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Effects of sensory education based on classroom activities for lower grade school children

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Abstract

This study is to verify the effects of sensory education based on classroom activities for 2nd and 3rd grade children. The hypothesis is that children who participated in sensory education would demonstrate positive changes in eating behaviors through sensory experiences. The sensory education program consists of 12 lessons. Twenty-six children were being recruited from one school in Changwon, Korea. Two control groups, one of which was the same age as the educated group and the other group of sixth graders, were selected by random sampling from the same school. Children answered a self-administered questionnaire. The parents (n = 20) of the children who participated in the program, took part in evaluating the program through self-administered questionnaires after the program ended. The questionnaire contained variables of general characteristics, education satisfaction, nutrition knowledge, eating attitude and behavior concerning unfamiliar foods. The score of nutrition knowledge was improved in educated children ($P < 0.05$). Food neophobia score towards unfamiliar foods ($P < 0.05$) was increased in educated children, but there are no changes in eating behaviors in all groups towards unfamiliar foods. In conclusion, sensory education is useful for having a positive eating attitude among children. Its consistent implementation could lead to healthier and well-balanced eating behaviors for children.

Key Words: Sensory education, picky eating, food neophobia, schoolchildren

Introduction

Eating behaviors and food preferences in childhood greatly influence eating habits in their adulthood. Therefore, it is important that children focus on the food quality and diversity [1]. Humans are reluctant to consume unfamiliar foods; it is a universal attitude of humans [2,3]. Although in the modern society human do not have to worry about being served food with fatal consequences, they still tend to avoid unfamiliar foods, especially noted in the predominant eating behavior of children [3-5].

In general, children do not try eating unfamiliar or novel foods. Most children, whom reject foods served at homes or schools, consider that the food tastes bad by judging from the appearance [3,6]. Children also tend to feel that only sweet food tastes good [7] and prefer familiar foods [8]. It can be assumed that the important criteria of food choice for children are familiarity or sweetness. Children's food preferences and food choices may be driven by their senses [1].

Children who are picky eaters tend to prefer instant foods, sweets and beverages, and are less inclined to consume vegetables than non picky-eating children [4,9]. Children who frequently eat sweets have undesirable dietary habits such as meal irregularity, skipping breakfast, unsuitable eating and unbalanced meals. In addition, they consume meat, ham, sausages, hamburgers and other fast foods more frequently than vegetables [10]. The frequency of vegetables and milk intake is recently lower than the frequency of of sweets or fast foods intake in children [11]. It can be deduced that the lack of sweetness and experience are the reasons why children avoid certain foods such as vegetables or milk.

One of the goals of sensory education is to allow children to familiarize themselves with the distinct tastes of different foods and to enjoy culinary diversity [1,12]. Reverdy *et al*. [12] reported that sensory education not only reduced food neophobia, but also increased awareness of various sensuous features of food. Food neophobia means 'fear of new food'. In other words, a person who has food neophobia tends to avoid novel or unfamiliar foods, and also, has a restrictive diet [13]. Sensory education may eventually have positive effects on children's diets in terms of greater variety and better quality of foods [12,14]. The increased willingness to try unfamiliar foods may lead to a healthier diet [14]. Therefore, implementing sensory education based on classroom activities may help to modify the desirable

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dietary behaviors of children.

Food and nutrition are inseparable; Food is related to 'how to eat', nutrition information is related to 'why to eat' in terms of education. Nutrition information is an abstract concept, but food is a concrete substance. McFarlane and Pliner [15] reported that abstract description of food and nutritional information has no effects on children's willingness to taste novel foods. Hence, sensory education would be a very effective education method for children, because it is being exercised by meaningful and specific education activities using real foods.

In recent years, sensory education was conducted in France, Finland, and other countries [12,14,15], but there are minimal studies in Korea. Therefore, it is necessary to promote and activate sensory education for promotion of children's health in Korean schools.

Eating is a natural human behavior related to sensory-affective responses, and it should be an enjoyable activity [16]. Humans are able to select foods based on health or nutritional criteria, but if they do not enjoy the foods, it is not sustainable. Therefore, understanding the factors influencing food choices such as taste preference, physiological mechanism, hunger/satiety, and sensory-specific satiety is useful for modifying children`s eating behaviors [17]. By conducting this sensory program, the children become more familiarized with the joys of eating and are motivated to adopt desirable eating behaviors.

This study is designed to verify the effects of sensory education based on classroom activities for 2nd and 3rd grade children. It is hypothesized that children who participated in sensory education would demonstrate positive changes in eating behaviors by increased exposures to foods through sensory experiences.

