Multimodal Training Intervention: an Approach to Successful Ageing Iceland

Title in original language:

Fjölþætt heilsurækt – Leið að farsælli öldrun

Short description of the intervention:

Mr. Janus Gudlaugsson, Doctor of Philosophy in Sport and Health Science at the University of Iceland. This intervention was a part of his thesis for a doctoral degree at the University of Iceland from 2007 – 2014. The doctoral defence was 22nd of September 2014. Multimodal training interventions (6-MTI) are of special interest for older individuals, because of their high rate of disability, functional dependence and use of healthcare resources.

The aim of this study was to examine the effects of a 6-month multimodal training intervention (6-MTI), and nutrition and health counselling on different variables, such as on functional fitness (FF), body composition (BC) and cardio metabolic risk factors (CMRF). The aim was also to evaluate at 6- and 12-month follow-ups the effects and sustainability of a 6-MTI. Furthermore, the aim was to investigate the effects on the different sexes and to see whether they were different between older males and females. Another goal was to examine the 6-MTI effect and long-term effects on participants, who were divided into three different age groups. Finally, the aim was to evaluate whether the applied 6-MTI design and methodology could form a sustainable strategy for developing and maintaining the health of older age groups with regard to international recommendations.

The participants were healthy older individuals, 71–90 years old, selected from the population-based Age, Gene/Environment Susceptibility – (AGES) Reykjavik Study that had been screened depending on their health and physical performance. Ninety-two of the 325 older individuals (>70 years), along with 25 spouses, accepted the invitation. The main reasons for not participate in the study were that the study was conducted over too long and binding period, participants showed a lack of interest or participants suffered illness.

This study was a randomized controlled, cross-over design. After enrolment and baseline assessment the participants (n=117) were randomized into an immediate training intervention group (n=56) and a delayed intervention group (n=61). The trial was conducted in three 6-month phases after the baseline assessment. The immediate intervention group participated in a 6-MTI, while the delayed intervention group served as a control group. After the first 6 months of the study the baseline measurements were repeated, and the crossover took place. The delayed intervention group now received comparable training intervention for 6 months as the immediate intervention group received before, which from that time-point did not receive any further intervention from the research staff. After the second 6-MTI, the baseline measurements were repeated in both groups. The delayed intervention group did not receive any further intervention. An additional 6-month follow-up was done and the measurements were repeated for the fourth time. At this time point the research was formally closed.

The intervention consisted of a 6-MTI with an emphasis on daily endurance training (ET) and twice-a-week resistance training (RT). This was supported by three lectures on nutrition and four on health-related topics.

The ET consisted of daily walking over the intervention phase. The duration of the training session increased progressively through the 6-month training period. During the first week, the participants trained for 20 minutes at each session, and then the duration was increased systematically over the training period. The average duration per day was estimated at around 30 minutes. In the first and last eight weeks, a health instructor was on site twice a week, but in weeks 9–18, only once a week. The training took place outdoors on a 400-meter running track, except for four weeks during the winter period when the training was indoors. Other endurance training sessions were self-administered with participants following a training plan from the program.

The RT took place twice-a-week in a fitness centre. It was individualized and always under the guidance of health instructors. The RT consisted of 12 exercises for all major muscle groups. The exercises for the lower body included leg press, leg extensions and calf raises. Exercises for the upper body included bench press, chest cross, shoulder press, pull downs, biceps curls, triceps extensions, and exercises for abdominal muscles and the back. The focus was on strength-endurance training for the first 3 months but for the latter 3 months it was on strength-power. The participations had 7 lectures, 3 on nutrition and 4 on healthy ageing, endurance, strength, and how to train.
Some municipalities in Iceland are exploring the possibility to implement this method, adapted to their situation.

To which type of interventions does your example of good practice belong to?

Individual Intervention.

How is this example of good practice funded?

