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Health Education Using Videos and Leaflets to Promote Preconception Care for Adolescent Females in Japan Evaluation up to Six Months Later

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Abstract

Objective: The purpose of this study was to evaluate health education using videos and leaflets for preconception care (PCC) awareness among adolescent females up to six months after the health education. **Methods:** The subjects were female university students living in the Kinki area. A longitudinal survey was conducted on 67 members in the intervention group, who received the health education, and 52 members in the control group, who did not receive the health education. The primary outcome measures were knowledge of PCC and the subscales of the Health Promotion Lifestyle Profile. Surveys were conducted before, after, and six months after the intervention in the intervention group, and an initial survey and survey six months later were conducted in the control group. Cochran's Q test, Bonferroni's multiple comparison test, and McNemar's test were used to analyze the knowledge of PCC data. The Health Awareness, Nutrition, and Stress Management subscales of the Health Promotion Lifestyle Profile were analyzed by paired t-test, and comparisons between the intervention and control groups were performed using the two-way repeated measures analysis of variance. **Results:** In the intervention group of 67 people, the number of subjects who answered "correct" for five of the nine items concerning knowledge of PCC increased immediately after the health education ($P = 0.006$) but decreased for five items from immediately after the health education to six months later ($P = 0.043$). In addition, the number of respondents who answered "correct" for "low birth weight infants and future lifestyle-related diseases" ($P = 0.016$) increased after six months compared with before the health education. For the 52 subjects in the control group, there was no change in the number of subjects who answered "correct" for eight out of the nine items after six months. There was also no increase in

scores for the Health Promotion Lifestyle Profile after six months for either the intervention or control group. **Conclusion:** Providing health education about PCC using videos and leaflets to adolescent females was shown to enhance the knowledge of PCC immediately after the education.

Keywords

Preconception Care, Adolescent Females, Health Education, Leaflets, Videos, Non-Randomized Controlled Trial

1. Introduction

Preconception care (PCC) is care that helps females and couples manage and improve their health for future pregnancies [1] and is an important initiative that leads to improvement of the health of females, couples, and children in the future. The U.S. Centers for Disease Control and Prevention (CDC, 2006) and World Health Organization (WHO, 2012) have already made substantial recommendations overseas [1].

In Japan, the average age of first marriage for females increased from 28.8 years in 2010 to 29.7 years in 2022 [2], and it has been noted that late marriage among females is associated with infertility due to the decline of fertility. In addition, 18.2% of couples have actually undergone (or are currently undergoing) infertility testing or treatment, and 28.2% of childless couples have undergone such treatment [3]. Furthermore, the number of low birthweight babies born to females due to excessive thinness has been increasing since the 1990s and has remained unchanged at around 10% since 2010 [2]. Low birthweight infants are at increased risk of developing lifestyle-related diseases in adulthood due to their low nutritional status during the fetal period, and DOHaD (Developmental Origins of Health and Disease) is considered a problem [4].

As a solution to these problems, the PCC Center was established at the National Center for Child Health and Development in 2015 to promote PCC, and a PCC checklist was created that was tailored to the actual situation in Japan [1]. In October 2019, the Association for Preconception Care defined preconception care in Japan as the maintenance and promotion of the physical, psychological, and social health of all people from preadolescence to reproductive age. It also proposed that its purpose should be to maintain and promote the health of the next generation as well as one's own health now and in the future and to improve the health of the entire nation [5]. Despite these efforts, there are still few preventive intervention studies of PCC for adolescent, young adult, and mature females in Japan [6], although some have been conducted for female high school students [7] and for mature working females [8] [9]. The author previously conducted a health education program for PCC awareness among mature working females without complications in 2019 and found that knowledge of PCC was improved but that behavior changes were only partially observed [8] [9]. In order to further promote behavior

changes, an attempt was made to modify the leaflets used in the previous program and create instructional media using video clips. In 2020, professionals involved in raising the awareness of PCC among adolescent females were asked for their opinions on the videos and leaflets that had been devised, with the target this time being adolescence, which was when the mature working females wished they had received the health education. Based on the results, areas to investigate were identified, and the videos and leaflets were refined.

