

Comparison of Life Skills Development between Different Nutrition Education Methods for High School Baseball Players: Verification According to the Stage of Change

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Abstract:

The development of life skills is essential for adolescents to grow into healthy adults. The purpose of this study is to examine the changes in life skills development among high school baseball players by comparing different methods of teaching nutrition education. The results were verified according to the stages of change of the Transtheoretical Model (TTM). The participants, one hundred and twenty-nine first-grade Japanese high school baseball players, were divided into three groups. All the participants were given a group lecture. In addition, based on the content of the group lecture, rice was utilized by the first group of athletes (RICE group). The second group was given individual tuition based on the results of individual body composition and dietary intake (INE group). The third group that only received the group lecture was set as the CON group. After three months of intervention, life skills scores among the three groups were compared according to the stages of change of the TTM. As a result, the amount of change in the life skills scores of the RICE group before and after nutrition education was significantly higher than that of the INE group in the pre-action stage ($P < .01$). Furthermore, the self-efficacy scores of the RICE group were significantly higher than the INE and CON groups ($P < .001$). These results were not seen in the action/maintenance stage. The results of this study suggested that, in order to develop life skills, it is necessary to understand the subject's stage of change and select a nutrition education method that is appropriate for that stage. If self-efficacy regarding dietary control is low, the results show that individual education for such subjects may hinder their improvement in life skills. In contrast, experiential nutrition education utilizing actual ingredients could be one of the methods of life skills education through food in the pre-action stage. Through comparison with other grades, it is necessary to verify whether the results of this study are characteristic of first-grade nutrition education.

Keywords: *life skills, self-efficacy, nutrition education, adolescent*

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1. Introduction

In order to confront many challenges and develop into healthy adults, adolescents need to develop various life skills (Gould, 2010). The World Health Organization defines life skills as “abilities for adaptive and positive behavior that enable individuals to deal effectively with the demands and challenges of everyday life”, and ten main life skills such as “creative thinking” and “effective communication” are listed (WHO, 1994). These skills are considered necessary skills for children and adolescents because they promote their health and well-being. However, many adolescents lack the life skills to deal with the demands and stresses they experience (WHO, 1994). For example, it is known that anxiety and poor life skills may cause the development of loneliness resulting from shyness (Dill, 1999). These are social and mental issues for adolescents, and because of the frequent maladjustment of adolescents and problematic behavior, life skills play a large role in the formation of personality during the growth period. Thus, life skills are associated with a variety of life experiences, and so education to acquire these skills during the growth stage is necessary to promote the healthy behavior and mental well-being of children (WHO, 1999).

Among children, it is known that the life skills of growing athletes are significantly higher than those of the same age group who do not belong to an athletic club (Murakami, 2004). In addition, improving the life skills of athletes not only helps them to solve problems in their daily lives, but also to improve their performance by applying the life skills they are taught (Papacharisis, 2005). Baseball players, in particular, are more cooperative than other sports players (Tokunaga, 2000). Since baseball is a team sport, it is expected that baseball players have opportunities to communicate with many environmental factors such as teammates, coaches, family members, and nutrition educators. Such an environment may influence the improvement of life skills, but there are few studies on life skills interventions for growing baseball players.

In this study, we focused on “food and nutrition” as an educational object of life skills because it can be practiced in everyday life. Eating is one of the basic activities of human life and is repeated several times a day. Adachi describes that eating behavior is an action concerning all persons, and the food that is the target can be quantitatively grasped, which makes it easy to objectively evaluate and set self-goals, which leads to a sense of achievement. Accordingly, learners are more likely to work independently (Adachi, 2000). When people are choosing what they need from a wide variety of foods, they must be able to analyze and evaluate complex information. In that process, critical thinking skills and self-management are needed (Cotento, 2020). Additionally, they need interpersonal relationship skills such as assertiveness and negotiation skills in order to make requests to the cooks for the meals they need. In this way, various life skills are required in situations related to dietary life. Therefore, acquiring life skills through food, which is directly linked to daily life, may lead to their general application in everyday life situations.

TTM shows that the appropriate transformation process is different for each stage of change (Prochaska, 1997). For this reason, it is predicted that there will be differences in the acquisition status of life skills depending on the stage of change. Therefore, when considering an educational method to improve life skills in the context of dietary situations, it is necessary to take into consideration the stage of change in dietary habits.