Subjects and Methods

Subjects

The subjects of this study were recruited from one elementary school in Changwon、Korea. Written consents were obtained prior to the program from all participating parent of children. Twenty six 2nd and 3rd grade children (2nd n = 16, 3rd n = 10) participated in the education program. Two control groups, one of which (control Ⅰ) was 26 children of the same age as the educated group and the other group consisted of 23 sixth graders (control II) selected from the same school. The characteristics of the subjects were presented in Table 1. The reason for including control II was to confirm that undesirable eating behaviors can be improved naturally when compared with other groups. Homogeneity of the educated group and control Ⅰ was verified by comparisons of nutrition knowledge and the food neophobia scale (FNS) in the pre-tests.

Table 1. General characteristics of subjects (n)

Group	Total	Boys	Girls
Educated			
the 2nd-3rd grade	26	5	21
Control			
Ⅰ: the 2nd-3rd grade	26	5	21
Ⅱ: the 6th grade	23	11	12

The parents of the educated group took part in the evaluation of the education by completing self-administered questionnaires after children`s education finished. Twenty out of the twenty-six questionnaires were returned and analyzed.

Development and implementation of sensory education program

The sensory education program, consisted of 12 lessons, was revised based on prior study [18]. This program was divided into two sessions. During the first session (from lessons 1 to 7), the children were trained to understand the different ways to feel and express the taste of foods. During the second session (from lessons 8 to 12), children experienced the differences of food preferences, eating behavior that helps to recognize and enjoy unique tastes (Table 2). Each lesson was designed to be 40 minutes. Sensory programs were implemented by after school classes for one lesson per week from March 23 to June 8, 2011. The researcher and one elementary school teacher participated together in the class. The procedure of the study was shown in Fig. 1.

Evaluation method and contents

Kirkpatrick's Four-level evaluation framework was adopted as the evaluation method. Kirkpatrick's Four-level model was divided from level 1 to level 4: reaction, learning, behavior or application of the learning, and results/impacts [19]. This evaluation was designed from level 1 to level 3 but not level 4 because of the short experimental period. The items, subjects and periods of each level are being shown in Table 3. Level 1 (reaction) s measured the education satisfaction of sensory education. Level 2 (learning) measured the nutrition knowledge

