

International Study & Promotion of Osteoporosis Prevention with Finnish Bone Exercise Monitor in Sendai City, Japan

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Abstract—Under the project launched by Finland and City of Sendai, Japan, we started an international study of osteoporosis prevention with high-impact exercise scaled with accelerometer-based physical activity monitor, Bone Exercise Monitor (BEM). Following to the previous study in Finland, a randomized controlled study was done in Japan for 91 premenopausal women. Based on the joint study an exercise protocol with BEM will be developed. The purpose is to promote prevention of osteoporosis with exercise and thus improve QOL of older adults.

I. BACKGROUND

AGEING is known as a big challenge for the society of most long-living nation Japan. However, it should be discussed and given solutions over the national borders. When an advanced technology is developed, it is recommended to be shared by multinational collaboration. With this consequence, Sendai City of Japan and Republic of Finland launched a project named Sendai-Finland Wellbeing Center (S-FWBC) (Fig.1). In the project we emphasize the dignity, autonomy and activity of senior citizens [1], [2], [3]. The ultimate goal of the project is to improve quality of life (QOL) of senior citizens supported by collaboration of academia, government, and industry.



Fig. 1. A view of Finnish Wellbeing Center in Sendai, Japan. Research and Development Unit (left) and Care Unit (right)

The worst situation of QOL for elderly is to be bedridden, which more frequently happens in Japan than in Finland.

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The Finnish health and welfare policy focuses on prevention and rehabilitation, which might reduce the amount of bedridden older persons. Through S-FWBC Project, Sendai City tries to import the Finnish Health Promotion Concept. In Japan, the first reason leading to bedridden status is cerebrovascular diseases, second is senile weakness and third is falling/bone fracture (Fig.2) [4]. For men, the first reason is cerebrovascular diseases, and for women it is falling/bone fracture [5]. In order to diminish the amount of cerebrovascular diseases, the Ministry of Health, Labor and Welfare of Japan has started a big campaign with new regulation to prevent metabolic syndrome starting from April 2008. The authors propose that next important action to prevent bedridden should be to prevent osteoporosis and related fractures.

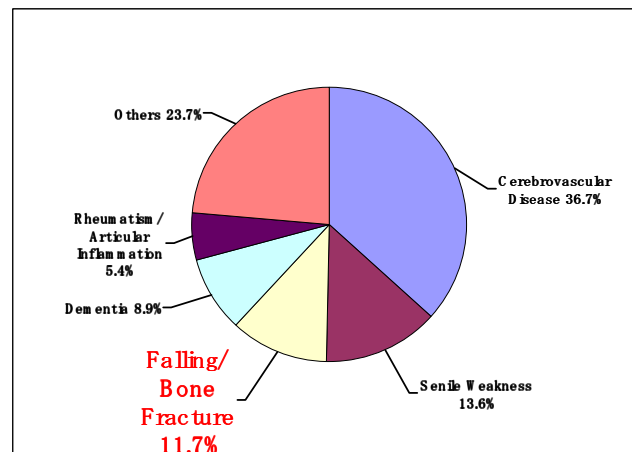


Fig. 2. Reasons of Bedridden for Persons 65 Years or Older in Japan

II. FINNISH TYPE HEALTH PROMOTION IN SENDAI

When S-FWBC Project started, Finland introduced Nordic Walking (NW) to Sendai. Nordic walking is defined as fitness walking with specially designed poles. The magnitude of increase in oxygen consumption and caloric expenditure is about 20%, the effect being similar for women and men [6]. Nordic Walking is efficient and not expensive exercise for prevention of metabolic syndrome. To promote NW, three bureaus of Sendai City cooperated to hold seminars at citizen centers. As a result, Japan Nordic Fitness Association (JNFA) was established. The association is certified as an official organization by International Nordic Walking Association (INWA). After 14 months of existence in March 2008, there were 400 members, 40 group members, and 5 supporters including the biggest tourist company in Japan. JNFA has held 180

times of one-day event with 5,700 participants and 35 times of lecture for instructor with 540 participants.

The next concept introduced by Finland was Bone Health Concept. It means prevention of osteoporosis with high-impact exercise scaled with Bone Exercise Monitor (BEM) and proper nutrition. In our international study, the focus was on prevention of osteoporosis, because it is one of the major reasons to worsen QOL of older adults in Japan. The study was carried out in Sendai under S-FWBC Project.

III. COLLABORATION OF ACADEMIA, GOVERNMENT, AND INDUSTRY

The research was done by the University of Oulu (Biomedical) from Finland, Tohoku University (Medical) and Sendai University (Sports Science), Japan, and S-FWBC from Japan participated into research. Oulu Innovation Ltd., Finland and Sendai City Industrial Promotion Organization (SIPO), Japan, supported the study financially. This system is very unique, that two local business support organizations were partly funding an international study (Fig.3). However, the goal of two business support organizations was to support the academic research results to be transferred into business actions. In addition to business activity, the purpose was to contribute to health promotion for citizens with evidence based knowledge. Accordingly, the study set-up served as a good example of real collaboration between universities, government, and industry.