2. Literature Review

As a study on the acquisition of life skills for adolescence, Life Skill Programs (LSP) such as the Life Development Interventions model (LDI) using goal setting as a central strategy as a means of empowerment, began to spread. (Danish, 1995). There is also LSP such as the GOAL program (Danish, 1992a) designed to help adolescents to acquire a sense of self-control and a sense of confidence about their future so that they can make better decisions. Education to develop life skills is also being provided for growing children, using the effects of sports on life skills (Forneris, 2014; Albert, 2004; Mossman, 2019). WHO (1999) states that life skills learning is facilitated by participatory learning methods and is based on a social learning process such as observation of the skill (modeling) and role-playing. Group work is another facilitating method for acquiring life skills. In this way, life skills learning must include practical experience and reinforcement of the skills for adolescents in a supportive learning environment (WHO, 1999). Thus, based on the positive effect of life skills learning, LSP has been used in various fields such as sports and health education.

In the nutrition education that has been provided so far, in addition to the group lecture, individual tuition is used. By providing nutrition education for each individual, it is expected that the subject will improve their life skills such as thinking ability, communication and goal setting in the process of thinking about issues themselves, communicating them to nutrition educators and setting goals. However, since meals are the private matters of individuals, it may be a burden for those who are not interested in meals and nutrition to have others step into their private lives. In nutrition education aimed at acquiring life skills, participatory programs using brainstorming related to breakfast and snacking behavior have been implemented (Haruki, 2009). Through this intervention, some of the participants acquired the life skills of decision-making and goal setting, but the skills scores of all participants were not acquired. Among the various methods for promoting participatory learning, the school lunch associated with the lesson content of various subjects is used as a “living teaching material” in nutrition education at school (Ministry of Agriculture, Forestry and Fisheries, 2018). It is known that children can think independently about themselves when we position them in experiential activities (Noda, 2013). Therefore, even in education aimed at acquiring life skills through food, they should not only participate in discussion but also use actual food and meals at the place of discussion. As a result, it is considered children can acquire life skills through proactive activities. Of all the foods, in particular, rice is a staple food of the Japanese people, and is a food whose intake can be easily adjusted by individuals and combined with a variety of other foods. Therefore, by utilizing rice as an ingredient, the knowledge gained through nutrition education can be repeatedly practiced in daily dietary life. If the teaching method to acquire life skills through nutrition education becomes obvious, nutrition education becomes not only a place of education just to acquire knowledge and attitudes about food, but also to gain the life skills necessary for living in society. In this way, it can be expected to enhance the significance of the nutrition education.

When considering the acquisition of life skills, it is necessary to confirm not only life skills but also the relationship with self-efficacy. This is because it has been reported that self-efficacy, which is a major construct in motivating behavior (Bandura, 1997), has a strong influence on goal setting (Sheard, 2006). On the contrary, psychological skill training such as goal setting may increase self-efficacy (Benight, 1999). In other words, they are interrelated.

In addition, it is necessary to consider the stages of change, which are informed by the TTM (Prochaska et al., 1997; Prochaska et al., 2015). The TTM is one of the most widely used behavior

change models to understand how people change health behaviors. It postulates that people are in different stages of readiness to make health behavior changes. It is composed of five stages. Self-efficacy is considered essential in the progression of each stage. Since there are stages in the development of a person's behavior, it is expected that there will be differences in the acquisition status of life skills and the self-efficacy related to it according to the stage of change. As a result, when considering an educational method to improve life skills in the context of food, it is necessary to clarify the mutual changes with self-efficacy according to the stage of change in dietary habits.

Therefore, the purpose of this study was to examine the changes in life skills development among high school baseball players by comparing different methods of teaching nutrition education according to the stage of change. This was verified by comparing the changes in life skills scores due to differences in nutrition education through practical nutrition education based on rice, the main dietary element in Japan, in group and individual nutrition education.