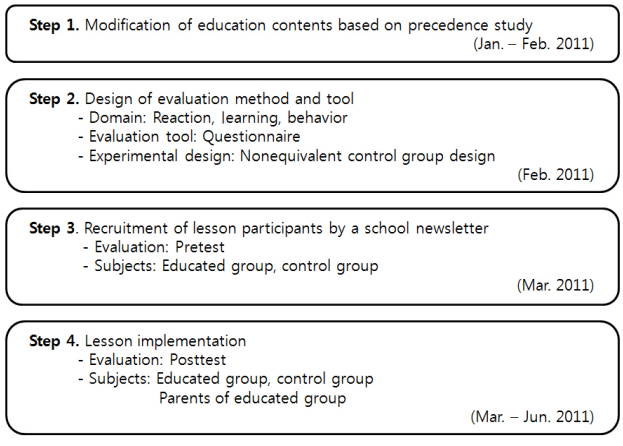

Fig. 1. The experimental procedure of the study

Table 2. The contents of sensory education program for school children

Lesson	Topic	Objectives	Education contents	Education material
1	The five senses	▪ Understand the five senses	▪ The five senses (sight, smell, texture, hearing and taste) ▪ The taste of food using the five senses	▪ Sample food (beans,vegetables)
2	The kind of tastes	▪ Understand and classify the tastes	▪ The basic taste (sweet, salty, sour, bitter) ▪ Classify the taste of food	▪ Sample food (sugar, salt, cocoa powder, lemon juice)
3	Senses of texture and sight	▪ Express the texture and sight	▪ The color and texture of ogokbab ▪ The color and taste of doenjang	▪ Sample food (ogokbab, doenjang)
4	Senses of smell and taste	▪ Understand the healthy reasons for kimchi ▪ Familiarize with kimchi	▪ The origin of kimchi ▪ The smell and taste of kimchi	▪ Sample food (baechugimchi, baekkimchi, sweet potato)
5	Senses of taste	▪ Know the taste of omijacha	▪ The healthful thing of omija ▪ How to drink omijacha ▪ The taste of omijacha	▪ Sample food (omijacha) ▪ Realia (dried omija)
6	Senses of smell, sight and taste	▪ Familiarize with cheonggukjang	▪ The healthful thing of cheonggukjang ▪ The smell, sight and taste of cheonggukjang ▪ How to make cheonggukjang jjigae	▪ Sample food (cheonggukjang)
7	Senses of sight	▪ Know the taste and ingredient of Korean traditional sweets and cookies	▪ How to cook dasik ▪ The sight and taste of dasik ▪ Know the Korean traditional sweets and cookies	▪ Sample food (dasik)
8	Taste & temperature	▪ Understand the proper temperature for foods	▪ The warm food and the cold food ▪ The relation between eating behavior and food taste	▪ Sample food (bab, apple, bulgogi)
9	The sweetness preference	▪ Know the sweetness preference ▪ Understand the relation between sweetness and health	▪ Identify the sweetness preference among the pupils ▪ The relation between sweetness and health	▪ Sample food (sikhye)
10	The unique taste of traditional foods	▪ Know the unique ingredients of traditional foods ▪ Experience the unique taste of traditional foods	▪ The unique ingredients of traditional Korean foods ▪ Dried vegetables with bibimbap	▪ Sample food (dried vegetables)
11	The value of food and table manners	▪ Know the value of food ▪ Keep the table manners	▪ The farming process ▪ Express the value of food through table manners	▪ Sample food (ballon flower root)
12	The pleasures of eating together	▪ Express the pleasure of eating together	▪ Self-evaluate eating habit ▪ Set the refreshment table ▪ The pleasure of eating together	▪ Sample food (injeolmi, omijacha, gangjeong) ▪ Model (stickers)

Table 3. Summary of evaluation method and tool

Level	Object	Measurement items	Tools	Subjects	Period
	General characteristics	Importance of five senses.	Questionnaire	Educated, control 1[1)]	Pretest
1	Reaction (satisfaction)	Effectiveness of teaching and learning. Appropriateness of materials and contents.	Questionnaire	Educated, parents	Posttest
2	Learning	Acquired the knowledge. Improved attitudes (FNS: food neophobia scale).	Questionnaire	Educated, control 1[1)], II [2)]	Pretest, posttest
3	Behavior	Changed Behaviors (WTNF: willingness to taste unfamiliar food test)	Questionnaire, unfamiliar foods	Educated, control 1[1)], II [2)]	Pretest, posttest

[1)] Same age and grade as educated group.
[2)] 6th grade

acquired, showing eating attitudes as a result of the program. Level 3 (behavior) measured the behavioral changes related to unfamiliar foods.

The pre-test and post-test were administered to the educated and control groups by the researcher, and the children answered self-administered questionnaires. The pre-test surveyed on general items, nutrition knowledge, eating attitudes and behaviors a week prior education. The post-test was done a week after the program with the same items from the pre-test and included education satisfaction.

The variables of general characteristics contained measures of

Table 4. The eight unfamiliar foods for tasting and willingness to eat

Pretest	Posttest
Proso	Adlay
Ssuktteok	Bamboo sprout
Olbanggaemuk	Ginkgo nut
Burdock	Dried slices of daikon
Sea weed fusiforme	Aralia
Beet	Maesiljangajji
Cheonggukjang	Korean lettuce kimchi
Sujeonggwa	Songhwamilsu

senses which are important food choices. Important sensory food choices are displayed on the 4-point Likert scale.

The questionnaire items of education satisfaction were selected based on previous studies [20]. The education satisfaction consisted of 3 items related teaching and learning activity and 4 items related education results for children. The questions for parents consisted of 2 items on teaching and learning activity and 5 items on educational outcomes. Cronbach's alpha of education satisfaction were 0.835 (children) and 0.875 (parents).

The items of knowledge formed 6 parts on Korean foods, 2 on the five senses and 1 on picky eating habits based on the program contents. Each item was answered 'right' or 'wrong', and scored either '1' point (right answer) or '0' (wrong answer). The items of knowledge were used after modifying the preliminary survey of 10 children. Reliability was assessed using the Kuder Richardson Formula (KR) 20, the KR-20 value was 0.60.

To analyze attitudes and behaviors related to unfamiliar foods, the food neophobia scale (FNS) and willingness to taste unfamiliar food tests (WTUF) were included. The method of FNS and WTUF followed procedures made by Mustonen *et al*. [1] and Reverdy *et al*. [12]. FNS with 10 items, which evaluated attitudes toward unfamiliar foods, were used 5-point Likert scales. The higher score of FNS assumed a high degree of acceptance for unfamiliar foods. Cronbach's alpha of food neophobia was 0.82.

