OPEN

Mortality Benefit of Participation in BOOCS Program

A Follow-Up Study for 15 Years in a Japanese Working Population

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Objective: This study aims to demonstrate the protective effect on mortality among participants of a health education program, Brain-Oriented Obesity Control System (BOOCS). **Methods:** A quasi-experimentally designed, 15-year (1993 to 2007) follow-up study was conducted with a total of 13,835 male and 7791 female Japanese workers. They were divided into three groups: participants in the program (1565 males and 742 females), nonparticipant comparative obese controls (1230 males and 605 females), and nonparticipant reference subjects (11,012 males and 6426 females). Hazard ratios were calculated with survival curves drawn to evaluate the mortality effects by the program participation. **Results:** The male participants showed significantly lower mortality risk for all causes of death at hazard ratio = 0.54 (95% confidence interval: 0.31 to 0.94) with significantly different survival curves ($P = 0.014$ by log-rank test) than obese controls. **Conclusions:** The results support a protective effect on mortality by participating in BOOCS program.

Learning Objectives

- Become familiar with the "brain-oriented obesity control system" (BOOCS), including the two principles and three basic rules of this psychosomatic approach.
- Describe the design of the quasi-experimental study, including more than 21,000 Japanese workers over 15 years.
- Summarize the health and mortality benefits of the BOOCS approach in obese workers.

For our health and well-being, better lifestyle is undoubtedly important. Many studies have provided scientific evidences showing that healthy behavior, including smoking cessation, physical exercise, low-fat diet, and balanced nutrition, is essential for disease prevention and health promotion. Prevalence of obese workers has increased during these decades, that is, 25.1% for males and 23.9% for females in the United States as a body mass index (BMI) of 30 or higher in 2003 to 2009,[1] and 28.5% for males and 11.6% for females in Japan as a BMI of 25 or higher in 2011.[2] We are now facing to risk of metabolic syndrome especially in developed countries, and the fact shows that substantial proportion of us would improve the ways of our life and health behavior.[3-8]

Key points of health education are logicalness, constructiveness, and persuasiveness for people, those screened as with ill-health condition. Effective and practical health programs should consist of not only an accurate theory but also flexible manner of guidance. Although several practical studies on worksite health programs have been conducted in Japan,[9-13] most of them utilize the traditional approach for lifestyle modification. We have established a new method of health education, Brain-Oriented Obesity Control System (BOOCS), and put it to practice.[14] This is a unique method prioritizing the recovery from fatigue, in particular, "brain fatigue," and it eventually induces better lifestyle modification and improvement of body weight and serum lipids.

This study was carried out under a quasi-experimental design, that is, an intervention study without random allocation of subjects with the aim to demonstrate the preventive effect of BOOCS program on mortality during the active employment among the program participants.

MATERIALS AND METHODS

Study Subjects

The all subjects were public service employees working for the municipal governments of Fukuoka Prefecture, Japan. They had the membership of a health service organization that provides a variety of services such as health examinations, health seminars and guidance, and health insurance programs.[15]

Of the members of this health service organization, those who were actively employed as of April 1, 1992, with at least 6 months of employment and aged 59 years or younger as of March 31, 1993, were included in the study population. The newest computerized personnel data file was used to identify the date of his or her employment and establishment of the membership, and the date of his or her retirement (only for the retired).

Definition of Intervention and Reference Group

In 1992, the health service organization introduced the health seminars that were specific to BOOCS program. The seminars were held 10 times a year, which was 1-day or 2-day program and consisted of lectures on health care by physicians and practical exercises by health care professionals such as a physical instructor, a dietician, and a psychologist. All participants received an individual interview of follow-up by occupational health nurses 1 year after the seminar.

At the beginning of the fiscal year 1993 to 1997, the occupational health nurses selected the workers with obesity and the risk of diabetes and/or hypertension with verifying the annual health checkup data of the previous year and sent them a letter to encourage them to participate in the program. The workers without participation histories were selected as priority candidates. The intervention subjects were those who first participated in the program during 1993 to 1997.

For the workers without participation in BOOCS program, conventional health guidance was provided for health promotion and disease prevention. They were divided into two groups as follows. The first group was composed of those with obesity at 25 or higher score of BMI, or with health problems relating to obesity, which was

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found in the annual health check-up in 1992. They were defined as comparative obese controls. The second group was composed of the rest of the workers after excluding the comparative obese controls, and they were defined as reference subjects.