3. Methodology

(1) Research Design and Participants

The target group consisted of six public high school baseball teams; all of whose members go to school from their homes. All the teams had a record of advancing to the top 16 or higher in local tournaments. In April 2018, one hundred and twenty-nine first-grade male athletes (15.1 ± 0.3 years old) were given a pre-intervention questionnaire survey. The details of the intervention for each group are shown in Table 1. Group nutrition education was conducted once for all teams between late May and early June 2018, and rice utilization was started to be used for two teams ($n = 33$) at the same time (RICE group). Two other teams ($n = 40$) were provided with individual nutrition education (INE group). The remaining two teams only received the group nutrition education (CON group, $n = 56$). In the post-intervention survey conducted in August 2018, the same questions as in the pre-intervention survey were asked. This study was carried out with the approval of the Ethics for Medical and Health Research Involving Human Subjects at Ritsumeikan University (2017-072-1).

Table 1. Groups and Methods

	Group	Participants	Group Lecture	Individual Tuition	RICE Utilization
1	INE	40	yes	yes	no
2	RICE	33	yes	no	yes
3	CON	56	yes	no	no

1. INE: Preliminary Group lecture + Individual nutrition education. (No specified diet)

2. RICE: Preliminary Group lecture + Specified Rice diet + advice (No Individual nutrition education)

3. CON: Preliminary Group lecture (No specified diet. No individual nutrition education)

We explained the purpose, the contents of the survey, and the possible risks and disadvantages of this study verbally and in writing to the athletes and their parents. We obtained informed consent from all subjects.

(2) Life Skills Questionnaire

The “Appraisal Scale of Required Life Skills for College Student Athletes” (Shimamoto et al.,

2013) was used to assess life skills. The scale consists of 40 items within ten subscales: stress management, setting goals, thinking carefully, appreciating others, communicating, maintaining etiquette and manners, always making one's best effort, taking responsibility for one's own behavior, being humble, and maintaining physical health and well-being. This scale has been confirmed to be reliable and valid (Shimamoto et al., 2013). For each question, the answers were evaluated by the 8-point Likert scale (1 = not applicable at all and 8 = very applicable), and the total score was calculated for each subscale. The reversal item was used after reversal processing when calculating the score. The potential range of the life skills score was from 40 to 320. A higher score indicates a higher level of life skills acquired. This scale was developed for university student-athletes, but the life skills evaluated by this scale are required for all athletes in general. Actually, a study targeting high school students has also been conducted (Shimamoto et al., 2014). Therefore, this scale was adopted for the high school students in this study.

(3) Self-Efficacy Questionnaire

“Self-efficacy scales on dietary control” (Sato et al., 2017) were used. This scale is composed of nineteen items of five subscales: balanced diet intake, understanding competition and diet, dairy products and fruit intake, prevention of excessive fat intake, and planned intake of snacks. This scale has been confirmed to be reliable and valid (Sato et al., 2017). The answers were evaluated by the 8-point Likert scale (1 = not confident and 8 = confident). The potential range of the total score was from 19 to 152. A higher score indicates a higher level of self-efficacy in eating habits acquired. This scale was developed for college athletes, but self-efficacy in eating habits evaluated by this scale is required for all athletes in general, so it was adopted for high school students in this study.

(4) Stages of Change Questionnaire

We asked about the stages of change related to the intake of a meal with a staple food, a main dish, and a side dish, referring to the question by Otaki (Otaki et al., 2012). The choices were the five stages of change of TTM: pre-contemplation stage, contemplation stage, preparation stage, action stage, maintenance stage. Respondents chose one of the stages most applicable to their current situation.

(5) Group and Individual Nutrition Education

We conducted a ninety-minute nutrition education course for the athletes, their parents, managers, and coaches of all groups about the role of nutrients, food metabolism, individualized intake, and the food composition of a typical Japanese diet. The same nutrition education lecture was conducted by the same registered dietitian for each group.

For the INE group, each participant received ten minutes individual nutrition education based on the results of individual body composition and dietary intake. Specifically, the athletes set their body composition goals, and the nutrition educator and the athletes discussed and set the dietary goals necessary to achieve the goals. During the intervention period, the athletes used a monitoring sheet to self-evaluate so that they could check by themselves whether they had achieved the set goals.