The WTUF was evaluated in terms of neophobia food behavior [1,12]. To analyze the willingness to taste unfamiliar foods, 8 foods unfamiliar to children were chosen (Table 4). Foods were selected among Korean traditional foods. The selected foods can be assumed as unfamiliar foods for children because those foods were not presented in common food sources of nutrients [21]. Different foods were presented in each test to evaluate behavior on unfamiliar foods. Children could touch and smell the foods, but they could not actually taste the foods. The children then indicated whether they would try consuming the good or not, and the reason why they would do so. The WTUF scores were calculated by dividing the number of unknown foods that the child was willing to eat by the total number of foods that were unknown. A higher score meant a less food neophobic subject. Cronbach's alpha of WTUF was 0.74.

Statistical analysis

The SPSS 18.0 version was used to analyze the data. Descriptive statistics were performed for general characteristics and education satisfaction. Chi-square tests were applied to analyze general characteristic for the groups. ANOVA with Duncan's multiple comparison test was conducted to analyze the homogeneity of the experimental and the control group, and sensual importances for food choices. According to the result of the homogeneity, there was a significant difference among the groups. Consequently, the results of the pre-test and post-test of each group were analyzed. A paired t-test was performed to compare the knowledge, FNS and WTUF in each group.

Results

General characteristics

Importance of senses (maximum score '4' points) for food choices in all subjects were taste (3.5 ± 0.9), smell (2.9 ± 0.9), texture (2.7 ± 0.9), and appearance (2.4 ± 1.0) as shown in Table 5. Taste was very an important criteria for food choices in children.

Education satisfaction

The scores of education satisfaction in educated group were shown in Table 6. The satisfaction total score of teaching and learning (maximum score '5' points) were 4.4 ± 0.7 (children), 4.4 ± 0.5 (parents). The satisfaction score of education results (maximum score '5' points) were 4.2 ± 0.7 (children), 4.1 ± 0.5 (parents). Data showed that most children and parents were satisfied with the education program.

Knowledge

The results of nutrition knowledge were shown in Table 7. The nutrition knowledge score was increased in the educated group after education ($P < 0.05$), but there was no increase in control groups. The knowledge items, which were significantly improved in the educated group were as follows. The improved knowledge items were 'Multigrain rice is healthier than white rice' ($P < 0.05$), 'The senses of sight, smell, hearing, touch, and taste are the senses related to eating pleasures ($P < 0.05$)'.

Food neophobia scale and willingness to taste unfamiliar food test

The results of the FNS were shown in Table 8. The educated group showed positive changes on the FNS ($P < 0.05$). There were no changes in control Ⅰ and control Ⅱ.

The results of the WTUF were shown in Table 9. There were no significant differences in all groups.

Table 5. The degrees of sensual importance in food choices in all groups

Variable	Items	Importance
Senses	Taste	$3.5 \pm 0.9^{a1),2)}$
	Smell	2.9 ± 0.9^{b}
	Texture	2.7 ± 0.9^{b}
	Appearance (color and shape)	2.4 ± 1.0^{c}

[1] Mean ± SD, The lowest scale (1 point) means 'not at all', the highest scale (4 points) means 'very important'.
[2] Values with different superscript letters within a column are significantly different at $P < 0.05$ by Duncan's multiple-range test.

Table 6. Education satisfaction by educated group

Variables		Items	Satisfaction
Teaching and learning activity	Children	The contents of material were easy to understand	4.2 ± 0.8[1)]
		The illustrations of material were helpful for understanding education contents.	4.4 ± 0.8
		The nutrition class was interesting	4.7 ± 0.6
		Total	4.4 ± 0.7
	Parents	My child attended the nutrition lesson with interest	4.6 ± 0.5[1)]
		My child told us learning contents of the lesson at home.	4.2 ± 0.8
		Total	4.4 ± 0.5
Education result	Children	I will try to do what is learned in nutrition class	4.0 ± 1.0
		To try eating novel foods is pleasant after nutrition class	4.5 ± 0.7
		I'm not picky in eating after nutrition class.	4.2 ± 1.0
		I'd like to recommend nutrition class to other friends.	4.2 ± 1.1
		Total	4.2 ± 0.7
	Parents	Eating behavior of my child has improved after class.	3.8 ± 0.8
		I learned something from talking to my child.	3.8 ± 0.8
		I hope that other children attend the nutrition class.	4.2 ± 0.5
		If the nutrition classes could be offered continuously, my child will attend.	4.4 ± 0.5
		I hope the parents' class to be opened in school for improving children's eating behaviors.	4.0 ± 0.7
		Total	4.1 ± 0.5

[1)] Mean ± SD, The highest scale (5 points) means 'very satisfaction'.