This time, the purpose of the survey was to evaluate the effectiveness of PCC health education in an intervention group using the modified videos and leaflets to raise awareness of PCC in adolescent women and a control group.

Raising awareness of PCC like this is provided as support for those in the process of maturing under the Basic Law on Maturity and Development promulgated in December 2018 [10]. In addition, this study also aimed to provide a fundamental resource for the support of those in the process of growing up.

Therefore, the purpose of this study was to conduct health education using videos and leaflets about PCC awareness among adolescent females and to evaluate it by comparing the knowledge, awareness, and behavior concerning PCC before, immediately after, and six months after implementation of the health education. In addition, the research hypotheses were: 1) the intervention group would have a higher proportion of people with "knowledge of PCC" after six months than the control group, and 2) the intervention group would have higher scores on the subscales of "health awareness", "nutrition", and "stress management" of the "Health Promotion Lifestyle Profile Scale" after six months than the control group.

2. Methods

2.1. Study Design

This was a non-randomized controlled trial to evaluate the effects of health education in two groups: an intervention group, in which health education was provided at each university, and a control group, in which health education was not provided.

The reason for opportunity sampling was that in the previous survey, working mature women had expressed a desire to take PCC health education courses while they were university students.

2.2. Subjects and Methods

A longitudinal, comparative study was conducted from November 2021 to November 2023 between the intervention group, which was provided health education using PCC videos and leaflets, and the control group, which was not provided such education. The subjects were adolescent female college students in their second year in medical related departments living in the Kinki area, and flyers describing the study were distributed to solicit their participation.

According to the *Kojien Japanese Dictionary*, "adolescence" refers to the period

from puberty to the mid-twenties [11]. Since the Japan Society of Obstetrics and Gynecology defines "puberty" as the period from 8 - 9 to 17 - 18 years of age [12], "adolescence" was defined in this study as the period after puberty from 19 to 25 years of age. The second year was selected in order to target second-year college students who were 19 years of age or older, as 18-year-old first-year college students were considered to still be in the puberty stage. Pregnant females were excluded.

2.3. Overview of the PCC Health Education

The specific goals of the PCC health education were as follows: 1) adolescent females will be able to learn about PCC and 2) adolescent females will be able to act based on their knowledge of PCC.

This study was planned with reference to the Trans-Theoretical Model [13] [14]. It is a model that promotes behavioral change by encouraging behavioral change through interventions tailored to each stage of the behavioral change process, which includes the precontemplation, contemplation, preparation, action, and maintenance stages [13] [14]. Although adolescent females have high levels of health given their ages, it is impossible to predict the stages of the subjects before an intervention. Therefore, in the questionnaire before the health education, the students were asked if they were interested in preconception care, and those who answered that they were not interested were considered to be in the precontemplation stage, while those who answered that they were interested were considered to be in the contemplation stage. This is because previous research has reported that Japanese females lack adequate knowledge about healthy pregnancy and childbirth [15], and it can be assumed that the majority are in the precontemplation stage (the stage in which there is no desire to change one's behavior and problems are denied) or the contemplation stage (the stage in which one understands one's own problems, finds the causes, and makes an effort to solve them).

