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EVALUATION OF THE EFFECTS OF A HEALTH EDUCATION PROGRAM ON THE IMPROVEMENT OF HYPERCHOLESTEROLEMIA

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This study examined the effects of a health education program based on the self- reliance and self-action philosophy and the use of group work methodology on hypercholesterolemia during and after the intervention period. Thirty-two people participated in the study. Measurement values were obtained at the commencement of the intervention (Baseline), during the 6-month intervention period, at the end of the 6-month intervention period (Middle Point) and 6 months after Middle Point (End Point). The average number of steps per day significantly increased during the 6-month intervention period. The energy intake and fat intake levels significantly decreased during the 6-month intervention period. Total cholesterol, triglyceride, and atherosclerosis-index levels significantly decreased between Baseline and End Point. The HDL cholesterol levels significantly increased between Baseline and End Point. Statistically significant decrease was also observed in total cholesterol and atherosclerosis-index levels between Baseline and Middle Point, and between Middle Point and End Point. It is concluded that the health education program based on self-reliance and self-action philosophy using a group work methodology is effective for improving hypercholesterolemia. Especially, the improvement in the serum total cholesterol and atherosclerosis-index levels was sustained even after the intervention period.

Key words: total cholesterol; group work; follow-up; self reliance; self-action

INTRODUCTION

In Japan, the number of the deaths caused by cerebrovascular and heart diseases in 2005 were 132,847 and 173,125 (Ministry of Health, Labour and Welfare, 2005), respectively. The deaths caused by these two categories account for about 30% of all the deaths (Ministry of Health, Labour and Welfare, 2005). Therefore, the prevention of cardiovascular diseases such as cerebrovascular and heart diseases is one of the most important issues for the Japanese health administration in extending life span and decreasing bedridden patients or cases suffering from subsequent complications (Liu et al., 2000,). It has been widely recognized that the most important preventive measures against those diseases are doing activities to improve the lifestyle as primary prevention (Elliott et al., 1996; Blackwelder, et al., 1980; Tsugane et al., 1999; Japan Atherosclerosis Society, 2002).

The Japanese administration emphasizes that the main emphasis of the activities for extending the life span, and prolonging the healthy life expectancy should now be shifted from secondary prevention to primary prevention. Several reviews (Blackwelder, et al., 1980; Elliott et al., 1996; Tsugane et al., 1999; Japan Atherosclerosis Society, 2002) of the studies on risk factors of chronic cardiovascular diseases have pointed out that the main risk factors of cerebral apoplexy, the most

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prevalent cerebrovascular disease, are hypertension, smoking habits, impaired glucose tolerance, too much alcohol drinking and hyperlipemia. Hypertension, smoking and hyperlipemia are also recognized as risk factors of ischemic heart diseases, the most prevalent heart diseases (Stamler et al., 1986; Japan Atherosclerosis Society, 2002; Third report of the NCEP, 2002). In both cases hyperlipemia is listed as one of the risk factors for the diseases.

It is known that the improvement of the lifestyle such as dietary habits and fitness exercises in daily life is essential for the prevention as well as treatment of hyperlipemia. Group health education, which provides instructions for improving fitness, dietary and other habits, is considered as an effective means of motivating people to change their lifestyle. Many reports have demonstrated the efficacy of health education aimed at changing habitual lifestyle on risk reduction against chronic cardiovascular diseases (Grimm, 1983; Bonanome and Grundy, 1988, Mann et al., 1990; Henkin et al., 1992; Denke,1994; Denke and Grundy, 1994; Dnallongeville et al., 1994; Hartman et al., 1995, Neil et al., 1995, Caggiula et al., 1996, Evans et al., 1996, Keyserling et al., 1997, Walden et al., 1997; Pine et al., 1997, Zheng, 1998; Ridgeway et al., 1999; Iso et al., 2002; Sartorelli et al., 2005; Howard et al., 2006). However, most of those reports have only demonstrated the efficacy of health education programs for improving health conditions during the intervention, and there are few reports mentioning their continuing effects after the intervention (Zheng, 1998; Keyserling et al., 1997; Howard et al., 2006; Sartorelli et al., 2005; Ridgeway et al., 1999; Walden et al., 1997).