The research project was funded by following institutions, organizations and companies:

- The Icelandic Centre for Research – RANNÍS (Rannsóknamiðstöð Íslands – RANNÍS)
- The Fitness Centre World Class Laugar (World Class Laugar heilsurækt)
- The Sport Fund at the Ministry of Education, Science and Culture (Íþróttasjóður)
- The Capital Area Commune Association (Samband sveitarfélga á höfuðborgarsvæðinu)
- The Football Association of Iceland (Knattspyrnusamband Íslands)
- The Physiotherapy Máttur in Árborg (Máttur Sjúkraþjálfun, Selfossi)
- The Commune Árborg (Sveitarfélagið Árborg)
- The General and Transport Workers' Union – Hlíf (Verkamannafélagið Hlíf, Hafnarfirði)
- The Older Fishermen's Home Hrafnista – DAS (Hrafnista – DAS)
- The Kiwanis Club Eldborg in Hafnarfjörður (Kiwanisklúbburinn Eldborg, Hafnarfirði)
- The Oddfellow Order in Iceland (Oddfellowreglan á Íslandi)
- The Directorate of Health in Iceland (Embætti landlæknis)
- The School and Leisure Department, City of Reykjavik (Íþrótta- og tómstundasvið Reykjavíkurborgar).

What is/was the level of implementation of your example of good practice?

The results of the research have been well received and caught the attention of both national and local authorities who are interested in implementing the method. According to the author, one of the main benefits of this multimodal training intervention is that the ideology can be adapted for single individuals or a group of older people, in small or large communities.

What are the main aim and the main objectives of your example of good practice?

The aim was to examine the effects of a 6-month multimodal training intervention (6-MTI) and nutrition and health counselling on different variables, such as functional performance, strength, endurance, body composition and metabolic risk factors. The aim was also to evaluate at 6- and 12-month follow-ups the effects and sustainability of a 6-MTI. Furthermore, the aim was to investigate if the effects on the different sexes and to see whether they were different between older males and females. Another goal was to examine the 6-MTI effect and long-term effects on participants, who were divided into three different age groups. Finally, the aim was to evaluate whether the applied 6-MTI design and methodology could form a sustainable strategy for developing and maintaining the health of older age groups with regard to international recommendations.

Please give a description of the problem the good practice example wants to tackle:

Results from a recently published study in Iceland (2011), showed that 33% of older adults engaged in no leisure time activity, 73% were eating fewer than five portions of fruit and vegetables daily, 24% were obese, and 8% were

currently smoking. Research has established that 6–10% of all deaths from non-communicable diseases worldwide can be attributed to physical inactivity. This percentage is even higher for specific diseases, such as ischemic heart disease, being about 30%. This underlines the importance of establishing specific health intervention efforts in communities in order to address preventable health risks among older adults and at the same time promote Physical activity, including appropriate training, and good nutrition among older adults.

Is your example of good practice embedded in a broader national/regional/ local policy or action plan?

No, but the results of the research have been well received and caught the attention of both national and local authorities who are exploring the possibility of implementation.

Implementation of your example of good practice is/was:

The trial was conducted in three 6-month phases after the baseline assessment (see Description). A 5 year follow-up has just been made (November 2014).

Target groups:

The target group was 117 healthy men and women from 71 – 90 years old. The participants were healthy older individuals, 71–90 years old, selected from the population-based Age, Gene/Environment Susceptibility – (AGES) Reykjavik Study that had been screened depending on their health and physical performance. Ninety-two of the 325 older individuals (>70 years), along with 25 spouses, accepted the invitation.

Who implements/implemented the intervention?

The administrator of the implementation was Dr. Janus Gudlaugsson (Ph.D.) and five master´s students did take part in the research team during the design phase, measurements or intervention. They have all now finished their Master degree via this research. This was done under control of Mr. Gudlaugsson´s PhD Committee:
Supervisor, Professor Erlingur Jóhannsson, and assistance Supervisor Professor Sigurbjörn Árni Arngrímsson both at the Centre for Sport and Health Sciences, the University of Iceland. Professor Vilmundur Guðnason from the Icelandic Heart Association, and Professor Pálmi Jónsson, Landspitali – University Hospital, Iceland. Other specialized persons were Dr Thor Aspelund, Icelandic Heart Association, associate Professor Anna Sigridur Olafdottir at the Centre for Sport and Health Sciences, the University of Iceland

What core activities are/have been implemented?