Table 7. Comparison of nutrition knowledge score among groups

Group	Pretest	Posttest	t-value
Educated	4.5 ± 2.4[1)]	5.5 ± 1.7	2.602*
Control Ⅰ[2)]	3.4 ± 1.7	3.5 ± 1.7	0.413
Control Ⅱ[3)]	5.0 ± 1.4	5.7 ± 1.3	1.875

[1)] Mean ± SD, The scale score is as follows: right answer '1', wrong answer '0'.
[2)] Same age and grade as educated group.
[3)] 6th grade
*P< 0.05 by paired t-test.

Table 8. Comparison of food neophobia scale[1)] among groups

Group	Pretest	Posttest	t-value
Educated	3.1 ± 0.6[2)]	3.6 ± 1.0	2.586*
Control Ⅰ[3)]	3.3 ± 0.5	3.3 ± 0.7	0.294
Control Ⅱ[4)]	2.9 ± 0.5	2.8 ± 0.6	1.651

[1)] 5-point scale: 1; totally disagree, 3; neither agree nor disagree, 5; totally agree.
[2)] Mean ± SD.
[3)] Same age and grade as educated group.
[4)] 6th grade
*P< 0.05 by paired t-test.

Table 9. Comparison of willingness to taste unfamiliar food test score[1)] among groups

Group	Pretest	Posttest	t-value
Educated	0.33 ± 0.2[2)]	0.30 ± 0.2	0.611
Control Ⅰ[3)]	0.38 ± 0.2	0.26 ± 0.2	0.924
Control Ⅱ[4)]	0.32 ± 0.2	0.27 ± 0.2	0.311

[1)] The highest scale (1) means 'not avoid to taste unfamiliar food'.
[2)] Mean ± SD.
[3)] Same age and grade as educated group.
[4)] 6th grade

Discussion

The developed sensory education program based on precedent studies can be considered as a new trial of nutrition education in elementary schools, Korea. Descriptive knowledge, such as nutritional information or imaginary foods on its own, has no sufficient effects on children trying unfamiliar or novel foods or generating desirable eating behaviors [13].

Children experiences 'food choices' and 'eating behavior', as repeated daily, through the activities of sensory education programs in the classroom. In addition, such education program can encourage children to recognize unique tastes through the senses using 'real food'. The senses such as sight, smell, hearing, touch, and taste experiences through the foods help children to recognize the distinct food characteristics and create recognitions and feelings [22]. Therefore, these activities are specifically for children.

After participating in the sensory education program, the satisfaction of education is high in both children and parents (Table 6). In addition, results indicate that the goal of the program, which is to eat a variety of foods and form healthy diets, may be efficient and effective. Thus, the teaching and learning activity are important factors to motivate children [23].

There are significant differences in knowledge between the educated group and control groups ($P < 0.05$). It clearly shows that the education contents and activities of sensory education be different from that of other subjects. Sensory education cannot only aim to improve thinking or understanding.

In the results of the FNS in children, there was significant differences in the educated group ($P < 0.05$), but there were no differences in both control Ⅰ and control Ⅱ. Findings from the control Ⅱ supposes that food neophobia, such as attitude to avoid

novel or unfamiliar foods, may not naturally change as children get older. Children who have strong food neophobia are usually picky eaters, and picky eating is connected with dietary problems such as limited and unhealthy diet [1,12]. Therefore, the propensity of children to avoid unfamiliar foods should be influence since childhood. This result indicates that sensory education can lead to motivation of children. Sensory education aims to motivate children to practice healthy eating behaviors. The contents and activities of sensory education may act as compelling forces that are necessary to improve eating behaviors [1].

The results of the WTUS in children showed there were no differences in all groups. Such findings indicate that behaviors to accept unfamiliar foods are not easily influenced. Findings from this study cannot precisely determine that sensory education leads to healthier and well-balanced eating habits in children, but changes of the FNS show that the program has the potential to improve children's attitudes towards certain foods.

In general, the activities in sensory education focus on the awareness and the expression of sensory modalities of foods, as well as sensory-affective satisfaction. The sensory education program adds pleasures to eating. Children do not consider the nutritions of food while eating; they only pay attention to the taste of the food [1]. The program allows children to try different foods and consider the food quality. Thus, this study suggests using various sensory education activities to enhancing children's consumption behaviors in elementary schools.

To maintain the effects of sensory education, it is necessary to continue this education over a longer period of time. Short-term education only has a temporary effect because human's behavioral change is a reversible process.

In conclusion, although this study emphasizing sensory education may encourage children to have a healthier eating behavior, the hypothesis of the study cannot be strongly verified. Nevertheless, this study shows the strengths of sensory education for children.

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