Full-Length Research Report

Effects of a Group Program to Increase Cognitive Performance Through Cognitively Stimulating Leisure Activities in Healthy Older Subjects

The AKTIVA Study

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Abstract. To investigate the effects of leisure activities on cognitive performance of healthy older subjects, an innovative intervention program was developed. Frequent participation in cognitively stimulating activities (i.e., reading, playing chess, or playing music) is associated with reduced risk of dementia. AKTIVA (active cognitive stimulation – prevention in the elderly) is an intervention program designed to enhance cognitive stimulation in everyday life by increasing cognitive stimulating leisure activities. The present study determines the effects of AKTIVA on cognitive function, mood and attitude toward aging in a sample of older participants from the general population. Several measurement instruments were used including the Alzheimer's Disease Assessment Scale (ADAS-Cog), the Trail-Making Test (TMT), and the Memory Complaint Questionnaire (MAC-Q). Initially, the sample consisted of 307 older persons (170 female, 72 ± 7 years). The intervention was evaluated with a randomized, controlled pre-post follow-up design. Participants were randomly assigned to one of three conditions: AKTIVA intervention ($n = 126$), AKTIVA intervention plus nutrition and exercise counseling ($n = 84$), no-intervention control group ($n = 97$). The AKTIVA intervention consisted of 8 weekly sessions and two booster sessions after a break of 4 months. Participation in the group program resulted in positive effects on cognitive function and attitude toward aging for subassembly groups. Older persons (≥ 75 years) showed enhanced speed of information processing (by TMT Version A) ($F = 4.17^*$, $p < .05$); younger participants (< 75 years) showed an improvement in subjective memory decline (by MAC-Q) ($F = 2.55^*$, $p < .05$). Additionally, AKTIVA enhanced the frequency of activities for leisure activities for subassembly groups. The results of this study suggest that the AKTIVA program can be used to increase cognitively stimulating leisure activities in the elderly. Further research is necessary to identify the long-term effects of this intervention particularly with respect to the prevention of dementia.

Keywords: prevention, dementia, intervention study, leisure activities, training program

Because of demographic changes that will increase the older population, there is an urgent search on for interventions to prevent or delay the most common age-related disorder of dementia. In particular, the current lack of any treatment to actually heal dementia shows the importance of prevention of this terminal disease. Aside from the treatment of established risk factors (e.g., hypertension, hypercholesterolemia, obesity, diabetes mellitus) (Kivipelto et al., 2001, 2006), observational studies suggest cognitive activity (Willis et al., 2006; Wilson, Scherr, Schneider, Tang & Bennett, 2007), physical activity (Lautenschlager et al., 2008), social integration (Fratiglioni, Paillard-Borg, & Winblad, 2004; Wilson, Krueger et al., 2007), and a Mediterranean diet (Scarmeas, Luchsinger, Mayeux, & Stern, 2007) as potential preventive strategies.

It is assumed that cognitive training programs lead to enhanced cognitive performance and may even slow the progression or delay the onset of cognitive decline and dementia (Ball et al., 2002; Buschert, Bokde, & Hampel, 2010; Valenzuela & Sachdev, 2009; Willis et al., 2006).

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Willis et al. (2006) presented evidence that cognitive interventions can be implemented in various training studies specifically to improve cognitive abilities of older adults. These cognitive interventions focus on enhancing the "cognitive reserve capacity" in the older population, which has been described as a hypothetical construct widely used to explain how individuals vary in the severity of their cognitive decline when neurodegenerative changes have occurred (Stern, 2002; Whalley, Deary, Appleton, & Starr, 2004). The cognitive reserve model suggests that the brain actively attempts to cope with brain damage by using reserve capacity, i.e., preexisting cognitive processing approaches. Compared to the model of the brain reserve, which describes brain size or neuronal count, it is possible to influence the cognitive reserve by several factors (Lindenberger & Baltes, 1994; Stern, 2006). Cognitive activity, intelligence, education, occupational achievements, degree of literacy, participation in leisure activities, and social interaction have all been shown to increase cognitive stimulation and to enhance cognitive reserve. Because cognitive reserve is not fixed, there are opportunities for modification and enhancement in old age, too (Stern, 2006). Structured cognitive training in the elderly has also been shown to enhance cognitive reserve. Such training focuses on concentration, attention, or memory as well as the ability to solve problems that follow a pattern or learning strategies (Buschert, Bokde, & Hampel, 2010).