The only specific intervention in this study was PCC health education using videos and leaflets. Therefore, the leaflets used in the previous study were modified based on the evaluation in that study and were prepared with the assumption that adolescent females were the target population. The videos and leaflets were then revised again under the supervision of one doctor, two public health nurses, one midwife, one nurse, and two dietitians. The main modification was use of the Preconception Care Check Sheet [5] to explain preconception care and the creation of checkboxes for on the day of health education, three months later, and six months later to enable scoring. The periodic scoring provided an opportunity for self-evaluation. A column for calculating and entering BMI was created to raise awareness of one's appropriate weight. In order to visualize the trends in late marriage and late childbearing in Japan, the average age at first marriage [2] and average age at childbirth among Japanese females [2] were shown in the figures. Furthermore, to raise awareness of oocyte aging, figures were presented for the "change in fertility with age of females" [16] and "mother's age and spontaneous

abortion rate" [17]. As information on thinness and its effects on the fetus, figures for the "percentage of thin females over 20 years old" [18] and "percentage of births under 2500 g among all births" [2] were shown. Information on folic acid intake and neural tube defects was illustrated with figures and photographs, and explanations were given about the disorders that affect daily life. The contents of the PCC health education were as follows: "What is preconception care?" "Oocyte aging, and infertility" "life planning", "about the effects of thinness", "about folic acid", "about rubella vaccination", "about sexually transmitted diseases", "about cervical cancer screening", and "self-examination for breast cancer" (Table 1).

Table 1. Contents of PCC health education.

Item
What is preconception care?
Oocyte aging, and infertility
Life planning
About the effects of thinness
About folic acid
About rubella vaccination (watching a video)
About sexually transmitted infections
About cervical cancer screening
Self-examination for breast cancer

Regarding congenital rubella syndrome, viewing of a video [19] of a mother who had contracted rubella during pregnancy and lost her child was period for emotional experience. Self-examination for breast cancer was explained using a video and leaflet.

2.4. Survey Procedures and Data Collection Details

2.4.1. Intervention Group

1) Before health education

A flyer was used to encourage participation through opportunity sampling, and the subjects were asked to gather at a designated location, such as a university lecture room, to scan a QR code or enter an URL, and to enter their responses online. To protect the subjects' data, SurveyMonkey, an online survey provider that has obtained ISO 27001 certification, was used. The survey included basic information (age, marital status, presence or absence of childbirth experience, pre-existing conditions, cohabitants, desire to have children in the future, interest in PCC); nine items related to the Knowledge of PCC (two response options: correct or incorrect); and 10 items from the Health Awareness subscale, nine items from the Nutrition subscale, and seven items from the Stress Management subscale of the Health Promotion Life Profile Scale (all on a four-point Likert scale; Table 2).

Table 2. Survey content.

	Item	Type of outcome
1) Background of the subjects	Age, marital status, presence or absence of childbirth experience, pre-existing conditions, cohabitants, desire to have children in the future, interest in PCC	Characteristics of the subjects
2) Knowledge, awareness, and behavior concerning PCC	Knowledge of PCC (9 items; 2 response choices: correct or incorrect) Subscales of the Health Promotion Life Profile Scale: Health Awareness (10 items), Nutrition (9 items), Stress Management (7 items) (All using a 4-point Likert scale)	Primary outcomes
3) Ease of understanding the videos and leaflets	(4 items: 4-point Likert scale) Free descriptions of opinions and impressions	Evaluations of the videos and leaflets

In conducting the longitudinal survey, the data were tracked by the PINs entered by the survey participants.

2) PCC health education

The leaflets used in the previous study in November 2021 were modified based on an evaluation of them, and the author, who is a qualified nurse and midwife, provided 30 minutes of health.

education at the designated sites using the PCC videos and leaflets prepared under the assumption that they would be targeted at adolescent females.

3) Immediately after the health education

A nine-item online survey on knowledge of PCC was conducted.

Then, an open-ended online survey concerning the videos and leaflets was conducted using four-point Likert scales for clarity (very easy to understand, easy to understand, somewhat difficult to understand, difficult to understand) and usefulness (very useful, useful, not very useful, not useful), as well as to collect opinions and impressions.

