**Titel: Effect of 6-week Faroese chain dance on health, balance and physical function**

# 1. Introduction

Prolonged physical inactivity can lead to many health conditions, including coronary heart disease (Lee et al., 2012), obesity (Leroux et al., 2012), circulatory diseases (Davey & Cochrane, 2013) and frailty (Fiatarone & Evans, 1990). Physical activity has a positive effect on health conditions, like endothelial function (Saisos et al., 2012), balance and physical function (Ip et al., 2013) antidepressant (Cunha et al., 2013), self-efficacy (Van Sluijs et al., 2005) and reducing obesity (Willams, 2012). The bad health conditions from physical inactivity and the positive effects of physical activity suggests that further efforts are needed to encourage physical activity for inactive populations (Kohl et al., 2012)

Physical inactivity is common observed among elderly people, with 27 % of men and women between 65-74, and 46 % for men and 65 % for women 75 year or older were inactive in England (Lenardt et al., 2013, Zhao et al., 2011, Christensen et al., 2014, Townsend et al., 2015) where barriers for physical activity for elderly people are chronic conditions, bad weather, program costs, reliability of affordable transportation, low self-efficacy, lack of interest and motivation (Belza et al., 2004; Sjörs et al., 2014). Enjoyment and maintaining a good health were important reasons to maintain physical activity (Sjörs et al., 2014).

Physical inactivity is defined as being physical active at moderate intensity for less than 2,5 hours a week (Kiens et al., 2007). The expenses for the Danish society to treat and care for the physical inactive elderly people in 2013 was 3.6 billion kr. (Eriksen et al., 2016), and the percentage of population older than 65-year-old in Denmark has increased with 31 % in the last 10 years, while only 1 % for the population under 65-year-old (Ældre I Tal, 2017). Is it presumable to think that physical inactive elderly people cost the Danish society even more today. Therefore, if the elderly were more engaged in physical activities, it would be beneficial for the society.

Older adults show interest in many challenging activities, if they have had previous experience in the activities such as dancing or swimming, but it needs to be offered to them (Kraft et al., 2015), and since social interaction and enjoyment improves through dance (Guzmán-García et al., 2012), dancing may break down the barriers for physical activity for elderly. Pau et al., 2014 has shown that vigorous physical activity has a positive effect on static and dynamic daily motor tasks, while for static balance light activity show acceptable results for elderly (Pau et al., 2014). And findings suggest that dance, regardless of style, can significantly improve muscular strength, balance, endurance and general fitness of older adults (Hwang & Braun, 2015).

In the Faroe Islands a simple ancient chain dance, where the dancers sing ancient ballads while dancing sideways, is still performed to this day. Some simple ballads are taught in primary school every year, weeks prior to the Shrovetide, a yearly Christian festivity. The dance is often performed at celebrations, such as weddings, festivals etc. and performed sporadically when a big crowd is gathered, like a grind (Wylie, 1993). But the number of events and number of participants has been declining over the last 10 years. Some faroese chain dance clubs are active around the isles, and it is mostly older people that attend the weekly dances and events.

The physical, mental and social effects of the faroese chain dance have never been examined scientifically. Therefore, this study will examine the changes in health, balance and physical function in elderly who attend a 6-week Faroese chain dance program.

I hypothesize that 6-weeks of faroese chain dance will improve balance physical function and health.

# 2. Methods

## 2.1 Subjects

Fifty-nine participants, thirty-six females and twenty-three males volunteered to participate in the study. To be included in the study, the participants had to be 67 years or older, be able to dance for 30 min straight and not demented, as verbally demanded by the ethical committee of Faroe Islands. Given that 45,3 % of older adults have 2 or more chronic conditions it is recommended that adults with chronic conditions should not be excluded (Hwang & Braun, 2015). Participants were excluded if they danced faroese dance once a week or more. Two volunteers were younger than 67year, eight could not dance for 30 min and sixteen had dementia determined by the staff on the nursing homes, these participants were excluded from the study. The study was a randomized controlled trial of a dance-based intervention for older adults. The remaining thirty-three participants were randomly assigned to a control group (CG) or exercise group (EG) stratified for age. Six participants (4 CG and 2 EG) dropped out prior to the pretests, duo to time constraints and travel expenses by participating in dance twice a week for six weeks. One participant from CG got sick and did not complete the posttest and one from CG participated in the dance three times without the recognition of the test supervisor and was then excluded from the study. Therefore, fifteen remained in the EG (six males, nine females), and ten served as a CG (three males, seven females).