Some reports have emphasized the importance of social support and self-efficacy in encouraging behavior modifications (Leonard et al., 1991; Fries et al., 1993a; Wiesemann et al., 1997; Margitic et al., 1999; Stevens et al., 1999; Norris et al., 2000). In conventional educational activities for improving the lifestyle, the importance of social support by health education staff members has been emphasized, but it seems to be more important to find people or organizations close to home that can support the activities to maintain and promote the health condition on the daily basis. One of the effective measures to support and encourage daily health improvement activities seems to be the application of group work methodology. Group work methodology is often used for changing the thoughts, attitudes, behavior and/or emotion of the participants and is considered to be an effective measure for increasing the feelings of camaraderie and creating social support networks (Peter, 1980). Former studies pointed out that the effect of the activities using group work methodology lasted longer than that of other methods after the intervention (Zheng, 1998; Ridgeway et al., 1999). It has also been pointed out that the self-efficacy is increased by the positive estimation by friends and acquaintances, and the intervention to increase the self-efficacy is considered to be effective in improving the dietary, physical fitness and smoking habits.

In the traditional style of health education, a torchbearer teaches what should be done, and why and how the activities should be done by showing the contents, effects and methods of the activities (American College of Sports Medicine, 1990; Goran and Poehlman, 1992; Meijer et al., 1999). In this way, however, the activities are most likely to decrease after the intervention, although the effect of the health education is maintained during the intervention period (Goran and Poehlman, 1992; Meijer et al., 1999).

The purpose of this study is to examine the effect of a health education program based on the self-reliance and self-action philosophy and the use of group work methodology on the improvement of hypercholesterolemia during and after the intervention period.

METHODS

Participants

The present study was planned and implemented in a town with a population of 11,931 in Japan. People with high serum cholesterol levels voluntarily participated in the study. Inclusion criteria for men were age 40 or more, and the 200 mg/dl or higher serum total cholesterol level at the periodical health check-ups in 2002. Inclusion criteria for women were age 50 or more and the 220 mg/dl or

higher serum total cholesterol level. Four hundred and twenty-five subjects met the criteria, and the people with the past or present history of any chronic diseases, such as diabetes, hyperlipidemia and hypertension, were excluded. People with a regular job were also excluded as it seemed to be difficult for such people to receive the health examination provided by the community and to participate in the daytime activities such as meetings in the project. Eighty people out of 425 fit the inclusion criteria in the town. All of them were asked to participate in our study by mail, telephone and/or interview at the debriefing session of the health examination for the residents. Finally, 37 participants, 8 males and 29 females, volunteered to participate in the study. Five people out of 37 left the program because of the necessity of family care, entering a school, starting work, or other personal reasons.

The study period consisted of the 6-month intervention period and the 6 month follow-up period. Table 1 shows the physical characteristics of 32 participants at the baseline. The intervention was carried out from October 2002 to March 2003. Before starting the program informed consent in writing was obtained from all the participants.

Table 1. Characteristics of the 32 participants.

Parameters	Male		Female	
	Mean	SD	Mean	SD
Number	7		24	
Age (year)	62.6	± 3.3	57.2	± 9.0
Height (cm)	165.2	± 4.1	153.9	± 6.4
Weight (kg)	65.6	± 7.2	54.4	± 6.8
Body mass index (kg/m^2)	24.0	± 2.7	23.0	± 2.5

Intervention design

Figure 1 shows the intervention design used in this study. A health education program was organized and the classes were held every month during the 6-month intervention period. The education program consisted of reports of daily physical activities and dietary intake from the participants, feedback instructions by health care personnel and small-group work.

Measurement values were obtained at the commencement of the intervention (Baseline), during the 6-month intervention period, at the end of the 6-month intervention period (Middle Point) and 6 months after Middle Point (End Point).