(6) Utilization of Rice by Athletes

For the RICE group, we explained the purpose and possible conditions for using rice during nutrition education to encourage them to utilize rice to maintain and improve their exercise

performance. Based on the content of the nutrition education, rice was utilized by the athletes for the purpose of maintaining and improving athletic performance between May and August. Rice was cooked at the school once or five times a week, depending on the actual situation of the team, by the athletes and managers at the school. The only food we provided was rice, but each team utilized it by arranging for it to be taken as a staple food during lunch with side meals brought from home, and as a snack during or after practice. In addition, some rice was brought back to the home by each athlete and used as a staple food at home and as a snack to bring to school. Each team utilized about 50 kg of rice per month. Only when the athletes and managers of the RICE group asked about the use of rice did we provide the necessary information. In order to understand the status of rice utilization, the team was asked to record the details of the implementation on a monthly basis.

(7) Statistical Analysis

The data in this study are shown as the average value \pm standard deviation (only for age) or standard error to show the comparison accuracy between the three groups. The One-way ANOVA was used to compare life skills and self-efficacy scores between the three groups before the intervention with Bonferroni post hoc tests. To clarify the effect of the intervention on the life skills and self-efficacy, the changes in the groups were compared. The amount of change was calculated by subtracting the value before nutrition education from the value after nutrition education, and the analysis was performed by adjusting the value before nutrition education using ANCOVA. We used chi-square tests to compare the percentage of the stage of change between the groups. The analysis was divided and performed in two stages according to whether the behavior was performed continuously or not: pre-action stage (pre-contemplation, contemplation, preparation) and action/maintenance stage (action, maintenance). All statistical analyses were performed with SPSS statistical software (IBM SPSS Ver.22.0, Tokyo, Japan). The threshold statistical significance was $P < 0.05$.

4. Findings

In the pre-intervention study, the self-efficacy of the CON group (106.1 ± 2.1) tended to be higher than that of RICE group (96.9 ± 3.7 , $P = .055$) and the INE group (97.6 ± 2.6 , $P = .063$). There was no significant difference in the self-efficacy scores between INE group and RICE group. The amount of change in self-efficacy scores before and after nutrition education of the RICE group (12.6 ± 2.4) was significantly higher than that of the INE group (1.0 ± 2.1 , $P = .001$) and the CON group (3.4 ± 1.8 , $P = .008$). There was no significant difference in the self-efficacy scores between INE group and CON group. Divided by stages of change, no significant difference in the self-efficacy scores between the three groups (RICE group; 4.5 ± 4.3 , INE group: -0.0 ± 4.1 , CON group: 4.7 ± 2.4) were observed in the action/maintenance stage (Figure 1).

A comparison of self-efficacy scores in the pre-action stage is shown in Figure 2. The amount of change in the self-efficacy scores before and after nutrition education of the RICE group (16.8 ± 2.7) was significantly higher than that of the INE group (2.1 ± 2.4 , $P < .001$) and the CON group (-0.0 ± 2.7 , $P < .001$). There was no significant difference in the self-efficacy scores between INE group and CON group.

In the pre-intervention study, the life skills score of the INE group (235.8 ± 4.1) was significantly lower than that of CON group (256.2 ± 3.1 , $P < .001$). There was no significant difference in the life

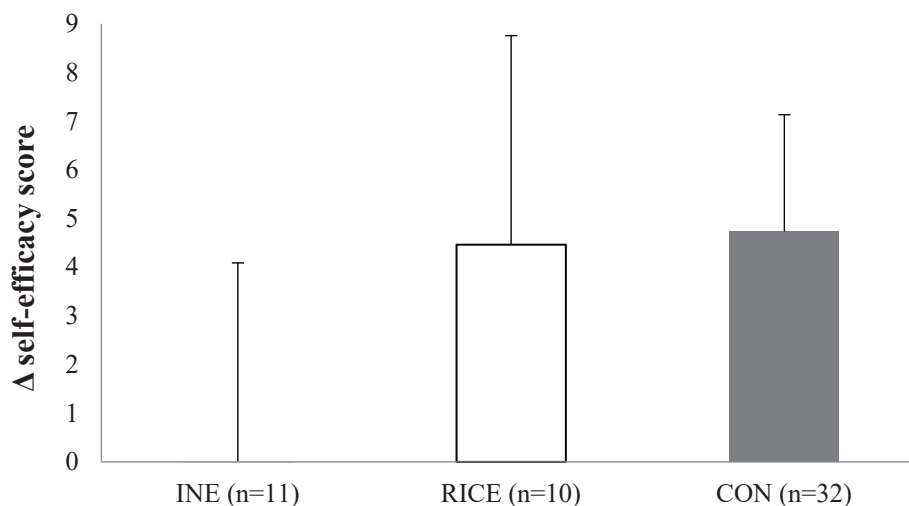


Figure 1. Comparisons of self-efficacy changes with intervention among the three groups in the action/maintenance stage

Values are expressed as means \pm SE. Analysis of covariance adjusted by self-efficacy pre-intervention.