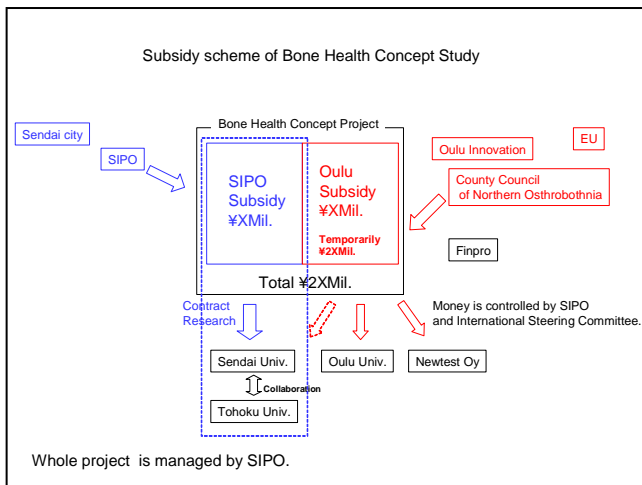


Fig. 3. Sendai-Oulu International Subsidy Scheme Managed by SIPO (Sendai City Industrial Promotion Organization).

IV. STUDY IN FINLAND

Physical exercise, especially high-impact one, has found to be effective in the prevention of osteoporosis. However, the optimal amount of exercise was not known. In Oulu City, Finland, T. Jämsä et al. designed a population-based randomized controlled study (RCT) in 2002 to examine the association between physical activity and changes in proximal femur bone mineral density [7], [8]. They performed a 12-month trial with 120 women (aged 35-40

years) randomly assigned to an exercise group or to a control group (Fig.4). The intensity of the physical activity of 64 women was assessed with accelerometer-based body movement monitor, BEM (Newtest Ltd., Finland). In conclusion, it was found that the intensity of exercise, measured as the acceleration level of physical activity, was significantly correlated with bone mineral density changes. In order to study the changes in different Asian population, an intervention study with Japanese women in collaboration of S-FWBC was initiated.

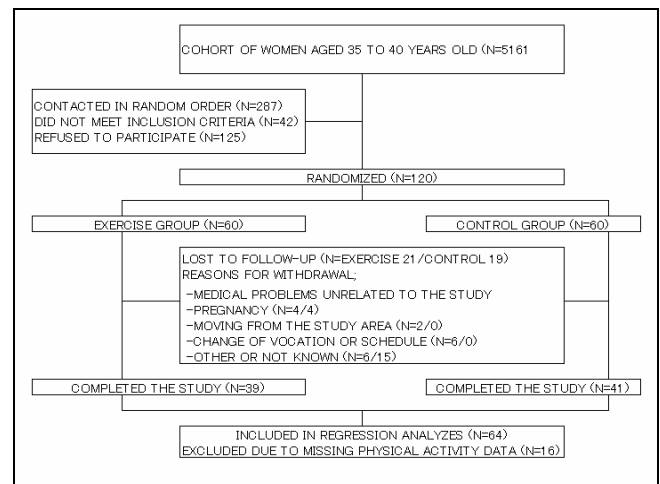


Fig. 4. Finnish Trial Profile

V. STUDY IN SENDAI, JAPAN

Following to the studies of Finnish researchers, University of Oulu, Tohoku University, Sendai University and S-FWBC started a study to find the results for the Japanese women. It was decided to examine the effect of office-based short-duration high-impact exercise on bone mineral density in healthy premenopausal women with using BEM.

There were some cultural differences in order to design the study set-up between Finland and Japan. In Finland, it is easier to carry out a population-based study, because Finnish people are quite eager to join scientific studies. However, that is not the case in Japan. The targeted subjects belonged to a very busy generation to foster children and/or work in the society. That was a reason to choose persons working at office. In addition, in Finland, the duration of exercise was one hour, but in Sendai it was 15 minutes.

The study field could be found from a calling center company, which paid attention to the women's health. They allowed calling operators to use 15 minutes per day to do exercise at elevator hall in its buildings. 373 employees were invited for the study, from which nearly 100 women aged 25-50 met the inclusion criteria. After exclusion of some participants, who met exclusion criteria, the rest were randomized into two groups: (1) control group with low-impact exercise and (2) intervention group with high-impact exercise.

