; 22 girls) from 3 kindergartens from phase 1 were randomly selected. Meals consisting of the test vegetable,that is, round cabbage were provided to the children during lunch time at the kindergartens for 3 days consecutively. Thirty-six grams of stir-fried cabbage was served each time and the leftover was weighed. **Results:** There was a significant increase in intake of the test vegetable from first day (21.58±9.55 g) to the third day of exposure (28.26±8.35 g), z = -3.317, p=0.002. Based on feedback from the parents, the level of liking towards the test vegetable was significantly increased after the intervention (p=0.038). **Conclusion:** It is suggested that multiple exposures to vegetables could be a strategy to increase consumption of vegetables among preschoolers.

Keywords: Intervention, multiple exposure, preference, preschoolers, vegetables

INTRODUCTION

Low fruit and vegetable intake has been identified as important risk factor for chronic diseases (Joshipura *et al*., 1999; Guilbert, 2003). Overall, it is estimated that up to 2.7 million lives could potentially be saved each year if fruit and vegetable consumption was sufficiently increased (Keller & Tukuitonga, 2005). There is a wealth of evidence from epidemiological studies that the nutrients obtained from a diet high in fruit and vegetables can offer protection from cancer, cardiovascular diseases and obesity in adulthood (Joshipura *et al*., 2001; WHO, 2003; Mendoza *et al*., 2006; Lakkakula *et al*., 2008).

The Malaysian Adults Nutrition Survey (MANS) shows that though vegetables were consumed daily, the servings were too little, that is one serving per day, compared to the WHO(2003) recommended daily intake of five servings per day (Norimah *et al*., 2008). Hall *et al*. (2009) showed that 85% of

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Malaysian adults fell into the 'low' category as defined by WHO guidelines for consumption of vegetables. According to Norimah *et al*. (2009), consumption of vegetables among Malaysian children was also reported to be low with more than 75% not consuming vegetables in their daily diet.

It is important to educate children to like fruits and vegetables because of the established health benefits. However, most of the vegetables have a bitter taste due to the presence of thioureas and related compounds that make it unpalatable for children (Steiner, 1979). Rejecting green leafy vegetable is known to be a child adaptation strategy when they are at the age of exploring their environment; it also helps to keep children away from plants that might contain dangerous toxins (Cashdan, 1998).

Childhood is a crucial time for nutritional intervention to promote fruit and vegetable intake and to establish healthy eating behaviours (Wardle *et al*., 2003a). New foods should be presented to children in a positive environment to allow them to explore and taste new foods. Such an approach will also provide additional reinforcement of food acceptance (Bellows, Cole & Gabel, 2006). It has been suggested that exposure to and consumption of fruits and vegetables from an early age may have a great influence on fruit and vegetable intake later in life (Wardle *et al*., 2003a) as children's food preferences is shaped by the frequency of encounters with a novel food (Birch & Marlin, 1982). It is suggested that the number of exposures required could be between 8-15 times for children aged 2 to 6 years to accept a novel food (Skinner *et al*., 2002; Wardel *et al*., 2003a; Bellows *et al*., 2006).

To the best of our knowledge, relatively little is known about the efficacy of this approach in the South-East Asian region particularly in Malaysia. Thus, the objective of this study was to determine the effects of multiple exposures to the acceptance of a targeted vegetable among Malay pre-schoolers. It was hypothesised that multiple exposures would increase the consumption and liking of the targeted vegetable.

METHODS

Study design and subjects

The first phase of this study was a cross-sectional study. A total of 68 children (37 boys and 31 girls) aged 5-6 years from 6 kindergartens managed by the Department of Community Development (KEMAS) in Muar were recruited by convenience sampling method. The purpose of this phase was to identify the most suitable test vegetable to be used in the second phase of the study. A questionnaire was developed to obtain information on the usual preparation methods of vegetables, frequency of vegetables served and consumed by children at home and parents' perception of children's liking towards the vegetables. The answer options for frequency of vegetables served at home and frequency of vegetable consumed by children at home were 'Never', '1-2 times a week', '3-4 times a week' and '5-7 times a week' while answer options for liking towards the vegetable were 'Dislike', 'Not Sure' and 'Like'. A list of 15 commonly available vegetables was included in the questionnaire. The questionnaire was pilot tested on 20 parents of 20 preschoolers in another district (Cronbach alpha=0.75). Class teachers were asked to distribute and collect the questionnaire from parents. Data were analysed and a target vegetable was identified.