Characteristics of BOOCS Program

The BOOCS program utilizes psychosomatic approach for behavior modification, which is distinct from the others.[14] Under the two principles and three basic rules (Table 1), effective and active guidance is provided for health promotion and disease prevention. Although lifestyle modification in a conventional approach starts with prohibition and inhibition of unhealthy behaviors such as alcohol drinking, smoking, and high calorie-intake, its strictness frequently results in the rebound of body weight and the appearance of guilty conscience. On the contrary, the BOOCS program does not induce such dilemmas because it begins with no prohibition and makes us recover from brain fatigue. Moreover, the three basic rules translating the principles easily lead us to modify our behavior for health and well-being in our everyday life.

Follow-Up

All subjects were followed up from April 1, 1993, to March 31, 2008, at longest. The follow-up was stopped when the subject died or retired and lost the membership because of compulsory retirement (usually at the age of 60 years) or voluntary retirement. The follow-up periods for the participants in the program were different according to the year of participation, 1993 to 1997. Personal information, including date of hire and that of retire/death, was computerized and the person years of the active membership were calculated on the basis of the information.

Data Analysis

First, standardized mortality ratios (SMRs) and corresponding 95% confidence intervals (CIs) were calculated. Person years at risk were accumulated for the subjects in the follow-up period. Expected numbers of deaths were calculated by multiplying the person years with sex-, age-, calendar-year-, and cause-specific death rates of the general population in Japan, 1993 to 2007.[16]

Second, hazard ratios (HRs) and corresponding 95% CIs were calculated between participants and comparative obese controls with adjusted by age as of March 31, 1993, and occupation as potential confounders. Also, survival curves were drawn for all deaths between participants and comparative obese controls. Statistical analyses were performed with SAS version 9.3 (SAS Institute Inc, Cary, NC), and PHREG and LIFETIME procedures were used for calculating HRs and drawing survival curves, respectively.

Ethical Issues

This study was approved by the Ethical Review Board of University of Occupational and Environmental Health, Kitakyushu, Japan.

TABLE 1. Two Principles and Three Basic Rules of BOOCS Program[a]

Two principles
1. Do not prohibit or order yourself as possible.
2. Do something pleasant for you.
Three basic rules
1. Do not practice what you dislike, even if it is good for your health.
2. Do not prohibit what you like even if it is bad for your health.
3. Do only what you like among good things and matters for your health.

Abbreviation: BOOCS, Brain-Oriented Obesity Control System.
[a]Adapted from Fujino.[14]

RESULTS

Figure 1 shows a process of recruitment and enrollment of the study subjects. From the personnel files, a total of 21,626 workers (13,835 males and 7791 females) were identified as the study subjects. After excluding 46 of them with no meeting the inclusion criteria, the number of BOOCS participants, comparative obese controls, and reference subjects were 2307 (1565 males and 742 females), 1835 (1230 males and 605 females), and 17,438 (11,012 males and 6426 females), respectively. Mean ages were significantly different among three groups in both males and females. Frequently seen occupations were a clerk and a firefighter in males, and a clerk, a kindergarten teacher/a nurse, and a food supplier in females (Table 2).

During the follow-up period, 24 (22 males and 2 females), 40 (35 males and 5 females), and 259 (206 males and 53 females) deceased in participants, comparative obese controls, and reference subjects, respectively (Table 3). In males of the deceased, 10, 16, and 90 persons with malignant neoplasms and 5, 6, and 50 persons with diseases of the circulation were included in the participants, comparative obese controls, and reference subjects, respectively (Table 4).

In males, SMRs for all causes were lower than those of the general population in Japan at 0.36 (95% CI: 0.22 to 0.52) in participants, 0.87 (95% CI: 0.69 to 1.29) in comparative obese controls, and 0.44 (95% CI: 0.38 to 0.51) in reference subjects. For those with malignant neoplasms, decreased SMRs were found to be statistically significant only in participants at 0.48 (95% CI: 0.23 to 0.82) and in reference subjects at 0.57 (95% CI: 0.46 to 0.70). Regarding those deceased because of diseases of the circulation and suicide, no statistically significant decrease or increase in SMRs was seen among both participants and comparative obese controls (Table 4).

In females, despite the lower number of deceased workers, SMRs for all causes were statistically significantly lower among participants at 0.14 (95% CI: 0.01 to 0.41) and among reference subjects at 0.45 (95% CI: 0.33 to 0.58) (Table 4).