Once again we faced cultural differences. In Japan, it is difficult to have a control group, which has no activities at all. Based on that fact, the control group had its' own program, too, but with only low-impact exercise. Both

exercise programs were done with instructors or video during working day. There were some challenges with compliance of participants. One example is hot summer in Japan. Air conditioning at the site of exercise was not sufficient for exercise programs. In order to ease the participants, an electric fan was introduced. Another factor was the hectic work load due to the general election of parliament in Japan in August 2007. Nevertheless, the majority of participants completed the study at the end of year 2007. (Fig.5)

There are also cultural differences in the way of exercising habits of women in Japan and Finland. Usually, Japanese women spend less time for physical activity than the Finnish. Our hypothesis was that even low-impact exercise might have effect on total health of Japanese women, including bone health. However, based on the recent Finnish study, exercise with high-impact should be more effective[8].

The aim of the study was to evaluate the relationship between the impact on lower extremities and change of bone quality or bone mineral density in premenopausal women. The data has been gathered and is now under analyses. The final scientific results will be released at medical conferences, such as IOF World Congress of Osteoporosis. Based on new data, algorithm of Japanese women will be installed in the BEM.

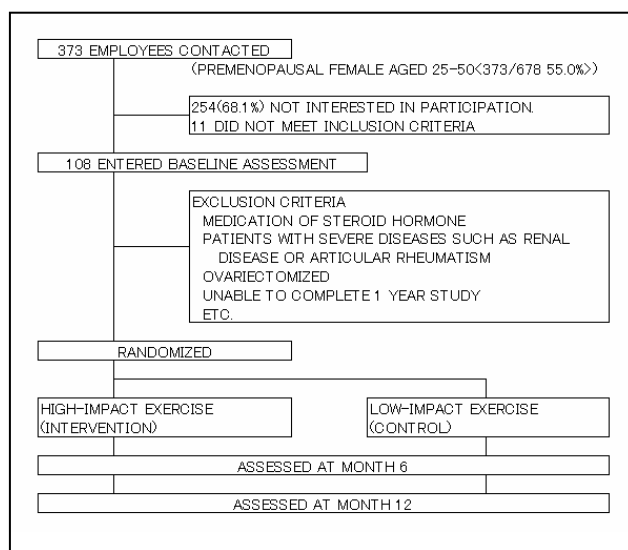


Fig. 5. Sendai Trial Profile

VI. MARKETING RESEARCH WITH COMMERCIAL BEM

As we explained earlier, one purpose of S-FWBC project is to support business incubation. Along with scientific bone health research, we did marketing research with Finnish BEM manufacturer (Newtest Ltd.), Japanese Fitness Club Company, and possible future distributor in Japan.

We made a study at 3 fitness clubs with 15 fitness instructors and gathered opinions from them. Because instructors are professional for fitness, they were interested in BEM. However, the first thing we learnt from them was, that fitness club customers are mainly focusing on losing weight, and attention paid to bone health is much less. We reached a conclusion, that concept marketing is more

important to do at first stage, followed by product marketing.

VII. CONCLUSION: PROMOTION OF OSTEOPOROSIS PREVENTION

At the Conference of the International Society for Gerontechnology, ISG05, the first author emphasized the importance of easy-to-use product and service for citizens. The technology that is not used is not the real technology. Through this joint study, we develop exercise protocol with BEM. The next action to be taken will be 1) to introduce proper quality and quantity of exercise with BEM to prevent osteoporosis under collaboration of academia, industry and government, and 2) to promote Bone Health Concept to citizens in Japan. In April, 2008, the first author did a presentation for 150 seniors at Citizen Center in Sendai as the first step to explain the importance of exercise. We have a plan to introduce this concept with BEM to private fitness clubs and Sendai City owned Health Promotion Center. We hope our study contributes to prevention of osteoporosis for both the Finnish people, Sendai citizens and globally.

REFERENCES

- [1] S. Salo, "Finnish – Japanese Collaboration in the Field of Wellbeing Services and Technology for Elderly Care, Finnish Wellbeing Center- project," in Proceedings of the 6th Nordic Conference on eHealth & Telemedicine, pp. 157-158, 2006.
- [2] A. Sakai, "Sendai-Finland Wellbeing Project", 1st International Society for Gerontechnology Japan Chapter, pp.13-16, 2006
- [3] Sendai-Finland Wellbeing Center hope page: <http://sendai.fwbc.jp>, as downloaded April 25, 2008.
- [4] Basic Survey of Japanese Life, MHLW 1998
- [5] 1st Health and Nutrition Survey for Elderly, Bureau of Hygiene, Tokyo Metropolitan Government, 1997.
- [6] T. S. Church, C. P. Earnest, and G. M. Morss, Research Quarterly for Exercise and Sport , Vol.73, pp.296-300, 2002.
- [7] T. Jämsä, A. Vainionpää, R. Korpelainen, E. Vihriälä, J. and Leppäluoto Clinical Biomechanics Vol. 21, 1-7, 2006.
- [8] A. Vainionpää, R. Korpelainen, E. Vihriälä, A. Rinta-Paavola, J. Leppäluoto and T. Jämsä. Osteoporosis International, vol 17, pp. 455-463, 2006.