Unfortunately, most cognitive training geared toward cognitive improvement is limited by previously acquired skills. There is no evidence showing that these trainings have a general effect on everyday cognitive abilities nor that these cognitive interventions delay or slow the progression of dementia (Owen et al., 2010; Papp, Walsh, & Snyder, 2009). Beyond that, cognitive training has been given in guided practice sessions that were different from the participant's daily routine. The patients trained in artificial situations to increase performance in specific tasks, i.e., strategies for memory, problem solving or attention, and it could be supposed that participants cannot transfer these strategies to everyday life. Cognitive training was not integrated in the daily routine, so that participants tend to terminate training when the intervention is over, and the effects of training disappear.

Because of these limitations of transfer, of sustainability, and of suitability for daily use, regular participation in cognitive-stimulating leisure activities could constitute a promising alternative to a standardized cognitive training of specific cognitive tasks. In general, an active lifestyle with a high frequency of cognitively stimulating activities has proved to best protect the brain from cognitive decline and to prevent dementia. Accordingly, participation in specific cognitive training programs is not the only intervention path with potential preventive effects. Cognitively stimulating leisure activities should be part of everyday life and are more likely to be performed if on a regular or routine basis. Several prospective observational studies observed reduced cognitive decline in older persons with more frequent participation in cognitively stimulating leisure activities like reading, drawing, playing chess or bridge, playing music, or visiting a museum during midlife (Scarmeas, Levy, Tang, Many, & Stern, 2001; Wilson, Bennett et al., 2002, Wilson, Scherr et al., 2007). Participation in these cognitively stimulating activities as well as participation in productive activities like gardening, cooking, and knitting seems to be a potentially good strategy for influencing the cognitive reserve and preventing cognitive decline. In observational studies, the performance of these activities was correlated with reduced risk of incident dementia (Verghese et al., 2003, 2006; Wilson, Scherr et al., 2007). Activities like watching TV or crossword puzzles are routine tasks and not appropriate cognitively stimulating activities (Lindstrom et al., 2005; Verghese et al., 2006). Especially watching TV is a nonintellectually stimulating activity and is associated with increased risk of cognitive decline (Lindstrom et al., 2005). Physical activity and a Mediterranean diet are also associated with a reduced risk of cognitive decline. The intervention study from Lautenschlager et al. (2008) demonstrated that exercise improves cognitive function in older people with subjective and objective memory decline, and Larson et al. (2006) found a reduced incidence rate of dementia for healthy older persons who regularly exercise. Also, proper nutrition with a high consumption of fish, vegetables, legumes, fruits, cereals, unsaturated fatty acids, and a low consumption of dairy products is associated with a reduced risk of cognitive decline (Scarmeas et al., 2007).

AKTIVA (**A**ktive **K**ognitive S**ti**mulation – **V**orbeugung im **A**lter, active cognitive stimulation – prevention in the elderly) is probably the first intervention program for healthy older people based on the concept of cognitive activation through cognitively stimulating leisure activities. According to Buschert, Bokde, and Hampel (2010), cognitive stimulation means engaging in a range of activities aimed at enhancing generally cognitive and social functioning in a nonspecific manner. Given that participation in these cognitively stimulating leisure activities might enhance cognitive functioning and reduce the risk of developing dementia in the long term by enhancing cognitive reserve, this study has three main hypotheses. The first hypothesis assumes that participants of the intervention training program would improve their frequency of leisure activities involving cognitive stimulation. The second hypothesis was that this improvement of leisure activities additionally improves the outcome measures of cognitive functioning, mood, and attitude toward aging. The third hypothesis assumes that participants in the intervention training program who received additional physical exercise training and nutrition counseling would show more improvement in the frequency of leisure activities as well as cognitive functioning, mood, and attitude as compared to participants who received no additional intervention.

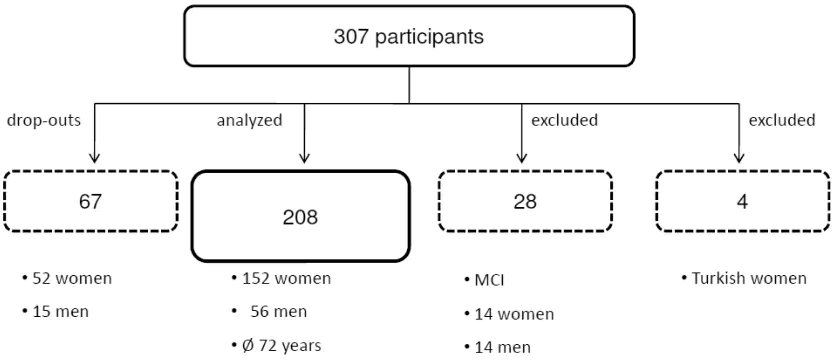

Figure 1. Sample size, dropouts, and excluded participants.

Method

Inclusion Criteria

Participants older than 65 years were included if there was no previous diagnosis of dementia or mild cognitive impairment (MCI). Because of the increased demand, younger participants from 50 years on were allowed to take part in the intervention program, too.