The intervention consisted of a 6-month multimodal training with an emphasis on daily endurance training (ET) and twice-a-week resistance training (RT). This was supported by three lectures on nutrition and four on health-related topics. The ET consisted of daily walking over the intervention phase. The duration of the training session increased progressively through the 6-month training period. During the first week, the participants trained for 20 minutes at each session, and then the duration was increased systematically over the training period. The average duration per day was estimated at around 30 minutes. In the first and last eight weeks, a health instructor was on site twice a week, but in weeks 9–18, only once a week. The training took place outdoors on a 400-meter running track, except for four weeks during the winter period when the training was indoors. Other endurance training sessions were self-administered with participants following a training plan from the program. The RT took place twice-a-week in a fitness centre. It was individualized and always under the guidance of health instructors. The RT consisted of 12 exercises for all major muscle groups. The exercises for the lower body included leg press, leg extensions and calf raises. Exercises for the upper body included bench press, chest cross, shoulder press, pull downs, biceps curls, triceps extensions, and exercises for abdominal muscles and the back. The focus was on strength-endurance training for the first 3 months but for the latter 3 months it was on strength-power. The participants received 7 lectures, 3 on nutrition and 4 on healthy ageing, endurance, strength, and how to train. The delayed intervention

group had the same intervention as the immediate intervention group, in addition: Hands-on teaching in kitchen and two personal interviews.

Who did the evaluation?

Both – internal and external parties.

What has been measured / evaluated?

Process evaluation (respondents, method, participants satisfaction) (please describe): Data regarding the participants satisfaction was gathered but haven´t been processed.
Evaluation of the impacts/effects/outcome (please describe the design): The primary measurements were: daily activity assessed with Actigraph accelerometers and a standardized questionnaire. Body mass index (BMI) was calculated as body mass (kg) divided by height squared (m2). Physical performance was measured with the SPPB-test and mobility and balance was measured by the 8-foot up-and-go test. Maximal isometric muscle strength of the thigh and hand was measured in an adjustable dynamometer chair and endurance performance was measured using the 6-minute walk test (6MW). Quality of life was measured with standardized questionnaire. Whole-body composition was measured using Dual energy X-ray absorptiometry, iDXA software, and blood analysis was done at the Icelandic Heart Association using standard protocols.
Functional fitness, body composition and cardio metabolic risk factors were measured. The results from physical performance tests for the whole group, male or female separated or different age groups, showed remarkable changes. This concerns the main results in the SPPB-test except balance which had a ceiling effect. The results from the dynamic balance 8-foot up-and-go test were similar. In both these tests the results were maintained for at least one year after the 6-MTI.
An improvement after the 6-MTI was seen in the strength tests for hand and thigh and also in the 6MW endurance test. The positive changes were maintained in the endurance test at 6 and 12 months follow-up but the strength went back to baseline. Changes in body composition, such as weight, BMI and fat-mass were for the better at the end of the 6-MTI. These changes were not all maintained in the follow-up phases. An increase was seen in total lean mass by the immediate intervention group, but in their control phase, 6 months after the 6-MTI, the total lean mass decreased back to baseline and the total fat mass increased at the same time. A decrease was seen in the cardio metabolic risk factors, waist circumference, systolic and diastolic blood pressure, after the 6-MTI by the immediate intervention group. The same results were seen for the delayed intervention group in their intervention period. Most of these changes were maintained at the 6-month follow-up, where the blood pressure kept on decreasing.

What are the main results/conclusions/recommendations from the evaluation?

