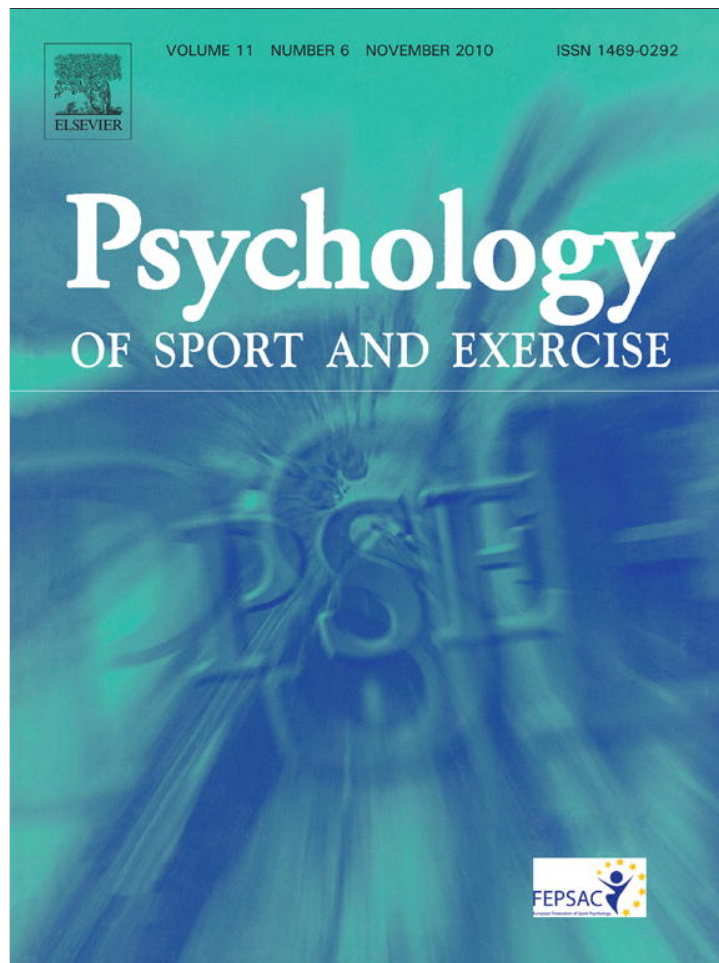


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Views on aging and emotional benefits of physical activity: Effects of an exercise intervention in older women

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ABSTRACT

Objectives: This intervention study evaluated the effects of exercise in old age on views on one's own aging and on direct approach motivation for physical activity. It further examined the mechanism between these variables.

Design: Two hundred forty-seven healthy women aged 70–93 years were randomized to an exercise course ($n = 86$), an active ($n = 85$), or a passive control group ($n = 76$) for a 6-month participation in Berlin, Germany. Activity interventions (3×1.5 h/wk) were conducted using standardized manuals.

Method: Group differences in changes of views on aging and direct approach were evaluated by analyses of covariance adjusted for baseline. A mediating effect of direct approach between exercise participation and views on aging was tested with percentile-based bootstrapping.

Results: In contrast to both the active and the passive control groups, higher direct approach, $F(2, 226) = 6.97, p = .001$, and less aging dissatisfaction, $F(2, 225) = 5.39, p = .005$, were observed in the exercise group after 6 months. Exercise had an indirect beneficial effect on aging dissatisfaction through direct approach, $B = -0.31, 95\% \text{ CI} = -0.68 \text{ to } -0.05$.

Conclusion: In women above 70 years, exercise participation increases direct approach motivation which in turn leads to lower aging dissatisfaction. This shows that exercise holds the potential to overcome subjective ageist bias.

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Views on one's aging (VoA) are an understudied issue (Kleinspehn-Ammerlahn, Kotter-Grühn, & Smith, 2008), although the satisfaction with one's aging has long been suggested as an integral aspect of subjective well-being in old age (e.g., Lawton, 1975; Neugarten, Havighurst, & Tobin, 1961). General life satisfaction is traitlike and highly stable over the life course (Diener & Diener, 1996; Diener & Suh, 1998), except for a decline immediately prior to death (Gerstorf, Ram, Röcke, Smith, & Lindenberger, 2008). Adaptation processes such as reorientation and reappraisal that buffer general life satisfaction against age-related losses (Staudinger, Marsiske, & Baltes, 1995) seem to be ineffective for personal VoA, however. The satisfaction with one's aging decreases across the life span and women are even less satisfied than men (Kleinspehn-Ammerlahn et al., 2008; Wurm, Tomasik, & Tesch-Römer, 2008). This is

especially alarming because negative VoA coincide with less attention to one's own health care (Levy, Slade, & Kasl, 2002; Wurm, Tomasik, & Tesch-Römer, 2010). Moor, Zimprich, Schmitt, and Kliegel (2006) doubted that aging self-attitudes can be modified by interventions. This issue has not been experimentally studied, though. For the purpose of our work presented here, we defined VoA as including both *self-perceptions* of one's aging as well as an actual *evaluation* of these, that is, a person's satisfaction with his/her aging.