Participants

A total of 307 older persons (222 female) with a median age of 72 years (*SD* = 7 years), living in Frankfurt/Main and Darmstadt, Germany, initially participated in this study. Most individuals (292) were of German ethnicity, and 15 were of Turkish ethnicity. Participants volunteered from senior social clubs, community centers, and print advertisements during Spring of 2008. Altogether 236 German participants and 4 Turkish participants completed both follow-up-tests. A total of 67 participants eventually withdrew from the study, the motives being various somatic disorders that inhibited participation (e.g., immobility), lack of time or interest to participate in the program, and one participant died. The data of the Turkish participants were excluded because the Turkish sample was too small to examine ethnic differences. In order to properly examine ethnic differences, an additional study should be implemented with more Turkish participants. The data from 28 other participants were also excluded and their data could not be used because these participants were found to likely suffer from MCI. These participants had impaired cognition and/or a clinical dementia rating (CDR) score of 1–0.5 at least two measurement points. Impaired cognition was defined as a score of < 27 on the Mini-Mental Status Test (MMST) and/or score of > 10 in the Alzheimer's Disease Assessment Scale, Cognitive Part (ADAS-Cog). People who had a score of > 0 in the CDR at just one point in time and unimpaired cognitive test scores at all other times were not defined as MCI cases and were included in the data sample: A diagnosis of MCI requires a stable pattern of cognitive impairment. So the analyzed sample consisted of a total 208 healthy older people of German ethnicity (152 female) with a median age of 71 years (*SD* = 6 years) (Figure 1).

Design

This study on the effects of the AKTIVA program was a randomized controlled training study, using a 3-group design – two intervention groups and a control group. Participants were randomly assigned to either an intervention group or the control group. Participants from both intervention groups received training in the AKTIVA program. Intervention Group 2 received additional nutritional education and physical exercise program to determine whether the combination of AKTIVA training along with nutritional and exercise counseling was more effective on outcome measures than the AKTIVA program alone. Participants in the second intervention group were required to receive a physical checkup and to take introductory courses in several sports and physical activities (e.g., gymnastics, walking, yoga) as well as a nutrition workshop, and to maintain a movement diary. The control group did not receive any

Table 1. Flowchart of the AKTIVA intervention program

	Weeks					
Group	1	4–11	12	13–29	30–31	32
IG_1 (*n* = 74, 54 women)	pretest	sessions 1–8	posttest	break	sessions 9–10	follow-up-test
IG_2 (*n* = 56, 45 women)	pretest	sessions 1–8 + guidance (sports & nutrition)	posttest	break	sessions 9–10	follow-up-test
CG (*n* = 78, 53 women)	pretest		posttest			follow-up-test + booklet

Note. IG_1 = intervention Group 1; IG_2 = intervention Group 2; CG = control group.

intervention other than a booklet pertaining to the training topics at the end of the intervention. The booklet was a way to pass on the benefits of the AKTIVA program to the control participants.

Table 1 presents the flowchart for the AKTIVA study. After all participants had been pretested with the complete test battery to determine a baseline in the outcome variables, the intervention groups received a total of eight training sessions. All participants were posttested after the last intervention session. Participants in the intervention groups did not receive intervention treatment from the 13th to the 29th week, and intervention treatment concluded with two booster sessions during weeks 30 and 31. All participants received follow-up testing during the 32nd and final week of the study. The participants in the control group received informational booklets after the intervention for the two intervention groups had been concluded.

Table 2. Description of the training modules in AKTIVA sessions

Module	Sessions	Content
Education & theory	1 + 2	• information about cognitive decline, dementia, risk factors and prevention strategies
		• concept of self-monitoring and implementation of the activity protocols
Resources & conditions	3–5	• information about the SMART principle to set goals, motivation and self-motivation
		• knowledge about cognitively stimulating activities
Memory & self-awareness	6–8	• information about cognitive change in the elderly, possibilities in old age and memory strategies
		• feedback about their activity-level
Refreshment	9 + 10	• exchange of experiences
		• clarify prospective goals

Note. SMART = **S**pecific, **M**easurable, **A**ttractive, **R**ealistic, **T**imely.