4) After six months

Six months later, a flyer was used to encourage participation, and the subjects were asked to gather at a designated location, such as a university lecture room; to scan a QR code or enter an URL; and to enter their responses online. The survey included nine items related to knowledge of PCC; 16 items related to PCC awareness and behavior; and 10 items related to Health Awareness, nine items related to Nutrition, and seven items related to Stress Management, which are subscales of the Health Promotion Life Profile Scale.

2.4.2. Control Group

1) Initial survey

A flyer was used to encourage participation through opportunity sampling, and

the subjects were asked to gather at a designated location, such as a university lecture room; to scan a QR code or enter an URL; and to enter their responses online. The survey included basic information (age, marital status, presence or absence of childbirth experience, pre-existing conditions, cohabitants, desire to have children in the future, interest in PCC); nine items related to the Knowledge of PCC (two response options: correct or incorrect); 10 items from the Health Awareness subscale, nine items from the Nutrition subscale, and seven items from the Stress Management subscale of the Health Promotion Life Profile Scale (all on a four-point Likert scale).

In conducting the longitudinal survey, the data were tracked by the PINs entered by the survey participants.

2) After six months

Six months later, a flyer was used to encourage participation, and the subjects were asked to gather at a designated location, such as a university lecture room; to scan a QR code or enter an URL; and to enter their responses online. The online survey was conducted on nine items related to PCC knowledge and on 10 items related to Health Awareness, nine items related to Nutrition, and seven items related to Stress Management, which are subscales of the Health Promotion Life Profile Scale.

3) After the six-month survey

The prepared leaflets on PCC were given to the online survey respondents, and the URLs for viewing the videos were distributed to their e-mail addresses.

The control group was provided with the PCC video and leaflet after completing the survey in order to minimize any disadvantages associated with not receiving the PCC health education.

2.5. Analysis Methods

The sample size was calculated using G*Power Ver. 3.0. Under the conditions of applying an unpaired *t*-test (two-tailed) to the difference between the means of the pre- and post-intervention changes in the primary outcome measures for the intervention and control groups and assuming an effect size of 0.5, a significance level of 0.05, and a power of 0.8, the required sample size was 64 subjects in each group. The final analysis included 67 subjects in the intervention group and 52 subjects in the control group. We believed that assuming a moderate effect size would increase statistical power and produce more reliable results.

First, descriptive statistics were calculated for the survey items.

Then, in comparisons of the characteristics of the subjects in the intervention and control groups, the Mann-Whitney *U* test was used for age, and the chi-square test was used for the other items. Cochran's *Q* test and Bonferroni's multiple comparison test were used to compare the percentages of subjects with knowledge of PCC before, immediately after, and six months after the health education in the intervention group. McNemar's test was used to compare control group data from the initial survey and that after six months. Furthermore, paired *t*-tests were used

for intragroup comparisons of the Health Awareness, Nutrition, and Stress Management subscales of the Health Promotion Life Profile Scale before and six months after the PCC health education in the intervention group and for the initial survey and that after six months in the control group, and two-way repeated measures analysis of variance was used for intergroup comparisons. The statistical analysis software used was IBM SPSS Statistics 28, and the significance level was set at 5% for all analyses.

Free-text responses for opinions and impressions of the videos and leaflets were categorized by common codes. In categorization, the data were analyzed with reference to KH Coder [20], a text mining software, and the validity of the naming was examined. The number of subjects for analysis of the videos and leaflets was 98.

2.6. Ethical Considerations

This research was conducted after receiving approval from the Research Ethics Review Committee for Human Subjects at the author's university, Setsunan University (approval number 2021-022). The research subjects were given a written and verbal explanation of the purpose, content, and methods of the research, as well as the right to decline to participate, the benefits and disadvantages, and the protection of personal information. If consent was obtained, the subjects were able to participate in the online survey.

3. Results

1) Characteristics of the subjects (Table 3)

Table 3. Characteristics of the subjects.