All subjects signed a consent form before participation and the procedures were approved by the ethical committee of the Faroe Islands (Appendix 2.1)

## 2.2 Experimental Procedure

The baseline data were collected within a week prior to intervention, and posttests were collected within a week after the intervention by the test manager. Prior to the tests, the test manager provided and explained the information for participants (Appendix 2.2) to the participants before they signed the written informed consent (Appendix 2.3). For the physical tests, the procedures were explained and demonstrated prior to each test.

### 2.2.1 Pilot Test

The Pilot test was conducted prior to the test period. The purpose was to test the equipment along with the protocol to ensure the correct data was measured. It was tested on one 62-year-old male and one 60-year-old woman.

### 2.2.2 Health Screening

The first measurements were the blood pressure and resting heart rate measurements. The cuff of a digital blood pressure monitor (AND, UA-779, Abingdon, United Kingdom) was strapped around the left upper arm 2-3 cm above cubital fossa. The participants were instructed to sit upright without crossing the legs for five minutes. 3 measurements were conducted with a minute of rest in between, and the average was used. Afterwards height, weight, body fat percentage and muscle mass were measured using an Body Composition Analyzer (InBody 270, Seoul, South Korea). The participants were instructed to remove socks and step on the scale with the feet aligned with the foot electrodes while grabbing the handle with the thumb placed on the oval electrodes with the arms straight and away from the body. 4 Participants (3 EG and 1 CG) had pacemakers and could not perform the measurements, because the device sends electrical current through the body, which can tamper with the pacemaker.

### 2.2.3 Balance evaluation

The participants performed 2 balance scales. The first scale, the Berg Balance Scale (BBS) (Appendix 2.4) is developed to measure balance in older people with impairment in balance function. Participants performed the BBS and were scored for each test. The second scale was the Fullerton Advanced Balance Scale (FAB) (Appendix 2.5) which identifies balance deficits in older adults.

### 2.2.4 Mobility, strength and endurance tests

To evaluate mobility and dynamic balance, participants performed the Timed Up & Go (TUG) test, where they were seated, and on the word “go” stood up from the chair, walk 3 m, turned around, walked back again and sat down. They were timed from the word go, until they were seated again.

To evaluate mobility in the lower extremities, participants performed the Short Physical Performance Battery (SPPB) (Appendix 2.6). To evaluate strength in the lower extremities, participants performed a 30 second Sit to Stand test, where they had 30 seconds to complete as many full stands from a fully sitting position as possible.

To evaluate endurance, participants performed a 6 min walk test, where they walk around a room following markers on the floor, as fast and long as they could. The distant was then registered.

## 2.3 Dance Protocol

The EG participated in a six-week intervention period between the pre- and post-test. They gathered at a recreation center in Torshavn to dance twice a week. The first 3 weeks, they danced for 30 min, and the last 3 weeks for 45 min. 2-5 extern dancers controlled the tempo and chose ballads and songs for the dance. The CG were encouraged to continue their normal daily routines.

## 2.4 Statistical analysis

Normality of the distribution for outcome measures was tested using the Shapiro-Wilk test and QQ-Plots. If results are non-normal distributed, Mann Whitney U-test were performed to examine possible between group differences in baseline. Independent samples t-tests were used for the normal distributed results to examine possible between-group differences in baseline scores prior to intervention. Two-way repeated measures ANOVAs were performed to test main effects of time (pre, post) and group (CG, EG) and time-by-group interactions. The significance level was set to p<0.05. Data are reported as means +/- standard deviation (SD). The data were analyzed using Statistical Package of Social Sciences (SPSS) version 25.