Procedure

Description of the Intervention

The AKTIVA training program was described in a standardized manual designed to increase cognitive stimulation in everyday life and leisure time. In groups of 10–12 individuals, participants were informed about dementia, risk factors, and individual prevention strategies over the duration of eight weekly sessions. After educating participants about the above, we gave information to participants pertaining to age-related changes (i.e., cognitive decline, loss of sensory abilities, experience of life, freetime in retirement), coping strategies to combat the effects of aging, and goal development for a healthy, active, and dementia-preventing lifestyle. Additional information about the importance and principles of motivation, self-motivation, and self-awareness was part of the intervention sessions. Games and exercises, such as role-plays, coaching cards, or a work-of-art game enriched the theoretical modules provided in the treatment interventions. During and after the intervention, the execution of training topics and imparted knowledge was the individual responsibility of each participant. The participants were systematically instructed and motivated to perform more cognitively stimulating activities like reading, playing games, or playing music as part of their daily routines. They were informed about the positive effects of these activities and the presumed association between an active lifestyle and prevention of cognitive decline. After analyzing the lifestyle of the participants, we discussed capabilities and capacities to enhance cognitively stimulating activities as well as individual motivational strategies for implementing them. Rigid guidelines for the prescription of activities were avoided in order not to constrain the participants. Participants were expected to voluntarily change their behavior and independently increase the frequency of leisure activities involving cognitive stimulation. During two booster sessions, after having received no intervention treatment for 16 weeks, the participants were given the opportunity to discuss their progress toward previously identified goals as well as their ideas regarding how a successful active lifestyle is achieved. Table 2 describes the content of the training modules in the AKTIVA program. The additional exercise training and nutrition counseling for the second intervention group consists of the opportunity to participate in different exercises like walking, yoga, and gymnastics as well as nutrition sessions to inform them about healthy eating (for more details, see Thiel et al., 2011). This additional treatment was implemented to examine whether a combination of cognitive stimulation with exercise and nutrition counseling is more effective than just participation in the cognitive stimulation part.

The theoretical basis of the intervention program was, among other things, the concepts of cognitive reserve, lifelong-learning, and the interest of older people in education as well as self-monitoring. As described above, cognitive reserve is the hypothetical, modifiable capacity of the brain to cope with brain damage by using preexisting cognitive processes or by enlisting compensatory processes (Stern, 2002, 2009). Cognitively-stimulating leisure activities, like those imparted by the AKTIVA program, are supposed to enhance these reserve capacity. Lifelong learning means that learning is not confined to childhood, but rather takes place throughout life. Older people are able to learn in the old age, too; there are only other regularities (see Lehr, 2007). Older people are also interested in education: They consider education as a preparation for the challenges of the age or for discovering the sense of life (Sommer, Künemund, & Kohli, 2004). Both skills and attributes allow the implementation of intervention programs like AKTIVA. Self-monitoring refers to the act of recording or rating

Table 3. Baseline characteristics

	Intervention Group 1 *n* = 74	Intervention Group 2 *n* = 56	Control group *n* = 78
age, mean (*SD*)	72.14 (6.56)	71.25 (6.38)	70.78 (5.24)
women, No. (%)	54 (73%)	45 (80.4%)	53 (67.9%)
years of education, mean (*SD*)	10.59 (1.92)	10.42 (1.91)	10.33 (1.63)
Academic education, No. (%)	18 (24.4%)	9 (16.1%)	15 (19.2%)
MMST, mean (*SD*)	28.43 (1.06)	28.16 (1.44)	28.45 (1.15)
ADAS-Cog, mean (*SD*)	7.30 (2.88)	7.30 (2.61)	6.85 (2.51)
TMT A, mean (*SD*)	47.22 (21.57)	41.21 (15.10)	38.26 (10.11)
TMT B, mean (*SD*)	104.92 (49.59)	104.27 (41.33)	90.21 (32.65)
CDR, mean (*SD*)	.03 (.13)	.04 (.13)	.03 (.11)
SDS, mean (*SD*)	34.82 (7.69)	36.25 (7.48)	33.58 (8.02)
NSL, mean (*SD*)	41.41 (11.43)	42.73 (11.29	39.98 (12.75)
MAC-Q, mean (*SD*)	24.89 (4.04)	25.68 (4.35)	25.48 (5.05)
PGCMS, mean (*SD*)	11.97 (4.20)	11.57 (3.85	12.77 (3.79)
LBZ, mean (*SD*)	27.63 (3.95)	26.96 (4.18	27.42 (4.27)

Note. Intervention Group 1: AKTIVA training; intervention Group 2: AKTIVA training plus nutrition and sport guidance; MMST = Mini-Mental-Status Test; ADAS-Cog = Alzheimer's Disease Assessment Scale cognitive subscale; TMT A = Trail-Making Test Part A; TMT B = Trail-Making Test Part B; CDR = Clinical Dementia Rating; SDS = Self-Rating Depression Scale; NSL = Nuremberg Self-Rating List (Nürnberger Selbsteinschätzungsliste); MAC-Q = Memory Complaint Questionnaire; PGCMS = Philadelphia Geriatric Center Morale Scale; LBZ = Quality-of-Life Scale (Skala zur Erfassung der Lebenszufriedenheit).

one's own behavior and results in behavior change (Webber, Scheuermann, McCall, & Coleman, 1993). The participants had to complete weekly activity protocols with the intention of enhancing the frequency of cognitively stimulating activities during the intervention program.