		Intervention group (n = 67)		Control group (n = 52)		P-value
		n	(%)	n	(%)	
Age†		20.19	(0.4)	20.10	(0.3)	P = 0.141
Marital status‡	Yes	0	(0)	0	(0)	-
	No	67	(100)	52	(100)	
Experience of childbirth‡	Yes	0	(0)	0	(0)	-
	No	67	(100)	52	(100)	
Presence of chronic illness‡	Yes	1	(1.45)	0	(0)	P = 0.376
	No	66	(98.5)	52	(100)	
Presence of cohabitants‡	Yes	60	(89.6)	48	(92.3)	P = 0.607
	No	7	(10.4)	4	(7.7)	
Presence of desire to have children‡	Yes	56	(83.6)	46	(88.5)	P = 0.451
	No	11	(16.4)	6	(11.5)	
Interest in PCC‡	Yes	33	(49.3)	19	(36.5)	P = 0.165
	No	34	(50.7)	33	(63.5)	

†Mann-Whitney U test; ‡χ^2 test; Age is shown as the mean (SD); Hyphens (-) in the column for the P-value indicate that calculation was not possible.

The characteristics of the subjects are shown in Table 3. There were 67 subjects in the intervention group (response rate of 62.0% at six months) and 52 subjects in the control group (response rate of 25% at six months). The mean (SD) age was 20.2 (0.4) years in the intervention group and 20.1 (0.3) years in the control group ($P = 0.141$), and there were no differences in the other characteristics.

2) Comparison of the percentage of those with knowledge about PCC in the intervention group before, immediately after, and six months after the health education (Table 4)

Table 4. Comparison of the percentage of subjects with knowledge of PCC before, immediately after, and 6 months after the health education (intervention group; $n = 67$).

Question item	Before health education n (%)	Immediately after health education n (%)	6 months later n (%)	P value†	Significant difference in intergroup comparison
Oocyte aging	62 (92.5)	61 (91.0)	57 (85.1)	0.269	
Decreased fertility	64 (95.5)	67 (100)	61 (91.0)	0.05	After > 6 mo., $P = 0.043$
Thinness and low birth weight	40 (59.7)	55 (82.1)	45 (67.2)	0.002	Before < after, $P = 0.002$
Low birth weight infants and lifestyle-related diseases	16 (23.9)	51 (76.1)	30 (44.8)	<0.001	Before < after, $P = 0.000$ Before < 6 mo., $P = 0.016$ After > 6 mo., $P = 0.000$
Folic acid and neural tube defects	35 (52.2)	59 (88.1)	45 (67.2)	<0.001	Before < after, $P = 0.000$ After > 6 mo., $P = 0.009$
Effects of rubella on the fetus	60 (89.6)	66 (98.5)	63 (94.0)	0.067	
STDs and infertility	58 (86.6)	66 (98.5)	57 (85.1)	0.017	After > 6 mo., $P = 0.028$
Cervical cancer screening from age 20	56 (83.6)	67 (100)	60 (89.6)	0.004	Before < after, $P = 0.003$
Pre-existing conditions and pregnancy	54 (80.6)	65 (97.0)	56 (83.6)	0.004	Before < after, $P = 0.006$ After > 6 mo., $P = 0.034$

Number of respondents who answered "correct" (%), †Cochran's Q test, Intergroup comparisons were performed with Bonferroni multiple comparisons before and immediately after the health education and 6 months after the health education.

Among the nine question items related to knowledge of PCC before the health education, the items with the highest number of respondents who answered "correct" were "decline in fertility with age" (64 subjects, 95.5%), "oocyte aging" (62 subjects, 92.5%), "rubella infection in pregnant females and its effects on the fetus" (60 subjects, 89.6%), "STDs and infertility" (58 subjects, 86.6%), "cervical cancer screening from age 20" (56 subjects, 83.6%), and "pre-existing conditions and pregnancy" (54 subjects, 80.6%). On the other hand, "low birth weight infants and future lifestyle-related diseases" (16 subjects, 23.9%), "folic acid and neural tube defects in the fetus" (35 subjects, 52.2%), and "pregnant females' thinness and low

birth weight" (40 subjects, 59.7%) had the fewest numbers of respondents who answered "correct".