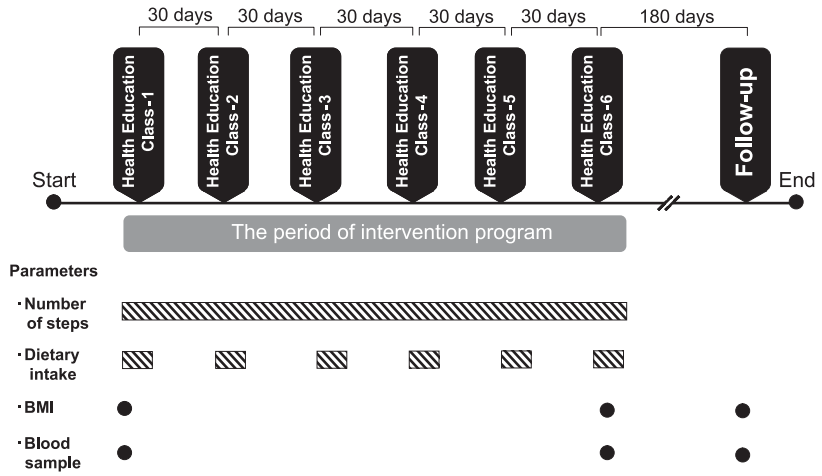

Fig. 1. Research design

Records of daily physical activities and dietary intake

Participants were required to record the number of steps per day using a pedometer (calorie counter select 2: SUZUKEN Co.), and to record the dietary intake estimated using a weighing method for 3 consecutive days during the month prior to the health education class held monthly. The data were recorded by the participants themselves and brought to the following group work meeting.

Feedback on physical activities and dietary evaluation

Sports scientists of the research team analyzed the physical activity levels based on pedometer records. Analysis of the dietary intake was also performed by dietitians based on the dietary intake records. All the participants received at the meeting the results of the analysis and comments by the specialists on their physical activities and dietary conditions.

Group work

In the group work meeting, a small lecture on the effect of exercise and diet was given first. After the lecture, small group discussion was conducted to identify the important points for continuing the exercise and dietary control. The main activity in the meeting was so called small-group discussion where participants were required to talk about the topics related to the device to initiate and continue the health promotion activities. Through discussion the participants were expected to notice the importance of improving their lifestyle on their own initiative referring to good examples implemented by their friends or neighbors.

The procedure of this small-group discussion was as follows. 1) Organize small groups of 7 to 8 members each for discussion. 2) Appoint a coordinator and a reporter in each group. 3) Give themes on how to improve their lifestyle and ask participants to write down their ideas on stick-on memo paper. 4) Classify all the ideas into clusters using the KJ–Method (Kawakita, 1986) which is a method to quickly reach a consensus on priorities based on subjective, qualitative data arising from small-group discussion. 5) Have the presenter of each group report the results of their group discussion to all the other participants. 6) Organize a plenary discussing session based on the reports from each small group, a plenary discussion session is organized.

Measurement variables

The mean number of steps per day was estimated using a pedometer to evaluate the daily physical activity levels. The mean energy intake (kcal/day), carbohydrate intake (g/day), fat intake (g/day) and protein intake (g/day) by the participants were also evaluated using a food weighing method. For evaluating the effect of the daily activity and energy intake control, the body weight and blood lipid levels were monitored during the whole study period. The Body Mass Index (BMI) was calculated by measuring the body height and weight when the activity started (Baseline). Changes in BMI were determined by measuring body weight 6 months (Middle Point) and 12 months (End Point) after Baseline. Blood samples were obtained by venipuncture at Baseline, Middle Point, and End Point. The blood samples were taken to a laboratory, and analyzed for total cholesterol (TC) (mg/dl), HDL cholesterol (HDL) (mg/dl) and triglycerides (TG) (mg/dl). Atherosclerosis-index (AI) (Mertz, 1980) was calculated using TC and HDL values.

Statistical analysis

One-way analysis of variance (ANOVA) with repeated measures was employed to detect significance in changes in the level of BMI, blood lipids (TC, HDL, TG, AI), the number of steps and the intake levels of energy, protein, fat and carbohydrate during the program period. Bonferroni or Dunnett post hoc tests were used to test a significant difference between groups, when ANOVA revealed significance. Data were analyzed using SPSS for Windows version 11.0 (SPSS, Inc., J). A level of 0.05 was used as the cutoff for rejection of the null hypotheses.

RESULTS

Daily activity

Figure 2 shows the changes in the daily number of steps from Baseline to the end of the 6-month intervention period. Significant increase in the number of steps was observed in the first one month and was even sustained over the 6-month intervention period ($F(6,186)=15.12$, $p<0.001$).