The test vegetable was selected based on parents' perception of their children's liking toward the vegetable. Based on the results from the Phase 1 study, the majority of parents perceived that the children liked most of vegetables in the list given to them. The top five vegetables that were least liked according to parent's perception were (i) tomato (ii) broccoli (iii) *kailan* (iv) round cabbage and (vi) lettuce.

Round cabbage was chosen as a test vegetable in this study due to a number of reasons; it is easily available, cheap, and the researchers expected to see positive changes in three rounds of exposure in three days. Selected cooking preparation for the test vegetable in this study was stir-fry as more than half (58.8 %) of parents reported that stir-fry was the most common cooking method for vegetables at home.

The intervention

The second phase was a randomised experimental trial which was conducted to investigate the effectiveness of multiple exposure on acceptance of the test vegetable. Three out of the six participating kindergartens from Phase 1 were randomly selected. A total of 42 children (20 boys and 22 girls) from the selected kindergartens were involved in this intervention.

A standard recipe of stir fried round cabbage was developed to be served for 42 children. The recipe consisted of round cabbage, garlic, red onion, anchovies, palm oil and salt. A serving of 36 g or 0.5 serving of cooked cabbage was considered the feasible amount for each exposure to the subjects. Packed lunches that incorporated stir-fried round cabbage were delivered to schools and served during lunch time for three consecutive days. Menu alongside the stir-fried cabbage for Day 1 was chicken porridge (237 kcal), Day 2 was fried rice (255 kcal) and Day 3 was white rice with soy sauce chicken (260 kcal). Each packed lunch was served in a container and labelled according to subject's code and name. Teachers were asked to observe the subjects while they were eating to ensure that they were not throwing the food or giving them away to their friends. The teachers were also asked to ensure that the subjects kept the leftover of the vegetable inside the container (if any). They were asked not to force the subjects to finish the test vegetable. Leftovers were collected and weighed by the researcher after lunch at the end of the school session. A digital scale (TANITA model KD 160) was used to weigh the leftovers. The amounts of stir-fried cabbage consumed by the subjects were calculated as 36 g stir-fried round cabbage minus the leftover (g).

Approximately 2 weeks following the intervention, parents were asked to prepare stir-fried cabbage using the same recipe and then rate their children's liking to determine the changes in liking towards the test vegetable using the same Likert scale 'as in Phase 1, that is,. 'Dislike', 'Not sure' and 'Like' (Cronbach alpha=0.84). For analysis purposes, the categories were assigned a score of -1, 0 and 1 respectively.

Ethical approval for the study was obtained from the Research Ethics Committee of Universiti Kebangsaan Malaysia. Approvals to conduct this study were obtained from administrators of selected kindergartens. Parents and teachers were informed both verbally and in writing. Informed consent was obtained from each parent before this study was conducted.

Statistical analysis

Data were analysed using Statistical Package for Social Science (SPSS) Version 16.0 and summarised by using means and standard deviations or medians and ranges. Categorical variables are expressed as counts and percentages. Data normality was checked before any statistical test was carried out using the Kolmogorov-Smirnov test. Data on consumption of vegetable was not normally distributed; therefore non-parametric tests were chosen. In order to test for effects of the intervention on consumption of the test vegetable, Friedman's Test was used to compare changes in consumption during the three days of intervention according to gender. Changes in liking at pre- and post-intervention and consumption on the 1st and 3rd day of intervention were tested using Wilcoxon Signed Rank test. Mann-Whitney test was used to examine the changes in liking score between pre- and post-

intervention. A *p* value of less than 0.05 was considered statistically significant.

RESULTS

Demographic profile

Of the 42 pre-schoolers, 5 were excluded from the study analysis as they did not complete the three intervention sessions. Of the 37 subjects who completed the intervention session, 19 (51.3%) were boys and 18 (48.7%) were girls (Table 1). The majority of the fathers of the subjects (89.2%) had education up to secondary school, were self-employed (59.5%) and had monthly incomes of below RM1500 (91.9%). Meanwhile, the majority of the mothers were housewives (73%) with secondary education level (86.5%).