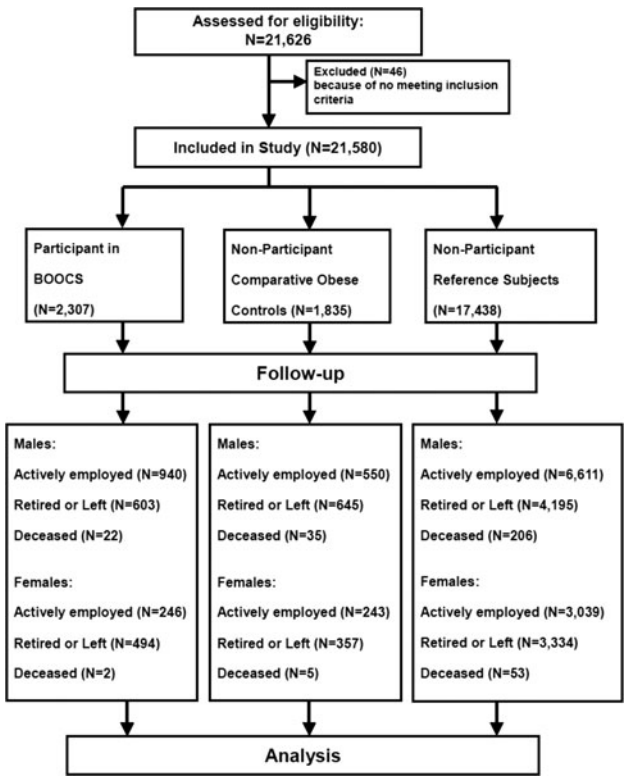

FIGURE 1. Process of recruitment and enrollment in this study.

TABLE 2. Basic Characteristics of Subjects in the Current Study, 1993–2007

	Participants in BOOCS Program	Comparative Obese Controls*	Reference Subjects†	*P*
Male				
No. of subjects	1,565	1,230	11,012	
Mean age ± SD‡	41.6 ± 8.5	44.4 ± 9.4	41.2 ± 9.3	<0.0001
Occupation, %				
Clerk	1,137 (72.7)	852 (69.3)	7,614 (69.1)	<0.0001
Firefighter	168 (10.7)	132 (10.7)	1,562 (14.2)	
Technician	75 (4.8)	91 (7.4)	575 (5.2)	
Health care	23 (1.5)	25 (2.0)	341 (3.1)	
Others	162 (10.4)	130 (10.6)	920 (8.4)	
Female				
No. of subjects	742	605	6,426	
Mean age ± SD†	45.5 ± 7.7	42.9 ± 9.9	41.0 ± 9.6	<0.0001
Occupation, %				
Clerk	363 (48.9)	226 (37.4)	2,532 (39.4)	<0.0001
Food supply	131 (17.7)	112 (18.5)	1.011 (15.7)	
Kindergarten teacher/nurse	143 (19.3)	141 (23.3)	1,442 (22.4)	
Health care	50 (6.7)	69 (11.4)	1,048 (16.3)	
Others	55 (7.4)	57 (9.4)	393 (6.1)	

Abbreviation: BOOCS, Brain-Oriented Obesity Control System.
*Those who had obesity with body mass index ≥25 or obesity-related health problems, and who did not participate in BOOCS program.
†Those who were the rest of nonparticipants after excluding the comparative obese controls.
‡As of March 31, 1993.

TABLE 3. Results of Follow-Up for Subjects in the Current Study, 1993–2007

	Participants in BOOCS Program	Comparative Obese Controls*	Reference Subjects†
Male			
Observed person-years	15,896.0	13,301.3	137,131.4
Status at the end of follow-up, %			
Active employee at the end of study	940 (60.1)	550 (44.7)	6,611 (60.0)
Retired or left before the end of study	603 (38.5)	645 (52.4)	4,195 (38.1)
Deceased	22 (1.4)	35 (2.9)	206 (1.9)
Female			
Observed person-years	6,076.6	6,511.4	73,591.7
Status at the end of follow-up, %			
Active employee at the end of study	246 (33.2)	243 (40.2)	3,039 (47.3)
Retired or left before the end of study	494 (66.6)	357 (59.0)	3,334 (51.9)
Deceased	2 (0.3)	5 (0.8)	53 (0.8)

Abbreviation: BOOCS, Brain-Oriented Obesity Control System.
*Those who had obesity with body mass index ≥25 or obesity-related health problems, and who did not participate in BOOCS program.
†Those who were the rest of nonparticipants after excluding the comparative obese controls.