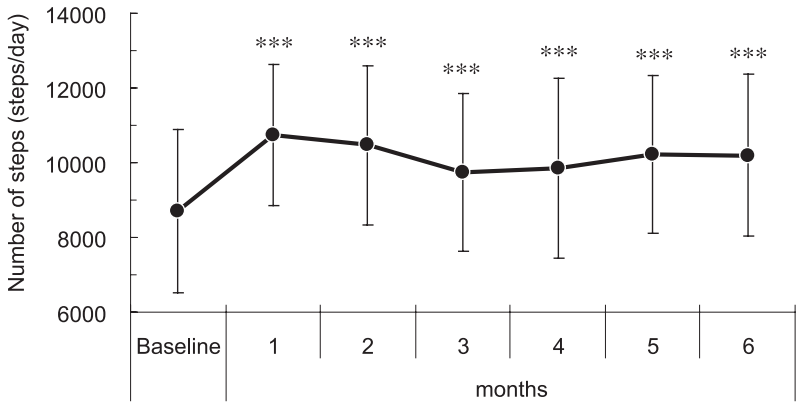

Fig. 2. Monthly changes in the mean and SD of the number of steps during the 6-month intervention period from October 2002 to March 2003.
***Significant differences from Baseline at p<.001. Each symbol mark (●) represents mean, vertical bars represent standard deviations.

Dietary intake

Figure 3 shows changes in the dietary intake during the period from Baseline to Middle Point. Significant decrease in the energy intake levels was observed between Baseline and 2, 4, 5, or 6 months after the start of the observation ($F(6,186)=4.20$, $p=0.001$). Significant decrease in the fat intake levels was observed between Baseline and 2, 3, 4, 5, or 6 months after the start of the observation ($F(6,186)=7.31$, $p<0.001$). No statistically significant changes were observed in the carbohydrate and protein intake levels at any measurement point during the 6-month intervention period compared with the Baseline level.

Physique

Figure 4 shows the changes in BMI between Baseline and End Point. Significant decreases in BMI were observed between Baseline and End Point ($F(2, 62)=29.57$, $p<0.001$) , Baseline and Middle Point ($p<0.01$) and Middle Point and End Point ($p<0.01$).

Blood lipids

Figure 5 shows changes in the blood lipid levels during the 12 months after Baseline. Significant change was observed in TC, HDL, TG and AI between Baseline and End Point: TC; $F(2,62)=34.98$, $p<0.001$; HDL; $F(2,62)=16.94$,$p<0.001$; TG; $F(2,62)=21.73$,$p<0.001$; AI; $F(2,62)=48.25$,$p<0.001$. In the TC level and AI, statistically significant decrease was observed between Baseline and Middle Point ($p<0.001$), and Middle Point and End Point ($p<0.001$). In HDL, statistically significant increase in the levels was also observed between Baseline and Middle Point ($p<0.001$), but no significant increase was observed between Middle Point and End Point. In TG, statistically significant decrease was observed between Baseline and Middle Point ($p<0.001$), but not between Middle Point and End Point.