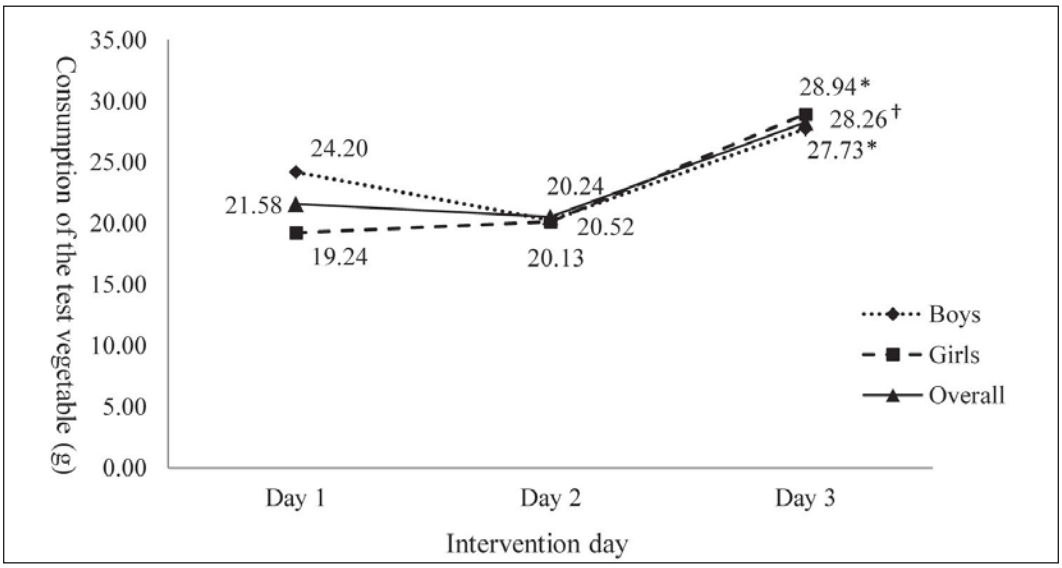
Table 1. Demographic characteristics of subjects (n=37)

Characteristics	*n*	*Percentage (%)*
Gender of subject		
Boy	19	51.3
Girl	18	48.7
Father		
Age (years old)		
31-40	19	51.4
41-50	15	40.5
51-60	3	8.1
Education level		
No formal education	1	2.7
Primary school	3	8.1
Secondary school	33	89.2
Occupation		
Government	2	5.4
Private	13	35.1
Self-employed	22	59.5
Monthly Income, RM (USD)		
<RM 1500 (USD 495.3)	34	91.9
RM 1500 – RM 3500 (USD 495.3- USD 1155.8)	3	8.1
Mother		
Age (years old)		
21-30	7	18.9
31-40	23	62.2
41-50	7	18.9
Education level		
No formal education	1	2.7
Primary school	1	2.7
Secondary school	32	86.5
Higher education	3	8.1
Occupational status		
Working	10	27.0
Housewife	27	73.0
Monthly Income, RM (USD)		
None	27	73
<RM 1500 (<USD 495)	7	18.9
RM 1500 – RM 3500 (USD 495- USD 1156)	3	8.1

Effects of multiple exposures on consumption of the test vegetable

Consumption of the test vegetable significantly increased from 21.58 g on the 1st day to 28.26 g on the 3rd day, z = -3.317, p=0.002 (Figure 1). Girls had a consistent increase in test vegetable consumption throughout the intervention sessions but this was not the case for boys (Figure 1). For girls, the consumption increased from 19.24 g on the 1st day to 20.13 g on the 2nd day and 28.94 g on the 3rd. However, among boys, the consumption of the test vegetable dropped from 24.20 g on the 1st day to 20.24 g on the 2nd day but increased to 27.73 g on the 3rd day. However, there was no statistical significance in the consumption of the test vegetable between gender on Day 1, Day 2 and Day 3.

After the intervention, the consumption of test vegetable increased among children whose parents had said their children 'liked' or 'disliked' the test vegetable at pre-intervention while the consumption amount did not increase in children whose parents had said 'not sure' (Table 2). Nevertheless, the increment was only statistically significant among those who 'liked' the test vegetable at pre-intervention (p=0.001).



*p<0.05, Friedman test; †p<0.05, Wilcoxon Signed Rank Test

Figure 1. Consumption of the test vegetable (g) during the intervention for overall subjects and by gender