# 3.  Results

There were no significant differences in the pretest values between the two groups, as shown in table 1. EG attended 84,4 % of the sessions.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Table 1: Mean of pre- and posttest measurements | EG Pre (n = 15) | EG Post (n=15) | CG Pre (n=10) | EG Post (n=15) | p value sig. (2. tailed) |
| Age, M ± SD (years) | 75,7 ± 5,0 |  | 74,2 ± 3,6 |  | 0,451 |
| Height, M ± SD (cm) | 164,9 ± 9,2 |  | 166,2 ± 7,9 |  | 0,735 |
| Systolic, M ± SD (mmHg) | 132,5 ± 18,2 | 125,7 ± 11.9 | 136,5 ± 21,3 | 135,5 ± 18,8 | 0,617 |
| Diastolic, M ± SD (mmHg) | 72,9 ± 13,6 | 68,9 ± 8,7 | 75,6 ± 130 | 72,2 ± 8,5 | 0,622 |
| Weight, M ± SD (kg) | 79,9 ± 13,2 | 64,0 ± 12,3 | 72,3 ± 12,9 | 67,2 ± 8,7 | 0,677 |
| Resting Heart Rate, M ± SD (bpm) | 65,5 ± 11,7 | 80,1 ± 13,7 | 69,8 ± 8,7 | 72,4 ± 12,3 | 0,337 |
| Muscle mass, M ± SD (kg) | 25,2 ± 4,6 | 25,9 ± 4,6 | 24,9 ± 4,3 | 25,3 ± 4,4 | 0,780 |
| Body fat percentage, M ± SD (%) | 36,3 ± 5,8 | 34,8 ± 5,8 | 34,1 ± 7,0 | 33,6 ± 6,6 | 0,960 |
| BBS, M ± SD (score) | 53,1 ± 2,5 | 54,9 ± 1,4 | 52,3 ± 3,9 | 135,5 ± 18,8 | 0,556 |
| SPPB, M ± SD (score) | 10,5 ± 1,4 | 11,7 ± 0,6 | 10,7 ± 2,5 | 72,2 ± 8,5 | 0,770 |
| FAB, M ± SD (score) | 27,1 ± 4,5 | 30,7 ± 2,8 | 24,2 ± 6,9 | 67,2 ± 8,7 | 0,222 |
| 30 sec Sit to Stand, M ± SD (reps) | 16,4 ± 5,4 | 18,7 ± 6,2 | 15,7 ± 6,9 | 72,4 ± 12,3 | 0,779 |
| 6 min walk, M ± SD (m) | 449,6 ± 63,9 | 466 ± 57,0 | 400 ± 124,9 | 25,3 ± 4,4 | 0,208 |
| TUG, M ± SD (sec) | 6,9 ± 1,2 | 6,32 ± 0,9 | 7,1 ± 2,0 | 33,6 ± 6,6 | 0,702 |

Table 1: Mean and standard deviation for pre- and posttest for EG and CG. Independent samples t test was used to examine possible between-group differences at pretest, shown as p value.

In the analysis of normality, the Shapiro-Wilk test revealed a non-normal distribution for EG in systolic and SPPB, and for CG in, Muscle mass, SPPB, BBS and 6 min walk (Appendix 1.1). The non-parametric test Mann Whitney U showed no difference between the two groups that where non-normal distributed (Appendix 1.13). Two-way repeated measures ANOVA test showed no significant difference between groups (Table 2).

## 3.1 Health Screening

In the two-way repeated measures ANOVA, no significant difference was found in time-by-group interaction (p>0.137) for systolic, diastolic, resting heart rate, weight, muscle mass or body fat percentage. But main effect of time for muscle mass (p=0.014) and body fat percentage (p=0.028) showed a significant difference over time (table 2).

|  |  |  |  |
| --- | --- | --- | --- |
| Table 2: Two-way repeated measures ANOVA | Time (p value) | Group (p value) | Time\*Group (p value) |
| Systolic | 0,151 | 0,801 | 0,246 |
| Diastolic | 0,060 | 0,634 | 0,061 |
| Resting Heart Rate | 0,153 | 0,315 | 0,783 |
| Weight | 0,505 | 0,822 | 0,637 |
| Muscle Mass | 0,014\* | 0,806 | 0,209 |
| Body fat Percentage | 0,028\* | 0,337 | 0,137 |
| BBS | 0,026\* | 0,515 | 0,196 |
| SPPB | 0,005\* | 0,776 | 0,022\* |
| FAB | 0,020\* | 0,262 | 0,031\* |
| 30 sec sit to stand | 0,053 | 0,504 | 0,128 |
| 6 min Walk | 0,339 | 0,730 | 0,960 |
| TUG | 0,015\* | 0,667 | 0,070 |

Table 2: Two-way repeated measures ANOVA was used to test for main effect of time, main effect of group and Time-by-group interaction.

## 3.2 Balance tests

In the two-way repeated measures ANOVA, a significant effect of time was found for both BBS (p=0.026) and FAB (p=0.020) as well as a significant time-by-group interaction for FAB (p=0.031) (table 2).

## 3.3 Mobility, strength and endurance tests

In the two-way repeated measures ANOVA, a significant effect of time was found for TUG (0.015) and SPPB (p=0.005) and time-by-group for SPPB (p=0.022) (table 2).