Outcome Measures

Frequency of cognitively stimulating activities, cognitive outcomes and the assessment of mood, subjective memory decline, and attitude to old age were used to assess treatment effects. Primary outcome is frequency of cognitively stimulating activities; secondary outcomes were cognition mood, subjective memory decline, and aspects of attitude. The psychometric tests were used as pre-, post-, and follow-up tests. Cognition was measured with Mini-Mental Status Test (MMST, Folstein, Folstein, & McHugh, 1975), the cognitive part of the Alzheimer's Disease Assessment Scale (ADAS-Cog; Rosen, Mohs, & Davis, 1984), part A and B of the Trail-Making Test (TMT, Reitan, 1956), and the Clinical Dementia Rating (CDR, Morris, 1993). Although the Alzheimer's Disease Assessment Scale is an instrument for measuring the severity of Alzheimer's disease, its subscale ADAS-Cog was used because of the availability of multiple parallel forms. Self-report questionnaires like the Self-Rating Depression Scale (SDS, Zung, 1965), the Memory Complaint Questionnaire (MAC-Q, Crook, Feher, & Larrabee, 1992), the Nuremberg Self-Rating List (Nürnberger Selbsteinschätzungsliste, NSL, Oswald & Fleischmann, 1991), the Philadelphia Geriatric Center Morale Scale (PGCMS, Lawton, 1975), and Quality of Life Scale (Skala zur Lebenszufriedenheit, LBZ, Oswald & Fleischmann, 1991) completed the test battery.

In order to measure the frequency of cognitively stimulating activities during the intervention training program, we asked the participants in the intervention groups to complete weekly activity protocols, a nine-item questionnaire created based on items reported in the retrospective studies of Wilson, Bennett et al. (2002), Wilson, Scherr et al. (2007), and Scarmeas et al. (2001). Participants scored the frequency of their participation in leisure activities like reading, playing games, doing sports, or meeting with friends on a six-point Likert scale. Table 3 illustrates the baseline characteristics of the two intervention groups and the control group after the battery of pretests.

73% of the participants were women and all participants were on average in their early 70s. Most participants had attended school for about 10 years, and only a few participants had completed an academic university education. Pretest scores as measured by the cognitive tests and the several questionnaires did not result in scores in a range indicating pathological cognitive decline (MMST, ADAS-Cog, TMT A/B, and CDR), depression (SDS), or age-related decline of vitality, cognition, and social interaction (NSL). The participants expressed minor complaints about age-related memory declines (MAC-Q), a positive attitude regarding the elderly (PGCMS), and a high quality of life (LBZ).

Analysis of Data

In order to evaluate the effects of the AKTIVA training, we used an ANOVA with repeated measures. Data from 208 participants were analyzed for cognitive variables. For the analysis of the questionnaires, the data were used only for participants who had no more than the number of missing items acceptable for each psychometric test (i.e., 4 missing items are allowed on the SDS and NSL, 3 missing items are allowed on the PGCMS, 1 missing item is allowed on the MAC-Q and LBZ). For these questionnaires missing items were imputed by mean scores. Data of questionnaires that topped this limit were eliminated. There were no significant pretest differences in cognition, mood, and attitude toward aging across the three groups.

First, the sample was analyzed as a whole, and in a second step the analysis was repeated for subassembly groups. For this purpose, the sample was divided into subgroups by age. In gerontological research, persons from 60–75 years are described as young-old and persons from 75 years as old-old (a. o. Schäuble, 1995). We use these designations.

Data from the weekly activity protocols of the intervention groups were analyzed with a trend analysis. Only the data of participants who completed all nine weekly activity protocols (protocols of intervention sessions 2–10) were included in the trend analysis ($N = 87$). The activity items were first standardized and then aggregated, and only the protocols of intervention sessions 2–8 were included in the analysis, which examined whether the observed activity variables followed a statistical linear trend.