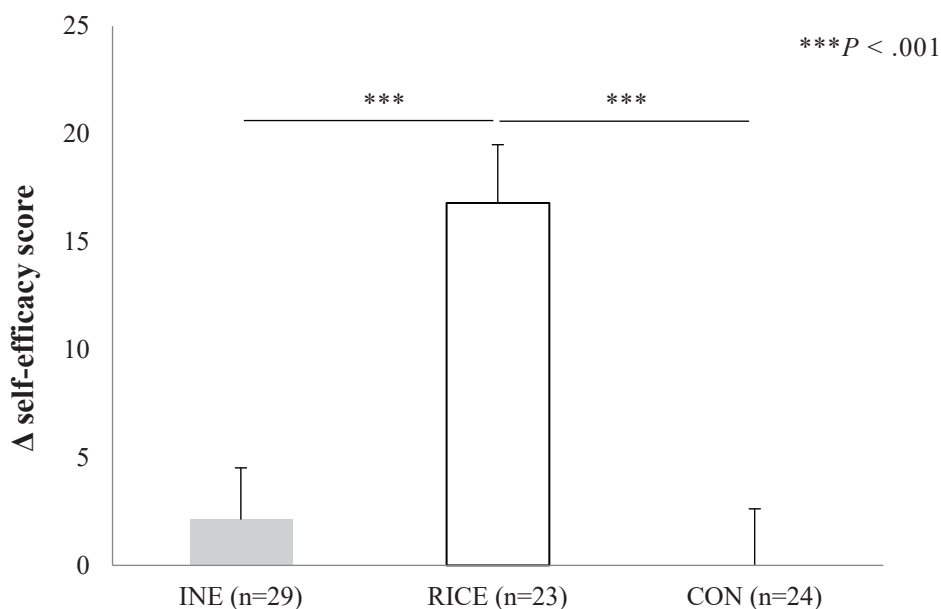


Figure 2. Comparisons of self-efficacy changes with intervention among the three groups in the pre-action stage

Values are expressed as means \pm SE. Analysis of covariance adjusted by self-efficacy pre-intervention (post hoc analysis with Bonferroni correction; the same letters (RICE group and INE group, RICE group and CON group) indicating significant difference, $P < .001$).

skills scores between the RICE group (244.5 ± 4.6) and the other two groups. The amount of change in life skills before and after nutrition education of the INE group (-9.5 ± 3.4) was significantly lower than that of the RICE group (8.4 ± 3.7 , $P = .002$) and the CON group (5.2 ± 2.9 , $P = .006$). There was no significant difference in the life skills scores between the RICE group and CON group. Divided by stages of change, at the action/maintenance stage, no significant difference in life skills scores between the three groups (RICE group; -1.1 ± 6.7 , INE group: -11.6 ± 6.6 , CON group: 5.6 ± 3.8) was observed in the action/maintenance stage (Figure 3).