The beneficial effects of physical activity on psychological well-being have been convincingly documented even for people of advanced age (McAuley & Rudolph, 1995; Netz, Wu, Becker, & Tenenbaum, 2005; Ransford & Palisi, 1996). Physical exercise in old age increases positive emotional experiences (McAuley, Elavsky, Jerome, Konopack, & Marquez, 2005), improves body self-concept (Stoll & Alfermann, 2002), self-esteem and quality of life (Elavsky et al., 2005), and it has mood-brightening effects (Ruuskanen & Ruoppila, 1995; Scully, Kremer, Meade, Graham, & Dudgeon, 1998). Exercise withdrawal, in contrast, can actually provoke

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depressive mood symptoms and fatigue (Berlin, Kop, & Deuster, 2006). However, so far no intervention study investigated specifically the effects of physical exercise on VoA.

If exercise is found to influence VoA, it would be important to explain this relationship by identifying possible mediators. Similarly, some authors emphasized the need to clarify the mechanisms by which exercise is effective in enhancing well-being, mood, or quality of life (Barbour & Blumenthal, 2005; Elavsky et al., 2005; McAuley et al., 2006, 2005; McAuley & Rudolph, 1995).

The distinction between approach orientation and avoidance orientation may likely play a role in this regard, because rational reasons for action determine if events or activities lead to specific emotional responses. These could then expand to the cognitive domain of subjective well-being, that is, evaluations of certain aspects of life (Diener, Suh, Lucas, & Smith, 1999). Diener and Fujita (1995) explained that resources (here: physical exercise as a resource for positive experiences) can only affect a person's subjective well-being if these are relevant to a person's ideographic strivings.

In advanced age, people focus more strongly on maintenance or loss-avoidance (Dittmann-Kohli, 2001; Heckhausen, 1997). Avoidance orientations, however, merely result in quiescence if a feared loss can be prevented (Higgins, 1997; Shah & Higgins, 2001). This might explain why in old age pleasant affect becomes increasingly rare (Diener & Suh, 1998) and why people are less likely to experience the positive side of life (Smith, 2001). Approach-orientations, in contrast, are directed toward gains and elicit cheerful emotions if goals are met (Higgins, 1997; Shah & Higgins, 2001). People who are approach motivated evaluate experiences more positive and perceive actions as more meaningful (Updegraff, Gable, & Taylor, 2004).

Mees and Schmitt (2008), in their motivation theory, have further pointed to a special case of approach motivation that they call *direct* approach. This is the most emotionally gratifying orientation, because of its entirely positive emotional outcomes and its close link with emotional stability and self-esteem (Mees & Schmitt, 2008). Hence, if activities allow for direct approach orientations to become effective, positive emotional experiences derived from them would likely meet important emotional needs in old age and by that might positively influence VoA.

Physical activity could provide an adequate background for such motivational processes since, on the one hand, it automatically generates feedback about effort and performance and was previously described as an ideal medium for defining one's self (Rejeski & Mihalko, 2001). On the other hand, it should reinforce direct approach orientation because it leads to immediate affective responses like enjoyment (Williams, Anderson, & Winett, 2005). There is evidence that a positive experience due to one's behavior gives people the feeling of being right in what they are doing (Higgins, 2008) and increases the "wanting" of more of these positive experiences (Vohs & Baumeister, 2008).

As follows from this outline, it is likely that if physical exercise activates direct approach orientations, these enable positive effects on VoA. Such a mediation model would simultaneously reflect that, first, exercise is appropriate to enhance the particular motivational schema that allows for positive emotional gratification in old age and that, second, by this process exercise experiences are transferred into one's self-concept and manifest themselves in more favorable VoA.

In a randomized controlled trial we evaluated an intensive 6-month exercise program in contrast to an active and a passive control group. We hypothesized that, first, engagement in exercise favorably affects VoA. We further assumed that, second, exercise fosters direct approach toward physical activity on the motivational level, and that, third, this direct approach orientation mediates the effect of exercise on VoA.

Material and methods

Participants

The current study is based on data from German-speaking women older than 70 years from Berlin, Germany, participating in a comprehensive research project on cognitive aging (see Klusmann et al., 2010; for details). Advertisement strategies included press releases, presentations at local senior organizations, and posters in public transportation. Out of 313 community-dwelling women who were enrolled, 259 women met the eligibility criteria, were included in the baseline assessment, and then were randomized. Of these, 247 women were allocated to one of three study groups, that is, a physical exercise course, an active control (i.e., a computer course), or a passive control group. The study protocol was approved by the local ethical review board and written informed consent was obtained from the participating women.