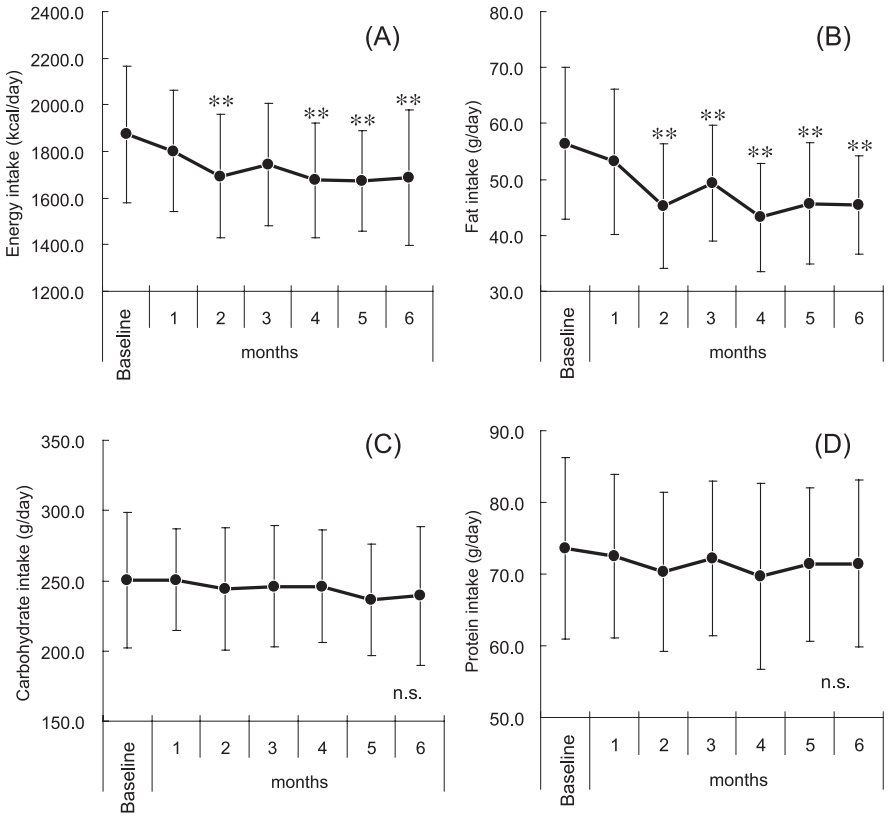

Fig. 3. Monthly changes in the mean and SD energy intake (A), fat intake (B), carbohydrate intake (C) and protein intake (D) during the 6-month intervention period from October 2002 to March 2003.
**Significant differences from Baseline at p<.01. Each symbol mark (●) represents mean, vertical bars represent standard deviations.

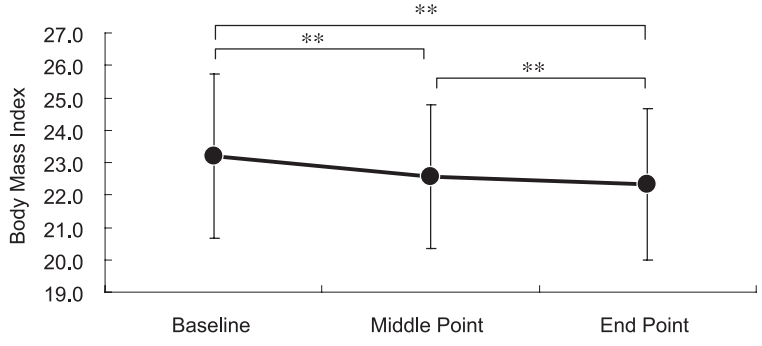

Fig. 4. Half-yearly changes in the mean and SD of Body Mass Index during the entire research period including follow-up.
** Significant difference at p<0.01. Each symbol mark (●) represents mean, vertical bars represent standard deviations.