Compared with comparative obese controls, HRs for all causes were significantly lower in participants at 0.54 (95% CI: 0.31 to 0.94). Survival curves were also statistically different and such significant mortality changes were persisted during follow-up period ($P = 0.014$ by log-rank test; Fig. 2). Nevertheless, the mortality effect was not found in females with 0.26 (95% CI: 0.02 to 2.52) (data not shown). Regarding other categories of cause of deaths, no significant change was observed in HRs, probably because of the small number of deaths in both males and females (data not shown).

DISCUSSION

In this study, protective effect for mortality by BOOCS program was indicated by significantly decreased HR for all causes of deaths to 0.54 (95% CI: 0.31 to 0.94) and its persistence in males until the end of follow-up ($P = 0.014$ by log-rank test). One of the reasons for such preventive effects of BOOCS program may be related to improvement of obesity during follow-up. Using the same data set of male workers in this study, we obtained the results that changes of BMI during the first 5 years were more remarkable, that is, higher by 1% to 5%, in participants than those in both comparative

TABLE 4. Mortality From Selected Causes of Death, 1993 to 2007

	Participants in BOOCS Program			Comparative Obese Controls*			Reference Subjects†		
Cause of Death (*ICD-10*)	**Obs‡**	**Exp§**	**SMR (95% CI)**	**Obs‡**	**Exp§**	**SMR (95% CI)**	**Obs‡**	**Exp§**	**SMR (95% CI)**
Male									
All causes	22	61.8	0.36 (0.22–0.52)	35	40.3	0.87 (0.69–1.29)	206	464.2	0.44 (0.38–0.51)
Malignant neoplasms (C00-C95)	10	20.8	0.48 (0.23–0.82)	16	17.7	0.90 (0.52–1.39)	90	156.8	0.57 (0.46–0.70)
Cardiovascular disease (I00-I99)	5	8.0	0.62 (0.20–1.28)	6	6.8	0.88 (0.32–1.72)	50	61.7	0.81 (0.60–1.05)
Suicide (X60-X84)	5	7.7	0.65 (0.21–1.33)	9	5.9	1.53 (0.70–2.67)	38	59.2	0.64 (0.45–0.86)
Female									
All causes	2	13.9	0.14 (0.01–0.41)	5	11.1	0.45 (0.14–0.93)	53	117.7	0.45 (0.33–0.58)
Malignant neoplasms (C00-C95)	2	7.0	0.28 (0.02–0.81)	2	5.6	0.35 (0.03–1.01)	36	59.7	0.60 (0.42–0.82)

Abbreviations: BOOCS, Brain-Oriented Obesity Control System; *ICD-10*, *International Classification of Diseases, Tenth Revision*; SMR, standardized mortality ratio.
*Those who had obesity with body mass index ≥25 or obesity-related health problems, and who did not participate in BOOCS program.
†Those who were the rest of nonparticipants after excluding the comparative obese controls
‡Observed number of death.
§Expected number of death.