# 4. Discussion

The study aimed at investigating if there was any improvement in health, balance and physical function in elderly that completed a six-week Faroese chain dance program.

I hypothesized that a structured faroese chain dance session would improve balance in the elderly, because the dance is performed sideways, a movement not normally performed. Both the BBS and FAB showed significant differences in effect of time and the FAB showed significant difference in time-by-group interaction. These findings are consistent with other studies. A study showed that folklore dance 1 hour, three times per week for 8 weeks had a significant effect on BBS (Eyigor et al., 2009). As well as other dances like jazz over 15 weeks, once a week for 90 min showed improved static balance (Wallmann et al., 2009) and a variety of ballroom dances 1 hour twice a week for 12 weeks improved balance (Federici et al., 2005). Of my knowledge FAB is not tested on other dance studies, but a study by Pirouzi et al., 2014, shows significant improvements in both FAB and BBS test for elderly that performed 30 minutes treadmill walking training three times a week for four weeks, 12 sessions (Pirouzi et al., 2014). It had a similar amount of sessions and 15 min less training for 6 sessions compared to my study, but still showed positive results. And both activities are made in walking tempo, so it can be assumed that the results would be similar, as they are.

The results from the health screenings indicate, that there was no difference in time by group in blood pressure, resting heart rate, muscle growth and body fat percentage, but in effect of time, there was a difference in muscle growth and body fat loss after completing a six-week faroese dance program. A study by Kim et al., 2011 where the exercise group completed one-hour Cha-Cha lessons twice a week for 6 months showed no differences in systolic and diastolic blood pressure, waist circumference and BMI between the exercise and control groups. It was discussed that it may be due to the low intensity of the dance exercise or that a large number of the participants were taking medication for hypertension and dyslipidemia (Kim et al., 2011). In another study comprising 3 times per week of 50 min of creative dance from a CD, no significant difference in weight, waist circumference and BMI was shown between EG and CG over a 6 months period (Cruz-Ferreira et al., 2015). The faroese dance was only performed for 6 weeks and people with chronic conditions were not excluded, so it is unknown if participants took antihypertensive drugs which could have an effect on the blood pressure results., This could indicate why there was no significant difference in the time by group results for the health screening. The effect of time results that showed significant differences was muscle mass and body fat percentage. This can indicate that the InBody 270 device measurements were not accurate. Bioelectrical impedance analysis (BIA) devices may underestimate body fat percentage on overweight people (Utter et al., 2005). And with the InBody having a bias of -2.53 % and a 95 % limit of agreement from -10.02 – 4.96 in compare with air displacement plethysmography testing (Montgomery et al., 2017). as well as the BIA overestimate muscle mass when overhydrated and underestimate body fat percentage (Panorchan et al., 2015). The difference in body fat percentage from pre- and posttest in this study are under -2.53 %, Therefore, the muscle mass and body fat percentage results may be biased.

The results from time by group showed a significant difference in SPPB, and in effect of time a significant difference for TUG and SPPB. Hui et al., 2009 showed a significant difference between EG and CG for the TUG test over a 12-week dance intervention, first two 50-min sessions per week for 6 weeks, follow by two 60-min sessions per week for 6 weeks. (Hui et al., 2009). This could implement, that if the faroese chain dance training had continued for 6 more weeks, it might have shown an effect on time by group for TUG. Of my knowledge no dance study has tested SPPB, so to discuss the SPPB results, I’ll compare to other studies on elderly that include SPPB. It is shown that both resistance and aerobic exercise training for older adults influenced SPPB over a 5 months 3-4 times a week (Chmelo et al., 2015). Tai chi performed by older adults 1 hour, twice a week for 12 weeks, also showed a significant improvement in SPPB score (Manor et al., 2014). These studies imply, that it takes longer to see an improvement in SPPB, but it can be, that if they tested after 6 weeks, they would have seen similar results to the findings of this study.

The faroese chain dance has a positive effect on the balance and physical function for elderly after 6 weeks of dancing, twice a week for 30-45 min. It is a dance, that everyone that is capable of walking, can perform. Therefore, it is recommendable to the elderly population in the Faroe Islands to enjoy this activity on a regular basis, to improve or maintain balance and physical function. There are some dance societies in the Faroes that assemble on a weekly basis, and they are open for new members, since there are no limits to the number of participants in the chain-dance. Folkloric dancing has a positive influence on quality of life after eight weeks (Eyigor et al., 2009), so it could be implied that the Faroese chain dance has the same effect, but no studies have been performed, yet.