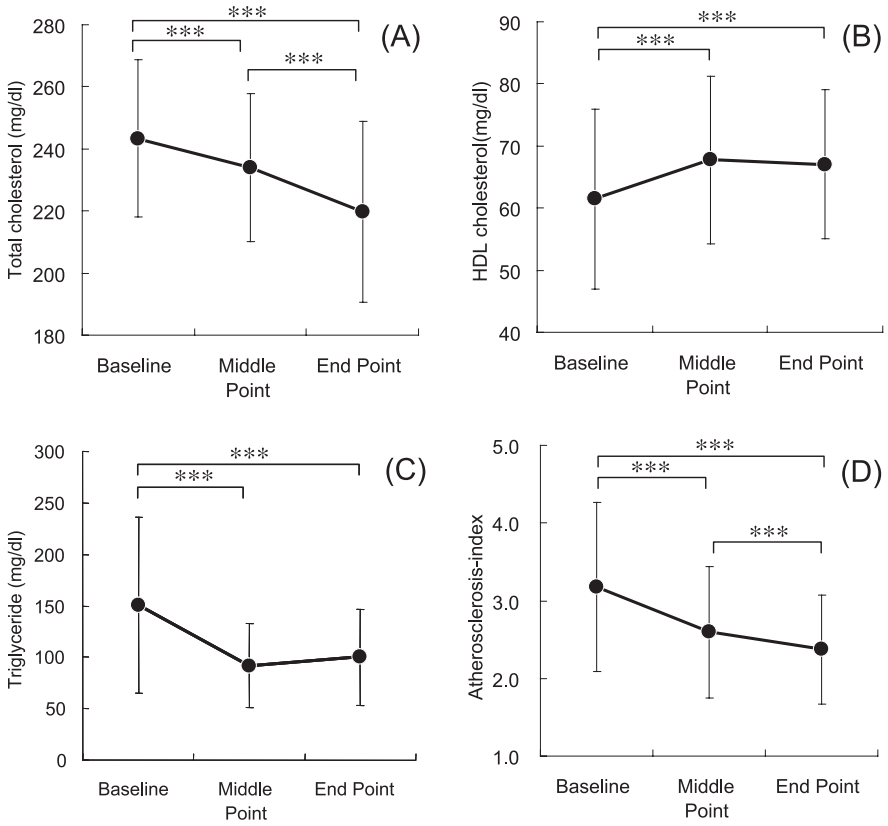

Fig. 5. Half-yearly changes in the mean and SD of total cholesterol (A), HDL cholesterol (B), triglyceride (C) and atherosclerosis-index (D) during the entire research period including follow-up.
*** Significant difference at $p<0.001$. Each symbol mark (●) represents mean, vertical bars represent standard deviations.

DISCUSSION

Changes during the 6-month intervention period

The TC, HDL, TG levels and AI improved during the intervention period and the improvement lasted until End Point. Similar results have been reported in the former studies using the traditional structured exercise method as well as in the studies using the lifestyle physical activity intervention method (Durstine and Haskell, 1995; Keyserling et al., 1997; Walden et al., 1997; Dunn, 1999; Sevick, 2000; Iso et al., 2002). The results of this study indicate that the effect on the improvement of TC, HDL and TG during the intervention period is similar to those revealed in the former studies. There should be several reasons why the serum lipid levels decreased in this study. The most possible reasons for the phenomenon are the increase in the number of steps a day (Kohl et al., 1998; Toda et al., 1998; Tully et al., 2005) and the decrease in energy and fat intake during the intervention period (Grimm, 1983; Bonanome and Grundy, 1988, Mann et al., 1990; Henkin et al., 1992; Denke,1994; Denke and Grundy, 1994; Dnallongeville et al., 1994; Hartman et al., 1995, Neil et al., 1995, Caggiula et al., 1996, Evans et al., 1996, Keyserling et al., 1997, Walden et al., 1997; Pine et al., 1997, Zheng, 1998; Ridgeway et al., 1999; Iso et al., 2002; Howard et al., 2006; Sartorelli et al., 2005). It is assumed that the change in the exercise and dietary habits decreased the serum lipid levels.

In the method used in our project, the participants were required to practice exercise and dietary routines it by themselves. The role of the instructors was only to provide essential knowledge on health promotion and conduct periodical monitoring of the health condition and daily health promotion activities of the participants. The participants were required to practice daily health promotion activities at their own responsibility. All provided in this method were low-cost, self-help inducing materials, such as note books for recording, pedometers, personal evaluating sheets for exercise and dietary habits. Nevertheless, the health education program used in this study showed the same effectiveness as those used in the former studies.

After the end of the 6-month intervention period

High TC is known to be one of the risk factors of coronary heart diseases (Stamler et al., 1986) and also high AI is reported to the risk of arteriosclerosis (Mertz, 1980). In this study, TC and AI decreased during the intervention period and also after the intervention; especially the average value of TC decreased to the normal range at the end of the observation period. There are several studies in which follow-up was made after finishing the intervention period (Iso et al., 1991; Keyserling et al., 1997; Walden et al., 1997; Zheng,1998; Ridgeway et al., 1999; Iso et al., 2002; Howard et al., 2005; Sartorelli et al., 2005). Iso et al. (1991) made a 6-month intervention and followed up its effect for 6 more months. They reported the average TC decreased continually during the intervention period and also after the intervention (Iso et al., 1991). They followed up their participants by telephone bimonthly after the end of the intervention period. However, there are some possibilities that such telephone calls reactivated health promotion activities of the participants (Iso et al., 1991).

In previous studies discussing the after-effects of the intervention, TC value was reported to be increased (Keyserling et al., 1997; Iso et al., 2002) or maintained (Walden et al., 1997; Zheng,1998; Ridgeway et al., 1999; Howard et al., 2005; Sartorelli et al., 2005) after the end of intervention. On the other hand, the decrease of TC was observed not only during the intervention period but also after the intervention period in our study. A possible factor that might relate to this difference is that small-group discussion using the KJ–Method (Kawakita, 1986) was implemented in our study. The group discussion was conducted to identify the important points for continuing the exercise and dietary control emphasizing that increasing self-efficacy and strengthening social support were important for continuing the activity. Participants discussed the important points in improving their lifestyle, the strategy and tactics to increase pedometer records by 2,000 steps a day, etc. We consider that the participants could share the hints to conduct good practices, as well as information and knowledge to continue the daily exercise. Through the small-group activities, the participants was apparently able to have good supporters or mentors to sustain their health promotion activities.