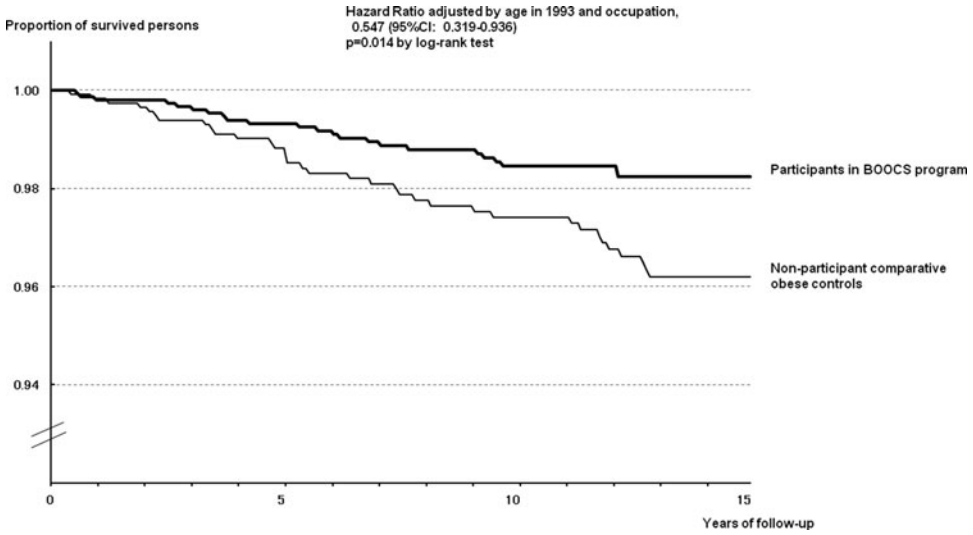

FIGURE 2. Survival curves of subjects according to BOOCS participation, 1993 to 2007 (all deaths, male). BOOCS indicates Brain-Oriented Obesity Control System.

obese controls and reference subjects.[17] These data coincide with the previous reports[18-22] that both all-cause and cancer mortality were associated with obesity. So-called "legacy effect" may exist in this study because only participant group showed mortality benefit after better BMI control disappeared.[23] These effects brought by BOOCS program may result in the protective effect for mortality in this study.

As mentioned earlier, BOOCS program is a unique method with a way of psychosomatic approach prioritizing mental and physical recovery from fatigue. Although relevant lectures regarding nutrition, physical exercise, and risk factors of lifestyle-related diseases are sufficiently provided in BOOCS program, it should be noted that harmful factors for health, for example, smoking and drinking, are not initially inhibited. According to Fujino,[14] the founder of the program, this approach is quite useful for making the participants fully aware of the fundamentals of health promotion and disease prevention, which leads them to modify their health behavior. He also insists that prohibitive and compulsive instructions are ineffective for behavior modification, and, in particular, those people who understand significance of health would result in failure through such methods and fall into vicious circle such as rebounding body weight. This approach may be consisted of the concept of behavior science and several reputed methods.[14,24-30] Nevertheless, the mechanism why BOOCS program is effective for behavior modification has not been clarified yet; therefore, further studies are strongly needed in the future.

The reason why such effect was not seen in females may be a small number of deceased workers and the low statistical power of our analysis. In addition, some sociological factors might be related to the results in female workers. In Japan, the traditional gender roles still remain, which argues that women should do housework.[31] The actual situations, where the promotion in the workplace is provided more for males than for females, and many Japanese women have retired after marriage or childbearing until recently, are seen. As shown in Table 3, more retired or left subjects were found among female workers than among male workers during the follow-up period. Some studies pointed out that working women may have more physical and mental health problems than housewives.[31,32] Although only a few female workers died in this study, we should pay attention to health status among them.

Advantages of this study are as follows: it is based on a large-scale working-population, long-term follow-up, and almost no dropouts from follow-up. All of those points may be fundamental and

important in epidemiological studies, and make our results valid and reliable. On the contrary, limitations of this study are as follows: no randomization was considered when dividing the subjects into participants and nonparticipants, and no information was collected on lifestyle such as smoking and drinking. Therefore, attention should be paid in interpreting the results because they may include potential confounders that could influence on the mortality risks calculated in the study.

In occupational epidemiology, the healthy-worker effect (HWE) is usually seen as the workers show significantly lower mortality risks than the general population.[33] Indeed, decreased SMRs were found in both participants and nonparticipants in this study, which could conceal the real mortality effect in the population. This potential problem can be controlled by the risk indicators, such as HRs, which is calculated for the internal reference group. Therefore, we believe this approach minimized potential bias by HWE.

In conclusion, in quasi-experimentally 15-year follow-up study of health effect of participation in BOOCS program with 13,835 male and 7791 female Japanese workers, the numbers of deceased workers were 22, 35, and 206 males and 2, 5, and 53 females among participants, comparative obese controls, and reference subjects, respectively. The SMRs for all causes and all neoplasms in comparison with the general population were statistically lower among participants and reference subjects, which may be due to the HWE. Mortality risk from all causes in comparison with comparative obese controls was statistically lower in participants with HR = 0.54 (95% CI: 0.31 to 0.94) accompanied by significantly different survival curves ($P = 0.014$ by log-rank test) in males. Such protective effect on mortality in males may be related to improvement of obesity by participation in the program. The results indicate a mortality benefit by participation in BOOCS program. For prevention of metabolic syndrome, effective measures are strongly needed in the future, and it is suggested that BOOCS program will contribute to them as a new approach for health promotion.

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