Among the nine question items related to knowledge of PCC, those for which the number of respondents who answered "correct" increased immediately after the health education compared with before the health education were "pregnant females' thinness and low birth weight" ($P = 0.002$), "low birth weight infants and future lifestyle-related diseases" ($P = 0.000$), "folic acid and neural tube defects in the fetus" ($P = 0.000$), "cervical cancer screening from age 20" ($P = 0.003$), and "pre-existing conditions and pregnancy" ($P = 0.006$). In addition, the number of respondents who answered "correct" for "low birth weight infants and future lifestyle-related diseases" ($P = 0.016$) increased after six months compared with before the health education. None of the items showed increases in the number of respondents who answered "correct" from immediately after the health education to six months later, whereas there were five items that showed decreases.

3) Percentage of subjects with knowledge about PCC in the control group in the initial survey and survey six months later (Table 5)

Table 5. Comparison of the percentage of respondents with knowledge of PCC in the initial survey and that 6 months later (control group; $n = 52$).

Question item	Initial survey n (%)	6 months later n (%)	P-value[†]
Oocyte aging	41 (78.8)	36 (69.2)	0.332
Decreased fertility	48 (92.3)	46 (88.5)	0.688
Thinness and low birth weight	35 (67.3)	44 (84.6)	0.035
Low birth weight infants and lifestyle-related diseases	26 (50.0)	31 (59.6)	0.302
Folic acid and neural tube defect	37 (71.2)	36 (69.2)	1.000
Effects of rubella on the fetus	46 (88.5)	48 (92.3)	1.000
STDs and infertility	48 (92.3)	47 (90.4)	1.000
Cervical cancer screening from age 20	46 (88.5)	46 (88.5)	1.000
Pre-existing conditions and pregnancy	36 (69.2)	42 (80.8)	0.180

Number of respondents who answered "correct" (%), [†]McNemar's test.

Among the nine question items related to the knowledge of PCC in the initial survey, the items with the highest number of respondents who answered "correct" were "decline in fertility with age" (48 subjects, 92.3%), "STDs and infertility" (48 subjects, 92.3%), "rubella infection in pregnant females and its effects on the fetus" (46 subjects, 88.5%), "cervical cancer screening from age 20" (46 subjects, 88.5%), and "oocyte aging" (41 subjects, 78.8%). On the other hand, "low birth weight infants and future lifestyle-related diseases" (26 subjects, 50.0%), "pregnant female thinness and low birth weight" (35 subjects, 67.3%), "pre-existing conditions and pregnancy" (36 subjects, 69.2%) had the fewest numbers of respondents who

answered "correct".

The number of respondents who answered "correct" for "pregnant female thinness and low birth weight" increased after six months as compared with the initial survey ($P = 0.035$). There were no significant differences among the other eight items.

4) Comparison of the Health Awareness, Nutrition, and Stress Management subscales of the Health Promotion Lifestyle Profile in the initial survey and that six months later (Table 6)

Table 6. Comparison of scores for the subscales of the health promotion lifestyle profile (health awareness, nutrition, and stress management) in the initial survey and that 6 month later.

Item Score range	$n = 67$ $n = 52$	Initial		6 months		Intragroup difference P-value†	Intergroup difference P-value‡
		Mean	Standard deviation	Mean	Standard deviation		
Health awareness (1 to 4 points)	Intervention group	2.22	0.45	2.12	0.41	0.071	0.79
	Control group	1.21	0.45	1.22	0.45	0.824	
Nutrition (1 to 4 points)	Intervention group	2.47	0.38	2.48	0.37	0.659	0.40
	Control group	1.55	0.39	1.52	0.41	0.418	
Stress management (1 to 4 points)	Intervention group	2.73	0.48	2.57	0.41	0.003	0.14
	Control group	1.74	0.46	1.68	0.43	0.295	

†Paired t-test; ‡Two-way repeated measures analysis of variance.