# 5. Conclusion

In the present study, we achieved improvements in balance and physical function on the elderly population in the Faroe Islands through a 6 weeks Faroese chain dance program. Hopefully, future studies will confirm the findings in the present and investigate other health benefits of the Faroese chain dance

# 6. References

1. Belza B, Walwick J, Schwartz S, LoGerfo J, Shiu-Thornton S, Taylor M. Older Adult Perspectives on Physical Activity and Exercise: Voices From Multiple Cultures. Prev Chronic Dis. 2004;1;4
2. Chmelo EA, Crotts CI, Newman JC, Brinkley TE, Lyles MF, Leng X, Marsh AP, Nicklas BJ. Heterogeneity of Physical Function Responses to Exercise Training in Older. Journal of the American Geriatrics Society. 2015;63;3:462-469.
3. Christensen AI, Davidsen M, Ekholm O, Pedersen PV, Juel K. Danskernes Sundhed – Den Nationale Sundhedsprofil 2013. Statens Institut for Folkesundhed, Syddansk Universitet for Sundhedsstyrelsen. 2014.
4. Cruz-Ferreira A, Marmeleira J, Formigo A, Gomes D, Fernandes J. Creative Dance Improves Physical Fitness and Life Satisfaction in Older Women. Sage Journals. 2016;37;8:837-855.
5. Cunha MP, Oliveira Á, Pazini FL, Machado DG, Bettio LE, Budni J, Aguiar AS, Martins DF, Santos AR, Rodrigues AL. The Antidepressant-like Effect of Physical Activity on a Voluntary Running Wheel. Medicine & Science in Sports & Exercise. 2013;45;5:851–859.
6. Davey RC, Cochrane T. Association of physical inactivity with circulatory disease events and hospital treatment costs. Clin Epidemiol. 2013;5:111-118.
7. Eriksen L, Davidsen M, Rosendahl Jensen HA, Thorning Ryd J, Strøbæk L, White ED, Sørensen J, Juel K. Sygdomsbyrden i Danmark – risikofaktorer. Statens Institut for Folkesundhed, Syddansk Universitet for Sundhedsstyrelsen. 2016.
8. Eyigor S, Karapolat H, Durmaz B, Ibisoglu U, Cakir S. A randomized controlled trial of Turkish folklore dance on the physical performance, balance, depression and quality of life in older women. Arch Gerontol Geriatr Suppl. 2009;48:84-88.
9. Federici A, Bellagamba S, Rocchi MBL. Does dance-based training improve balance in adult and young old subjects? A pilot randomized controlled trial. Aging Clinical and Experimental Research. 2005;17;5:385-389.
10. Fiatarone MA, Evans WJ. Exercise in the oldest old. Top Geriatr Rehabil. 1990;5:63-77.
11. Guzmán-García A, Hughes JC, James IA, Rochester L. Dancing as a psychosocial intervention in care homes: a systematic review of the literature. Geriatric Psychiatry. 2013;28;9:914-924.
12. Hui E, Chui, B.T., Woo, J. Effects of dance in physical and psychological well being in older persons. Arch Gerontol Geriatr. 2008;49:45-50.
13. Hwang PW, Braun KL. The Effectiveness of Dance Interventions to Improve Older Adults' Health: A Systematic Literature Review. 2015;21;5:63-70.
14. Ip EH, Church T, Marshall SA, Zhang Q, Marsh AP, Guralnik J, King AC, Rejeski JW. Physical Activity Increases Gains in and Prevents Loss of Physical Function: Results From the Lifestyle Interventions and Independence for Elders Pilot Study. 2013;68;4:426-432.
15. Kiens B, Beyer N, Brage S, Hyldstrup L, Ottesen LS, Overgaard K, Klarlund Pedersen B, Puggaard L. Fysisk inaktivitet– konsekvenser og sammenhænge. Motions- og Ernæringsrådet. 2007.
16. Kim SH, Kim M, Ahn YB, et al. Effect of dance exercise on cognitive function in elderly patients with metabolic syndrome: A pilot study. J Sport Sci Med. 2011;10:671-678.
17. Kohl HW, Craig CL, Lambert EV, et al. The pandemic of physical inactivity: global action for public health. The Lancet. 2012;380:294-305.
18. Kraft KP, Steel KA, Macmillan F, Olson R, Merom D. Why few older adults participate in complex motor skills: a qualitative study of older adults’ perceptions of difficulty and challenge BMC Public Health. 2015;15:1186.