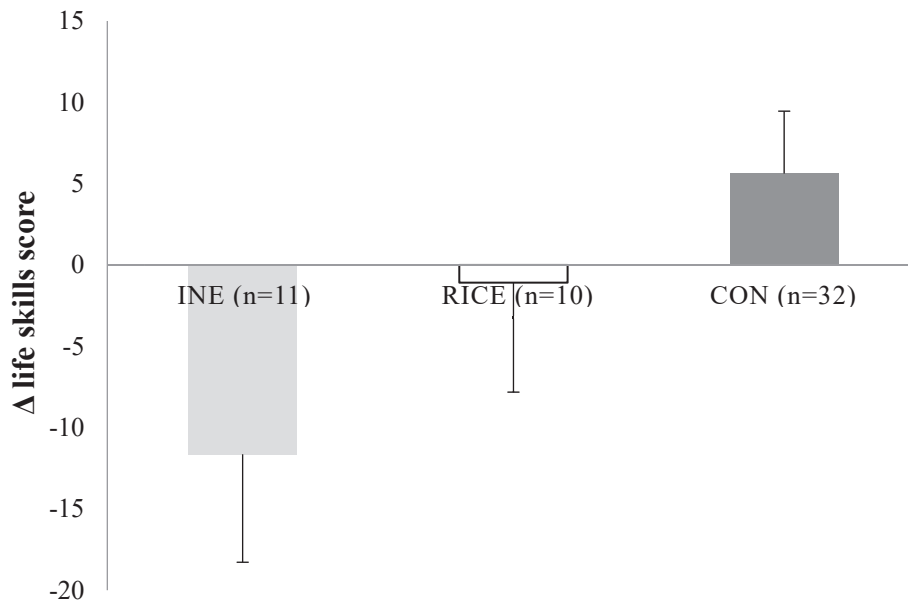


Figure 3. Comparisons of life skills changes with intervention among the three groups in the action/maintenance stage

Values are expressed as means ± SE. Analysis of covariance adjusted by life skills pre-intervention.

Figure 4 shows that the amount of change in the life skills scores before and after nutrition education of the RICE group (13.0 ± 4.4) was significantly higher than that of the INE group (-8.1 ± 4.0 , $P < .01$) in the pre-action stage. There was no significant difference in the life skills scores between CON group (3.5 ± 4.4) and the other two groups.

In the pre-intervention survey, the percentage of those who were in the pre-action stage was 69.7% in the RICE group, 72.5% in the INE group, and 42.9% in the CON group ($P = .005$). Of those who were in the pre-action stage in the pre-intervention survey, 65.2% in the RICE group, 58.6% in the INE group, and 58.3% in the CON group moved to the action/maintenance stage.

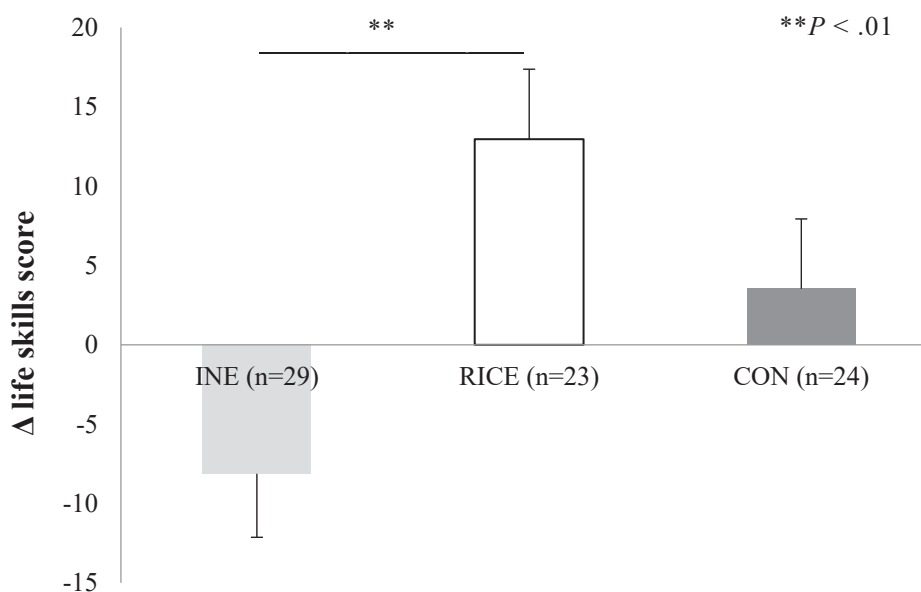


Figure 4. Comparisons of life skills changes with intervention among the three groups in the pre-action stage
 Values are expressed as means ± SE. Analysis of covariance adjusted by life skills pre-intervention, (post hoc analysis with Bonferroni correction; the same letters (INE group and RICE group) indicating significant difference, $P < .01$).

Of those who were in the action/maintenance stage in the pre-intervention survey, there were none in the RICE group, 18.2% in the INE group, and 25% in the CON group entered the pre-action stage. For the rest of the participants, there was no change in the stages of change before and after the intervention.

(1) Discussion

In the pre-action stage, the amount of change in the self-efficacy scores before and after nutrition education of the RICE group was significantly higher than that of the INE group and the CON group. Furthermore, the amount of change in the life skills scores before and after nutrition education of the RICE groups was significantly higher than that of the INE group. It is presumed that these capacity improvements were due to the fact that the practice of utilizing rice was an experiential activity, and it was easy to incorporate what was learned in nutrition education into daily life. It has been shown that self-efficacy influenced personal goal setting (Bandura A. 1989: 805-814), which is one of the life skills. Hence, it seems that the improvement of self-efficacy may also be a factor in the higher life skills of the RICE group.