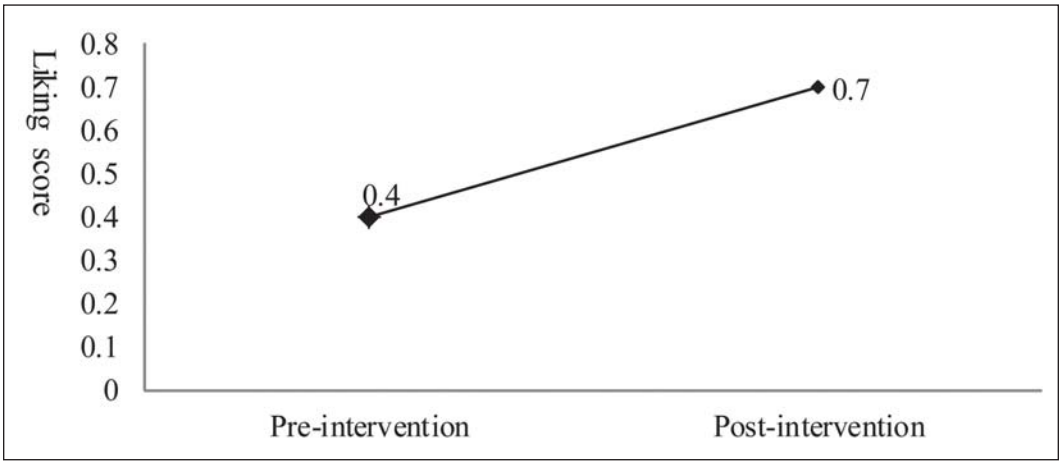
Table 2. Mean intake ± SD (g) of the test vegetable during intervention according to liking at pre-intervention (n=37)

Liking at pre-intervention	*Day 1 (g)*	*Day 2 (g)*	*Day 3 (g)*
Like	21.24±9.95	20.12±6.65	31.00±6.37*
Not sure	27.50±2.38	22.00±4.39	26.50±9.75
Dislike	19.90±9.80	19.64±7.83	25.00±9.55

*p<0.05 Wilcoxon Signed Rank test

Effects of multiple exposures on liking of the test vegetable

The results showed that the liking score in the post-intervention was significantly higher compared to the pre-intervention, p=0.038 (Figure 2). The percentage of subjects who liked the test vegetable according to the parents' report increased from 53.1% in pre-intervention to 75.1% in post-intervention. Only 6.1 % of the parents said their children disliked the test vegetable during the post intervention compared to 34.4 % in pre-intervention (Figure 3).



*p<0.05, Wilcoxon Signed Rank test

Figure 2. Mean of liking scores towards the test vegetable at pre- and post-intervention

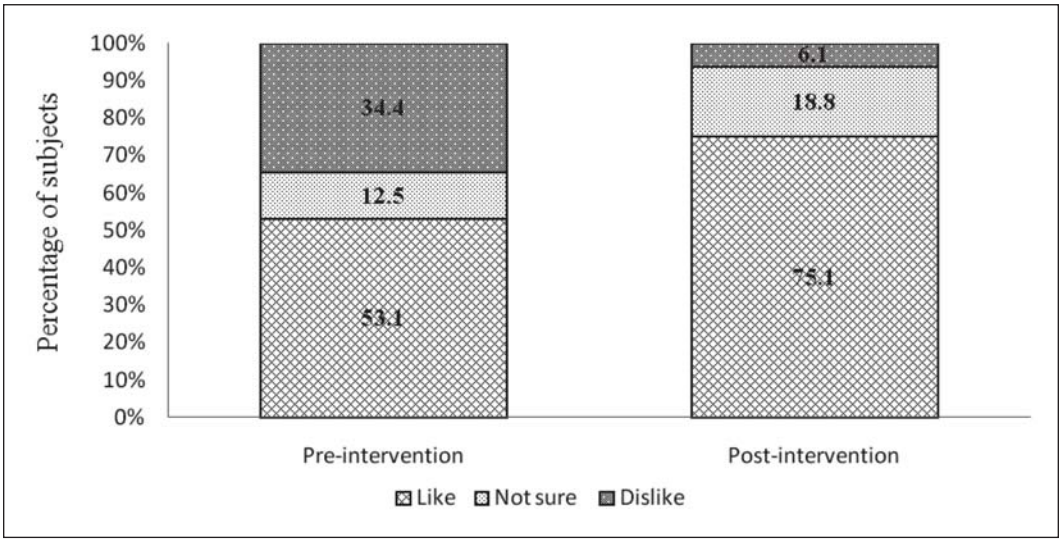


Figure 3. Percentage of subjects that 'dislike', 'not sure' and 'like' the test vegetable at pre- and post-intervention based on parents' reports

DISCUSSION

The aim of this study was to determine the effect of multiple exposures to the acceptance of a test vegetable among Malay pre-schoolers. We found that multiple exposures to the test vegetable increased consumption and liking among the subjects. Studies by Wardle *et al.* (2003a; 2003b) on 3-7 year-old children in London and Maier *et al.* (2007) on 7-month-old infants in Germany had found similar results.