19. Lee IM, Shiroma EJ, Lobela F, Puska P, Blair SN, Katzmarzyk PT. Effect of physical inactivity on major non-communicable diseases worldwide: an analysis of burden of disease and life expectancy. Lancet. 2012;380:219-229.
20. Lenardt MH, SousaJR, Carneiro NHK, Betiolli SE, Melo Neu Ribeiro DK. Physical activity of older adults and factors associated with pre-frailty. Acta paul. Enferm. 2013;26;3
21. Leroux JS, Moore S, Richard L, Gauvin L. Physical inactivity mediates the association between the perceived exercising behavior of social network members and obesity: a cross-sectional study. PLoS One. 2012;7;10:1-6.
22. Manor B, Lough M, Gagnon MM, Cupples A, Wayne PM, Lipsitz LA. Functional Benefits of Tai Chi Training in Senior Housing Facilities. Journal of the American Geriatrics Society. 2014;63;8:1484-1489.
23. Montgomery MM, Marttinen RH, Galpin AJ. Comparison of Body Fat Results from 4 Bioelectrical Impedance Analysis Devices vs. Air Displacement Plethysmography in American Adolescent Wrestlers. International Journal of Kinesiology & Sports Science. 2017;5;4:18-25.
24. Panorchan K, Nongnuch A, El-Kateb S, Goodlad C, Davenport A. Changes in muscle and fat mass with haemodialysis detected by multi-frequency bioelectrical impedance analysis. European Journal of Clinical Nutrition. 2015;69:1109-1112.
25. Pau M, Leban B, Collu G, Migliaccio GM. Effect of light and vigorous physical activity on balance and gait of older adults. Archives of Gerontology and Geriatrics. 2014;59;3:568-573.
26. Pirouzi S, Motealleh AR, Fallahzadeh F, Fallahzadeh MA. Effectiveness of Treadmill Training on Balance Control in Elderly People: A Randomized Controlled Clinical Trial. Iranian Journal of Medical Sciences. 2014;39;6:565-570.
27. Siasos G, Chrysohoou C, Oikonomou E, Tousoulis D, Zaromitidou M, Gialafos E, Zisimos K, Marinos G, Kioufis S, Miliou A, Papageorgiou N, Papavassiliou AG, Pitsavos C, Stefanadis C. Beneficial effect of physical activity on enothelial function in middle-aged and elderly habitants in an area with increased rates of longevity: Ikaria study. Journal of the American College of Cardiology. 2012;59;13:e1540.
28. Sjörs C, Bonn SE, Lagerros YT, Sjölander A, Bälter K. Perceived Reasons, Incentives, and Barriers to Physical Activity in Swedish Elderly Men. Interactive Journal of Medical Research. 2014;3;4:e15.
29. Townsend N, Wickramasinghe K, Williams J, Bhatnagar P, Rayner M. Physical Activity Statistics 2015. British Heart Foundation: London. 2015.
30. Utter AC, Nieman DC, Mulford GJ, Tobin R, Schumm S, McInnis T, Monk JR. Evaluation of leg-to-leg BIA in assessing body composition of high-school wrestlers. Med sci Sports Exerc. 2005;37;8:1395-1400.
31. Van Sluijs EMF, Van Poppel MNM, Twisk JWR, Brug J, Van Mechelen W. The positive effect on determinants of physical activity of a tailored, general practice-based physical activity intervention. Health Education Research. 2004;20;3:345-356.
32. Wallmann HW, Gillis, C.B., Alpert, P.T., Miller, S.K. The effect of a senior jazz dance class on static balance in healthy women over 50 years of age: a pilot study. Biol Res Nurs. 2008; 10; 3:257-266.
33. Williams PT. Attenuating Effect of Vigorous Physical Activity on the Risk for Inherited Obesity: A Study of 47,691 Runners. PLoS ONE 7;2: e31436.
34. Wylie J. Too Much of a Good Thing: Crises of Glut in the Faroe Islands and Dominica. Comparative Studies in Society and History. 1993;35;2:352-389.

Zhao G, Ford ES, Li C, Balluz LS. Physical activity in U.S. older adults with diabetes mellitus: prevalence and correlates of meeting physical activity recommendations. J Am Geriatr Soc. 2011;59;1:132-137.

1. Ældre I Tal: Antal Ældre. 2017