Results

There were no overall significant intervention effects in this study; further, the combination of AKTIVA and nutrition and exercise counseling (intervention Group 2) was not more effective than the AKTIVA program alone (intervention Group 1). With respect to the age classification, three-factor ANOVAs (Time × Group × Age) revealed significant effects for information processing, measured by part A of the Trail-Making Test ($F(4, 404) = 4.37^{**}$, $p < .01$) and for age-related memory declines, measured by the MAC-Q ($F(4, 388) = 3.03^{**}$, $p < .01$). Further analysis showed significant variances between participant age groups. Old-old participants (≥ 75 years, $N = 51$) showed enhanced speed of information processing as measured by the TMT A ($F(4, 96) = 4.17^{*}$, $p < .05$) (Figure 2). Participants from the first intervention group showed significant improvement in processing speed compared to those in the second intervention group and those in the control group. Young-old participants (< 75 years, $N = 150$) showed an improvement in subjective memory decline as measured by the MAC-Q ($F(4, 294) = 2.55^{*}$, $p < .05$) (Figure 3). Both intervention groups showed significant improvements in subjective memory decline compared to the control group.

Because of the different patterns of behavior during leisure time within different gender- and age-related subgroups (a. o. Kade, 1994; Künemund, 2006; Opaschowski & Reinhardt, 2007), the data of the activity protocols were analyzed for subgroups divided by age and gender. The division by intervention group was made because of the additional program in the second intervention group. The analyses of the weekly activity protocols for participants in the intervention groups showed significant outcomes during the intervention program for weeks 2–8. This analysis verifies whether the observed data, the scores of the activity protocols, approach a statistical linear trend. These results were found for subgroups divided by age and gender (i.e., old-old men ≥ 75 years), by age and intervention group (e.g., young-old participants < 75 years in intervention Group 1), and by age, gender, and intervention group (e.g., old-old-women ≥ 75 years in intervention Group 2).

Male participants in the old-old subgroup (i.e., men ≥ 75 years old) showed an increased frequency for several activities (Table 4).

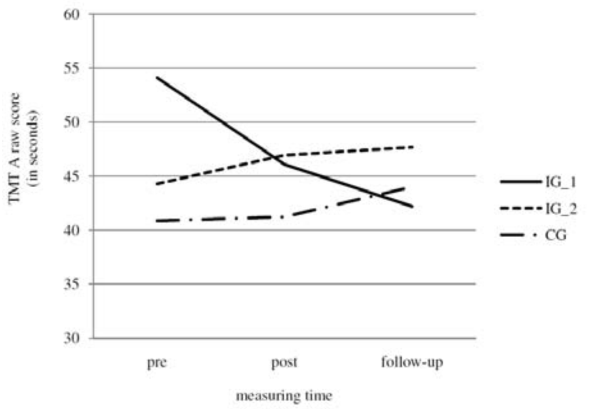

Figure 2. Training effects on speed of information processing, measured by Trail-Making Test A (TMT A) for old-old participants (≥ 75 years).

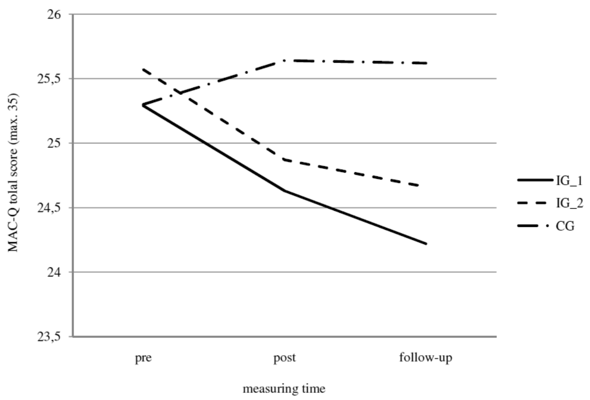

Figure 3. Training effects on the assessment of subjective memory decline, measured by Memory Complaint Questionnaire (MAC-Q) for young-old participants (< 75 years).

Table 4. Results of the trend analysis

Subsample	Dependent variable	B_{const}	B_{int}	$p_{(Bint)}$
Men ≥ 75 years	Social interaction	–1.35	0.28	< .01
Men ≥ 75 years	Reading	–1.32	0.25	= 0.01
Men ≥ 75 years	Take a walk	–1.24	0.22	< .01

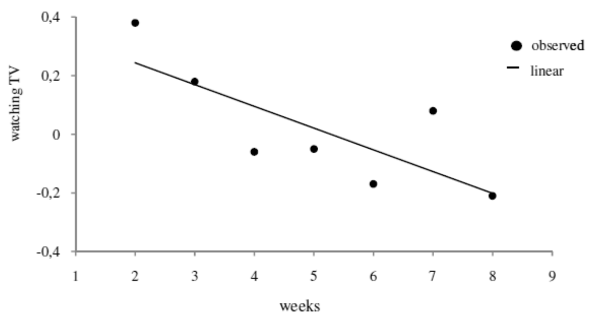

Figure 4. Trend analysis of the activity-variable "watching TV" for young-old participants (< 75 years) in intervention Group 1.