Earlier studies have suggested a minimum of 5 exposures to change the liking leading to an increase in consumption for children aged 6-years-old (Wardle *et al.*, 2003a; Maier *et al.*, 2007). However, according to Birch *et al.* (1987), the exposure number needed also depends on the ability of the parents and researchers to conduct the exposures. In this study, the subjects were exposed to a test vegetable only three times due to time and budget constraints. We used round cabbage which was not the subjects' least preferred vegetable. We did not use *kailan* although this vegetable was the least preferred vegetable by the children at home as it is bitter and therefore may need a greater number of exposures.

According to Guthrie, Rapoport & Wardle (2000) if it is feasible, taste test using a real food is the best method to assess children's liking toward the vegetable. The taste test can be conducted by asking the children to taste a number of small cuts of prepared vegetable and then asking them to express their liking using the 3-point-faces-scale, that is, Happy for like, Indifferent for not sure and Sad for dislike. We had tried this method among the children in the pilot study, but we found that the children could not cognitively express their preference. Therefore, we assessed children's liking based on their parent's perception. Moreover, according to Livingstone, Robson & Wallace (2004), self-reporting food intake and knowing the names of the food requires several cognitive abilities that are only found in children aged at least 8 years old.

Although the number of exposures for this study is comparatively low and the test vegetable was not the least liked vegetable according to parent's perception, a significant increase in the consumption of test vegetable was observed. This is consistent with a previous study (Wardle *et al.*, 2003a) for children aged 6 years. It is expected that a higher frequency of exposures is needed for the least liked vegetable or bitter vegetables. We found that after the intervention, consumption of the test vegetable increased statistically among children whose parents said their children 'liked' the test vegetable but not among those whose parents said 'dislike' or 'not sure' about their children's' preference toward the test vegetable at pre-intervention. This finding shows that the 3-day exposure may not be enough to increase the intake of a test vegetable which they do not like.

In this study, it was found that the mean consumption of the test vegetable among girls was higher across the 3 days of study duration compared to boys but the difference was not statistically significant for each day of exposure. This trend was consistent with an earlier finding of a cross-sectional study by Wind *et al*, (2006) which was performed on 2,468 school children aged 11 years from Netherlands. They reported that vegetable intake in girls was higher compared to boys. However, when they conducted a statistical analysis, the difference was not statistically significant. An intervention study conducted by Wardle *et al.* (2003b) on preschoolers aged 5-7 years also observed that the consumption of the test vegetable, that is, red pepper varied between genders.

Our result shows a overall dip in the consumption of the test vegetable on day 2 for subjects. When we looked at the consumption data by gender, this happened only among boys. While the consumption of the test vegetable in girls increased steadily

throughout the intervention. We found that on Day 2, most of the boys did not finish the fried rice and the test vegetable served whereas the girls did so in the case of Day 1 and Day 3. It may be possible that the main dish served with the test vegetable influenced the acceptance. From our observation and teachers' feedback, boys preferred dishes with gravy as compared with girls. This may indicate that it is also important to take into account the preparation method of other dishes when serving vegetables to children.

There are a number of limitations in the present study that should be addressed. First, the effect of multiple exposures of the test vegetable on the consumption was recorded immediately after three exposures. Therefore, it is uncertain whether the improvement in the consumption of a test vegetable is sustainable. It is possible that the increment of the test vegetable consumption may also be influenced by its availability during the intervention. Second, sample size of this study was comparatively small, limiting generalisation of the findings to a wider population. Third, the data on preference for the test vegetable was based on the parents' perception before and after the intervention. This may not truly represent the subjects' preference. Finally, the number of exposures in this study was also comparatively low compared to earlier studies (Birch *et al*., 1987; Wardle *et al.*, 2003a; Maier *et al.*, 2007) where there was an increase in the consumption of the test vegetables among those who had already liked it before the intervention. A case-control study should be conducted with a greater number of frequent exposures among those who did not like the test vegetable before the intervention to determine the effect of the multiple exposures. Despite these limitations, the present study demonstrates a positive potential for an exposure-based intervention of a test vegetable even with limited number of exposures on preschoolers.

CONCLUSION

This study has shown the potential positive effect of multiple exposures of a test vegetable in preschoolers. Parents and teachers may need to offer vegetables more than three times and have it served with preferred dishes before assuming that their child truly dislikes the vegetable given. This suggests that related organisations such as the Ministry of Education, Ministry of Health and Department of Community Development (KEMAS) should also use this approach to increase preference for vegetable intake among pre-schoolers. Continued research is needed to explore the effectiveness of this approach in different age groups with more frequent exposures in the home and school settings.

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