In contrast, the life skills change of the INE group was significantly lower than that of the RICE and CON groups in the pre-action stage. In addition, the INE group tended to be of lower self-efficacy before intervention than that of the CON group, and the amount of change before and after the intervention was significantly lower than in the RICE group. This may be due to the fact that a large percentage of the INE group was in the pre-action stage of stages of change. It has been reported that when self-efficacy is low, it becomes difficult to use external resources such as social support (Benight et al. 1999: 2443-2464). It is speculated that the INE group, with such a low self-efficacy, was given individualized nutrition education, which resulted in excessive intervention and negatively affected the improvement of their life skills. Therefore, it was suggested that individual nutrition education as an intervention in the pre-action stage, when the subjects are not yet ready, may reduce life skills.

In conclusion, it was shown that in order to develop life skills, it is necessary to understand the subject's stage of change and select a nutrition education method that is appropriate for that stage. If self-efficacy regarding dietary control is low, the results show that individual education for such subjects may hinder their improvement in life skills. In contrast, experiential nutrition education utilizing actual ingredients could be one of the methods of life skills education through food in the pre-action stage. In the future, through comparison with other grades, it is necessary to verify whether the results of this study are characteristic of first-grade nutrition education.

(2) Limitations

The study design of this study was a non-randomized controlled trial, so it is possible that grouping may have affected the results. Since there was a difference in the percentage of stages of change between the groups before the intervention, it is possible that the scores before the intervention were affected. Since this study only confirmed changes over the period of several months in the first year, improvement of life skills may appear by an educational method different from this time, depending on the time of intervention. Therefore, it is necessary to confirm the fluctuation due to the difference in the intervention method by continuous intervention. Since the relationship between life skills and self-efficacy is reciprocal, it is not clear from this analysis alone whether the improvement in self-efficacy improved life skills or the improvement in life skills improved self-efficacy. The relevance needs to be clarified through further verification.

5. Conclusion

The purpose of this study is to examine the changes in life skills development among high school baseball players by the comparison of different methods of teaching nutrition education according to the stages of change. We verified using the stages of change in the TTM, which describes the stages of human behavior change, because different stages of change may affect the results. The subjects were one hundred and twenty-nine first-grade Japanese high school baseball players from six schools. Nutrition education was conducted once for all teams, and rice utilization was started to be used for two teams at the same time (RICE group). Athletes of two other teams were provided with individual nutrition education (INE group). Only group nutrition education was provided to the remaining two teams' athletes (CON group).

As a result, the amount of change in the life skills scores of the RICE group before and after nutrition education was significantly higher than that of the INE group in the pre-action stage ($P < .01$). Furthermore, self-efficacy scores of the RICE group were significantly higher than the INE and CON groups ($P < .001$). These results were not seen in the action/maintenance stage. Since it has been shown that improvement in self-efficacy leads to improvement in life skills, it is possible that one of the factors that led to significantly higher life skills in the RICE group than in the INE group was the effect of an improvement in self-efficacy. On the contrary, it has been reported that when self-efficacy is low, it becomes difficult to use external resources such as social support. Under these conditions, it is speculated that individual nutrition education provided excessive intervention and had a negative impact on the improvement of life skills. Therefore, it was suggested that individual nutrition education as an intervention in the pre-action stage, when recipients are not ready, may reduce life skills.

These results indicate that, in providing nutrition education, the choice of the form of intervention according to the stage of participant's preparation, while taking into account the actual conditions of the athletes, is necessary for effective life skills' acquisition. If self-efficacy regarding dietary control is low, the results show that individual education for such subjects may hinder their improvement in life skills. In contrast, nutrition education using rice improved life skills in the case of low preparation levels.

Therefore, it was suggested that experiential nutrition education using actual ingredients could be effective as a method of life skills education through food for these subjects. Although the results this time showed a decrease in life skills in the INE group, other school years may have a different result. Thus, it is necessary to verify whether the results of this study are characteristic of first-grade nutrition education through comparison with other grades.

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