Self-efficacy is one of the determinants of positive exercise behavior (McAuley and Blissmer, 2000). It has been pointed out that positive exercise behavior increases self-efficacy regardless of sex, age, or race (Sallis et al., 1989; Oka, 2003). MuAuley et al. (2000) also reported that self-efficacy significantly increased after the exercise program period. Sonstroem (1984) reported that self-esteem was closely related to the degree of satisfaction in physical aspect. We consider one of the important reasons why the physical activity was sustained is the multiplier effect of positive exercise behavior and small-group work.

According to the results of some previous dietary interventions, TC increased or remained unchanged, namely no further improvement was observed, after the end of the intervention period (Keyserling et al., 1997; Walden et al., 1997; Iso et al., 2002; Sartorelli et al., 2005; Howard et al., 2006). In the studies where nutrition surveys were conducted after the intervention period, the TC level kept the same as at the end of intervention (Keyserling et al., 1997; Iso et al., 2002). It is then suspected that the activity to check the nutrition after the intervention period served as a kind of stimulation to decrease the TC intake or increase physical activity level, and improve the serum TC level. To avoid this unexpected effect of nutrition check, measurement of serum lipids after the intervention period was not planned in this study. In the present study, the TC value decreased by 9.3mg (3.8%) during the 6 month intervention period and by 14.2mg (6.1%) during 6 month after the intervention.

These results suggest that dietary improvement activities may be sustained after the end of the intervention period if the program is planned based on the method emphasizing the self-reliance and self-action, and using group work methodology.

Former studies (Bandura, 1982; Deci and Ryan, 1987; Meland et al., 1999; Oka, 2003) emphasized that it is necessary to increase self-efficacy and strengthen social support to change the behavior and to sustain the change. The dietary intervention method in this study consisted of self-recording of foodstuffs, lecture on dietary habits, evaluation of the practiced fitness and dietary activities during the month prior to each measurement point and the small-group work. In the group work, case reports on successful trials to continue the exercise or diet control were presented to the members. It is expected that small-group work can increase the feeling of camaraderie and make it easy to create a meaningful social support system (Peter, 1980).

In this study, we did not measure physical activity levels or dietary intake values after the end of the intervention, as it is apprehended that such measurements may act as a kind of stimulation. Therefore, it is unclear whether the participants continued the daily activities of fitness and diet, but the fact that the health indicators improved or at least remained the same at End Point strongly suggests that the participants continued such daily activities after the intervention period. A possible reason why the participants could continue the activities is that methodology based on group dynamics was applied in this project. The participants implemented small-group discussion using the KJ–Method (Kawakita, 1986) to identify the important points for continuing the exercise and dietary control activities during the intervention period. Bandura (1982) emphasized that increasing self-efficacy and strengthening social support were important for continuing the activities. We consider that the participants could share good practices and knowledge and promote better communication through the small-group work and that these activities might make it possible to sustain their health promotion activities even after the intervention period.

It should also be noted that a voluntary group to sustain the activities was established at the end of the 6-month intervention period by 30 out of 37 participants (81%). They held monthly meetings after the end of the 6-month intervention period, and such activities played an important role for each individual to sustain the activity.

As for selection bias, Remington (1978) reported that they found little consistent tendency for volunteering behavior to be related to serum cholesterol, blood pressure, relative weight, level of activity at work, or Type A behavior variables. Even though the possibility of the selection bias may not be denied in this study, it is worthwhile to discuss the effective intervention method to activate health promotion activities among the people recognizing the importance of lifestyle change. It is also important to plan the future research where the procedure of recruiting of the participants is more seriously considered.

CONCLUSION

It is concluded that a health education program based on self-reliance and self-action philosophy and group work methodology is effective for improving hypercholesterolemia. Especially, the improvement in the serum TC and atherosclerosis-index levels and BMI was sustained after the intervention period. These results suggest that the program, main contents of which are dietary education, small-group work, and self-recording and administration of the daily fitness and dietary activities is an effective measure to control hypercholesterolemia.

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