There were no increases in the scores of the Health Awareness, Nutrition, and Stress Management subscales of the Health Promotion Lifestyle Profile between the initial survey and that at six months for either the intervention group or control group, neither intragroup differences nor intergroup differences, at six months.

5) Evaluation of videos and leaflets for PCC health education

Immediately after the health education, the subjects were asked about the ease of understanding and usefulness of the videos. Among them, 96 (98%) responded with "very easy to understand" or "easy to understand", and 97 (99%) responded with "very useful" or "useful". Regarding the ease of understanding and usefulness of the leaflets, 96 (98%) responded with "very easy to understand" or "easy to understand", and 98 (100%) responded with "very useful" or "useful".

Opinions and impressions about the videos and leaflets were requested in open-ended comments and categorized by common codes. As a result, 10 subcategories and 51 codes were obtained. Subcategories are indicated in square brackets below together with the numbers of codes in parentheses: [Easy to understand] (17), [I

understood the necessity of the vaccine] (10), [It made me think about my future] (5), [I learned something I didn't know] (5), [Important knowledge for both males and females] (4), [The video of a mother with a child with congenital rubella syndrome left an impression on me] (3), [I will definitely get inoculated against rubella] (2), [I want to perform self-examinations for breast cancer] (2), [It is useful] (2), and [I hope it will become popular] (1).

4. Discussion

1) Current situation regarding knowledge about PCC

Compared with the 2019 survey, in which the percentages of mature working females with correct responses were 90.7% for "oocyte aging" and 81.3% for "decline in fertility with age", those for the adolescent female population in the current survey were 92.0% for "oocyte aging" and 95.0% for "decline in fertility with age", indicating that the population had higher recognition rates. Among the mature working females, 64.0% had no knowledge of "pregnant female thinness and low birth weight", and 81.3% had no knowledge of "low birth weight infants and future lifestyle-related diseases" [8] [9]. In this study, 41.0% of the respondents had knowledge of "pregnant female thinness and low birth weight", and 76.0% had knowledge of "low birth weight infants and future lifestyle-related diseases", indicating that they were more knowledgeable than those in the previous studies [8] [9]. It was clear that there is a need to inform adolescent females about the "effects of thinness on the fetus", as few of them were aware of this, especially that it leads to "future lifestyle-related diseases". In the previous studies, 80.0% of the subjects had no knowledge of "folic acid and neural tube defects in the fetus" [8] [9], whereas in the present study, 48.0% of the subjects had no knowledge of this. Since 2000, the Ministry of Health, Labour and Welfare (MHLW) has recommended folic acid intake for the prevention of neural tube defects [21], and some improvement has been made, as the number of people who are aware of this recommendation has been increasing. However, the situation remains that about half of the respondents "do not know about it". For the prevention of neural tube defects in the fetus, the intake of folic acid by pregnant females is necessary from one month before pregnancy to the third month of pregnancy [21]. Therefore, it is necessary to continuously educate not just adolescent females but both adolescent and mature females about the necessity of folic acid for the prevention of neural tube defects in the fetus.

2) Evaluation of PCC health education using videos and leaflets

a) Comparison of the percentage of subjects with knowledge about PCC in the intervention group before, immediately after, and six months after the health education