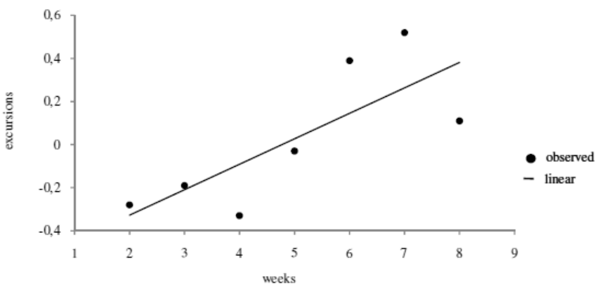

Figure 5. Trend analysis of the activity-variable "excursions" for old-old women (≥ 75 years) in intervention Group 2.

Young-old participants (i.e., participants < 75 years old) in intervention Group 1 demonstrated a significant reduction in the frequency of watching television (B_{const} = 0.39; B_{int} = –0.07*; $p(B_{int})$ < .05) (Figure 4); and old-old women (i.e., women ≥ 75 years old) in intervention Group 2 showed increased frequency in the "excursions" activity (B_{const} = –0.57; B_{int} = 0.12*; $p(B_{int})$ < .05) (Figure 5).

Participation in the AKTIVA-study showed significant intervention effects for certain subgroups. Old-old persons (≥ 75 years) were characterized by an enhancement of the cognitive function speed of information processing; older men increased participation in leisure activities like reading, social interactions, and taking a walk, and older women of the intervention Group 2 increased participation in the leisure activity doing an excursion during intervention time. Younger persons (< 75 years) improved the rating of their subjective memory decline and younger participants from the first intervention group reduced the frequency of watching television during intervention time.

Discussion

The AKTIVA study is the first randomized and controlled study of the effects of a group training program to increase the frequency of cognitively stimulating leisure activities. The main hypothesis of this research was that participation in AKTIVA increases cognitively stimulating leisure activities, which in turn improves cognitive function in older persons.

Findings of this study showed that the AKTIVA training program significantly affected cognitive functioning for certain subgroups in this study. Another result was a significant training benefit in the measurement of subjective memory decline for young-old participants. The participants improved the assessment of their memory functions. In order to explain this effect, we may assume that contact with their group peers in the interventions sessions they realized that their own cognitive performances were appropriate to their age, and that they did not need to worry about it. This positive change in the assessment of subjective memory decline could be supposed to influence emotions associated with cognitive functions. People with memory complaints often suffer from anxiety, shame, and depressions, especially in the early phase of their cognitive decline, and depression plays an important role as a risk factor for dementia (a. o. Bierman, Comijs, Jonker, & Beekmann, 2007; Gallagher et al., 2011; Wilson, Barnes et al., 2002). Perhaps the assessment of subjective memory functions, induced by participation in the intervention program, prevents negative emotions like anxiety and depression and reduces well-known risk factors for cognitive decline in the long term.

The behavioral modifications demonstrated by the weekly activity protocols during the intervention (i.e., reading more books or newspapers, doing more excursions, watching less television), supported the idea that the program includes approaches for an active and dementia-preventing lifestyle. Male participants over the age of 74 benefited most from their participation; their participation increased in the frequency of three cognitively stimulating activities in this study. For example, they participated in more social interactions with friends, they read more books or newspapers, and they went on more walks. This shows that individuals over age 74 are still willing to change their lifestyle and may particularly benefit from a training intervention designed to facilitate these changes. In that regard, note that these is self-reported information: The participants perhaps did not answer correctly because of not being sure of their weekly activity level or because of social desirability response set.

It appears that there were two main reasons that could explain why there were fewer beneficial treatment effects in this study than expected. First, although the main intervention goal of this study was to increase the frequency of additional cognitively stimulating activities in participants' everyday lives, the majority of participants did not change their behavior in this regard. A main component of the AKTIVA program included informing participants about the benefits of performing cognitively stimulating activities and making suggestions to participants about how to implement the activities in their everyday lives. But it was difficult to control the quality of participants' involvement in the activities. The participants' involvement in cognitively stimulating activities appears also to have been affected by factors of willingness, motivation, and available time. There was a low level of commitment among the majority of participants to increase the frequency of their involvement in cognitively stimulating activities. Additionally, the directions and instructions given to participants in order to implement more cognitively stimulating activities were not mandatory. The participants voluntarily chose how to spend their time, which could be a reason for lack of a significant difference between the intervention groups and the control group in this study. Therefore, it would be important for future research to increase participants' motivation and commitment to participate more frequently in cognitively stimulating activities. One way to achieve enhanced motivation might be to implement individual support sessions in addition to the group program. Individual sessions might enable more participants to develop individual goals and strategies to become involved more frequently in cognitively stimulating activities with a higher degree of persistence. Another way to increase participants' motivation might be to request that participants complete the activity protocols on a daily basis rather than on a weekly basis. Webber et al. (1993) showed that daily self-monitoring can be particularly instrumental to increase a desired behavior. Beyond that, AKTIVA tends to cause behavioral modifications in the participants. These behavioral modifications are designed to be sustainable in the long-term too. AKTIVA operates additionally on a voluntary basis, and so it's not surprising that there are only a few preliminary results. Further research is necessary to identify supposed long-term interventional benefits.