The main results concerning PA at baseline showed that most of the participants did little PA according to international guidelines. About 60% was physically active for 15 minutes or less each time they walked, which is far from the international recommendation. Seventy percent of the participants walked three days or less each week and about 10% participated in RT. Six months after the 6-MTI about 35% walked 16 to 30 minutes every time they walked, and 35% walked longer than 30 minutes when they walked. About 50% had four or more walking days in every week at this time-point and 40% said they walked 2–3 days a week. About 40% of the participants had two or more resistance-training days 6 months after the 6-MTI, but about 60% did not do any kind of RT. One year after the intervention the status was similar, both in endurance and RT participation. The results from physical performance tests for the whole group, male or female separated or different age groups, showed remarkable changes. This concerns the main results in the SPPB-test except balance which had a ceiling effect. The results from the dynamic balance 8-foot up-and-go test were similar. In both these tests the results were maintained for at least one year after the 6-MTI. An improvement after the 6-MTI was seen in the strength tests for hand and thigh and also in the 6MW endurance test. The positive changes were maintained in the endurance test at 6 and 12 months

follow-up but the strength went back to baseline. Changes in body composition, such as weight, BMI and fat-mass were for the better at the end of the 6-MTI. These changes were not all maintained in the follow-up phases. An increase was seen in total lean mass by the immediate intervention group, but in their control phase, 6 months after the 6-MTI, the total lean mass decreased back to baseline and the total fat mass increased at the same time. A decrease was seen in the cardio metabolic risk factors, waist circumference, systolic and diastolic blood pressure, after the 6-MTI by the immediate intervention group. The same results were seen for the delayed intervention group in their intervention period. Most of these changes were maintained at the 6-month follow-up, where the blood pressure kept on decreasing.

Is the evaluation report available, preferably in English or at least an English summary?

- Mr. Gudlaugssons' Doctoral thesis (Abstract in English), see http://skemman.is/item/view/1946/19892;jsessionid=4DE8511776A7D1A94E1F1C7D92AFD9A3
- Three scientific papers from the research:
  1. Gudlaugsson et al. (2012). Effects of a 6-month multimodal training intervention on retention of functional fitness in older adults: A randomized-controlled cross-over design. *International Journal of Behavioral Nutrition and Physical Activity*, 9:107. http://www.ijbnpa.org/content/9/1/107
  2. Gudlaugsson et al. (2013). Effects of exercise training and nutrition counselling on body composition and cardio metabolic factors in old individuals. *European Geriatric Medicine,* 4, 431–437. http://www.europeangeriaticmedicine.com/article/S1878-7649(13)00892-9/abstract
  3. Guðlaugsson et al. (2013). The effects of 6 months' multimodal training on functional performance, strength, endurance, and body mass index of older individuals. Are the benefits of training similar among women and men? *Læknablaðið (The Icelandic Medical Journal)*, 99; 331–337. http://www.laeknabladid.is/tolublod/2013/0708/nr/4910

Was there a follow-up (describe how) or is any follow-up evaluation planned in the future?

1. The first follow-up was 6-month after the intervention. June 2009 (the immediate intervention group) and December 2009 (the delayed intervention group)
2. The second follow-up was 12-month after the intervention. December 2009 (the immediate intervention group)
3. The third follow-up was 6 and a ½ year after the intervention. November 2014 (both groups)

What were, in your opinion, the pre-conditions for success? Were there any facilitating factors?

The study design and plan contained the before mentioned elements. In addition, the seven lectures about health and nutrition designed to further strengthen the possibilities of developing sustainable strategies after the 6-month multimodal training intervention and to influence physical activity and other lifestyle behaviour of the participants. The cooperation with the Icelandic Heart Association, who assisted to contact the participant´s, the participant´s themselves who were positive and encouraging, cooperation with World Class, health and fitness centre who offered free facilities and all the master´s students who helped with the research.

What are the main lessons to be learned?

The results of this thesis emphasize the need for continued development of interventions for this age group to support older individuals in keeping up their activity of daily living as long as possible. The results are positive as shown in the published papers, but several of the findings highlight the need for longer term programs. An assessment of the cost-effectiveness of such a measure and other expenses is beyond the scope of this discussion

and in the thesis, but the results nevertheless demonstrate that this type of simple program seems to be effective. A financial or economic analysis would be an interesting area for future research.

Web page related to the intervention

In progress.

References (to the most important articles or reports on the intervention

- Mr. Gudlaugssons' Doctoral thesis (Abstract in English), see http://skemman.is/item/view/1946/19892;jsessionid=4DE8511776A7D1A94E1F1C7D92AFD9A3
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