Among the nine question items related to knowledge of PCC, those that showed increases in the percentage of respondents with knowledge of PCC after the health education compared with before the health education were "pregnant female thinness and low birth weight" (P = 0.002), "low birth weight infants and future

lifestyle-related diseases" (P = 0.000), "folic acid and neural tube defects in the fetus" (P = 0.000), "cervical cancer screening from age 20" (P = 0.003), and "pre-existing conditions and pregnancy" (P = 0.006). The percentage of subjects with knowledge of "low birth weight infants and future lifestyle-related diseases" increased after six months compared with before the health education (P = 0.016). There were no items for which the percentage of subjects with knowledge of them increases from immediately after the health education to six months later, whereas there were five items that showed decreases. In this study, no interventions were conducted between immediately after the health education and six months after the education. In the previous study's interventions, a survey was administered in the third month, and feedback was collected by mail in the form of single-phrase comments about the survey results. The results showed that without interventions such as feedback of the results, knowledge was not retained. The percentage of subjects with knowledge of PCC increased immediately after the health education compared with before the education but decreased after six months. The decrease after six months may have been due in part to the fact that 50.7% of the respondents indicated that they had no interest in PCC. Adolescent females are "adults with no immediate intention to become pregnant" in the "model of the behavioral phases of preconception" [5]. Therefore, they have little interest in preconception care. However, the lifestyle habits of adolescents affect their ability to have healthy children in the future. The provision of information on how to avoid losing the ability to have healthy children may motivate adolescent females to change their behavior, and thus information should continue to be provided to adolescents.

b) Comparison of the initial results and those after six months for the Health Awareness, Nutrition, and Stress Management subscales of the Health Promotion Lifestyle Profile

There were no increases in the scores of the Health Awareness, Nutrition, and Stress Management subscales of the Health Promotion Lifestyle Profile between the initial survey and that six months later for either the intervention or control group. In the "model of the behavioral phases of preconception", [5] adolescent women are "adults who have no intention of becoming pregnant anytime soon". For this reason, it is thought that they have little interest in preconception care, which explains why there was no increase in scores after six months in both the intervention and control groups. In a survey of mature working females, the scores for Health Awareness increased after six months [8]. Again, it is possible that the three-month feedback intervention had an effect on the increase in scores. This suggested that there is a need for continuous provision of information from adolescence.

c) Evaluation of videos and leaflets for PCC health education

Immediately after the health education, the videos and leaflets received positive and high evaluations, with 96 (98%) of the respondents answering that the videos were "easy to understand", 97 (99%) of the respondents answering that the videos were "useful", 96 (98%) of the respondents answering that the leaflets were "easy to understand", and 98 (100%) of the respondents answering that the leaflets were

"useful. However, although it was found that the responses for "ease of understanding" and "usefulness" influenced knowledge acquisition immediately after the health education, they did not lead to knowledge retention or changes in awareness and behavior six months later.

Thus, in this study, research hypothesis 1) was partially verified because the proportion of participants with knowledge of PCC increased at the end of the study compared to before the health education. Hypothesis 2) regarding "PCC awareness and behavior" was not verified because no behavioral changes were observed 6 months after the PCC health education. In order to further establish knowledge of PCC among adolescent females and promote behavioral changes, it is necessary to provide repeated feedback, as it is difficult to establish knowledge and promote behavioral changes with a single health education session.

3) Limitations of the research and future research issues

The limitations of this study include the fact that it was conducted in a limited area and did not employ random sampling. As future issues, the subjects must be randomly selected and the results must be generalizable.

5. Conclusions

The aim of this study was to evaluate health education using videos and leaflets by assessing changes in knowledge, awareness, and behavior concerning PCC before, immediately after, and six months after health education to raise preconception care awareness among adolescent females.

The results showed that the percentage of subjects with knowledge of PCC increased immediately after the health education compared with those before the health education, but it decreased after six months. The percentage of subjects with knowledge of "low birth weight infants and lifestyle-related diseases" increased six months after the health education. No behavioral changes were observed in the Health Awareness, Nutrition, and Stress Management subscales of the Health Promotion Lifestyle Profile six months after the PCC health education.

Therefore, it was found that knowledge of PCC was obtained immediately after the education but that only one item of knowledge of PCC remained established until six months after the education. For items for which knowledge was not maintained and for which behavior changes were not observed, ways to provide information on an ongoing basis will continue to be developed in the future.

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Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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