The second explanation for the lack of significant effects in this study might be the composition of the sample. The participants were generally interested in the study, but they also reported being involved in many other activities in their leisure time (e.g., going to senior social clubs, meeting friends, playing sports, doing voluntary service, doing housework), so they often did not have enough available time to implement additional cognitively stimulating activities in their current daily schedules. Given that participants sampled in this study already had active lifestyles, it seems that there were possible ceiling effects in this study since most of the participants actually did not need the intervention program. Perhaps participants with a less predetermined schedule and less preexisting involvement in cognitively stimulating activities could profit more from the AKTIVA program. Increased control of participants' daily schedules to spend time in the program is important in order to more clearly determine the effects of the AKTIVA program.

The combination of AKTIVA and nutrition and exercise counseling in the second intervention group was not more effective than the AKTIVA program alone. The lack of different effects between both intervention groups could be explained by the very time-consuming additional guidance. The participants received a physical checkup, took part in several sports, were required to evaluate their physical activities with daily protocols, and joined a nutrition workshop. Perhaps these participants did not have enough available time to implement additional cognitively stimulating activities and just focused on physical activities and nutritional information. Therefore, the second intervention group did not implement the combined intervention approach, but could be understand as a sports group.

In conclusion, these results are preliminary in that future research designed to better control outcomes might produce different findings. Although this study demonstrated some positive significant effects, further research is necessary to facilitate implementations of cognitive stimulation programs into everyday life and to identify long-term intervention benefits. Nevertheless, the AKTIVA program is an encouraging cognitive intervention approach toward the prevention of cognitive decline in the elderly which needs to be developed and implemented once again.

Finally, there are a number of methodological limitations of the present study. We did not use an intention-to-treat analysis and excluded Turkish participants before analysis. Accordingly, we analyzed a selected sample, which can be seen as a limitation of our analysis. But with this procedure we wanted to prevent overestimation of the intervention effects. The separate dropout analysis shows that there are significant differences between the participants who withdrew and the others. The withdrawn participants were significantly older and showed significantly lower performances in cognition, mood, and attitude to old age. It could be presumed that these persons terminated their participation because of being overstrained through the cognitive tests and questionnaires as well as because of the duration of the weekly training sessions or because of some disappointment of their expectations. Additionally, not using intention-to-treat analysis caused an imputation of missing responses by mean score. This method may lead to a distortion of the distribution and substantial underestimation of the variances. Not applying this procedure led to many eliminated data as well, because only questionnaires with an accepted number of missing items were analyzed. Furthermore, the definition used of the age categories ("young-old" participants < 75 years and "old-old" participants ≥ 75 years) is only one possible classification (see Schäuble, 1995). In the recent literature other classifications have also been used (a. o. Baltes & Smith, 2003; Opaschowski & Reinhardt, 2007.) Baltes and Smith (2003), for example, described a third and a fourth age group in a further elaboration of the young-old versus old-old distinction and put persons older than 80 years into a fourth age category. In the present analysis it would have been possible to use three categories rather than two or to integrate age as a continuous variable in the analysis. However, we do not think that this approach would have altered our results considerably. Since we did not perform baseline measurement of the activities for participants of the intervention groups and no activity-measurement of the control group comparisons between baseline and intervention time just as between interventions groups and control group were not possible. The registration of the activity level started in intervention session two and took place in all intervention sessions (2–10). However, there was no measurement during the interval between the sessions eight and nine. It was not possible to observe the activity behavior of the participants during this long time period. Perhaps the majority of participants did not continue doing more cognitively stimulating activities because there was no control through activity protocols. Therefore, only the activity data from sessions 2–8 were analyzed, and it was just possible to demonstrate training effects during the intervention time when the weekly sessions took place. Additionally, all information on weekly activity level were self-reported and could be biased by social desirability. A lie scale was not used to statistically control this putative self-reporting bias. Furthermore, to present the results of the study, various adhoc analyses based on subsamples were conducted. This procedure enhances the Type I error in the multiple tests and was not controlled for, which is certainly a limitation of the analysis.

Replication with a representative sample and improved methodology is clearly needed.

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