Eligible women were all rather sedentary (all were exercising less than 1 h/wk) but had an age-appropriate good health status (no severe visual or hearing impairments, no previous or current diagnosis of psychosis or depression, and no other medical disorder that may interfere with cognitive performance). Cognitive impairment was excluded by screening with the *Mini-Mental State Examination* (MMSE) using a cut-off score of 26 (Folstein, Folstein, & McHugh, 1975) and depressive mood was ruled out by applying a cut-off score of 5 points on the 15-item short-form of the *Geriatric Depression Scale* (GDS-SF; Sheikh & Yesavage, 1986).

The baseline data of one woman, being randomized to the exercise course, was missing for the items of the Geriatric Depression Scale. Thus, analyses with these items were based on 246 women for baseline measurement and 229 for follow-up. The analyses were based on the intention-to-treat principle, including the women who discontinued the intervention at any point in time but were available at follow-up. Solutions with imputation of missing data (i.e., $n = 1$ for baseline GDS scores and $n = 17$ for all follow-up data) using Expectation Maximization (EM) or Last Observation Carried Forward (LOCF) procedures completely mirrored the findings based on non-imputed data.

Interventions

Seven consecutive cohorts of about 36 women each underwent the 6-month study program. The physical exercise group engaged in an intensive and multifaceted group intervention with sessions of 90 min at 3 days per week. The active control group took part in a computer course group with equal frequency and duration of sessions as the exercise group to control for the new activity level and for social contact. The women in the passive control group lived their life as usual.

The exercise program consisted of aerobic endurance, strength, and flexibility training, also addressing balance and coordination. Typically, sessions included 30-min training on bicycle ergometers. The active control group was designed as a computer course for seniors dealing with common software and hardware, internet, emailing, image and video editing, etc. Standardized manuals were followed in both group interventions that were carried out in groups of 12 women in 7 consecutive cohorts in different sites all over Berlin, Germany.

Objectives

The terms *views on one's aging* (VoA), *aging satisfaction*, or *aging self-perceptions* all apply to a subjective cognitive evaluation of a person's own aging process and are used interchangeably for the

purpose of this study. First, we evaluated the effects of regular physical exercise on VoA and, second, how physical activity influenced a person's direct approach toward exercise. Finally, we tested whether there was a mediating effect of direct approach for the relationship between physical exercise and VoA.

Measures

Aging dissatisfaction

We feel that the currently available tool to assess aging satisfaction, the *attitude toward own aging* scale of the *Philadelphia Geriatric Center Morale Scale* (PGCMS; Lawton, 1975; Liang & Bollen, 1983), might be suboptimal in terms of content validity. Two items address ambiguous comparisons of one's state of energy ("I have as much pep as I had last year") or of happiness ("I am as happy now as when I was younger"). These could be disagreed upon just because of qualitative changes with no valuation predefined. Another item is problematic because it suggests preexisting negative expectations about aging ("As I get older, things are better than I thought they would be").

For these reasons, based on expert ratings that judged content validity and on factor analyses, out of an item pool of well-established well-being measures we generated six items for VoA (see the online Appendix for the psychometric evaluation of the measures used). The six items were: "I have dropped many of my activities and interests" (originating from the GDS), "My life has worsened, because I am getting older", "The older I become the more I have to give up in my life", "Growing older has had a positive effect on my life", "Things keep getting worse as I get older", "As you get older you are less useful" (the latter two items originate from the PGCMS). All of these items except item 4 express a negative VoA and thus item 4 has to be scored reversely when calculating scale scores and the measure was labeled as 'aging dissatisfaction'. Baseline sum score mean (SD) of the sample ($n = 246$) was 14.78 (4.63), Min = 6, Max = 28, with a possible range of scores from 6 to 30 (see Table 1).

Direct approach orientation

Direct approach toward physical activity was measured by three items that addressed the expectation to derive immediate positive emotional outcomes from such activities as reasons for action ("Physical exercises do not give me any pleasure (R)", "I have fun when I am active", "I feel much livelier when I am exercising"; the first of these items has to be scored reversely; see the online Appendix for the psychometric evaluation of the measures used). Baseline mean (SD) of the sample ($n = 247$) was 12.81 (2.34), Min = 5 and Max = 15, with a possible score range from 3 to 15 (see Table 1).

A 5-point Likert scale applied to all instruments. Participants were asked to indicate how well each statement described

themselves using specified categories: 5 = *very well*, 4 = *moderately well*, 3 = *average*, 2 = *not much*, and 1 = *not at all*. Items are translations from German.

Statistical analyses

Analyses of covariance

Analyses of covariance (ANCOVA) with planned simple contrasts were used to test for differences between the exercise group and the active and the passive control group regarding the change of VoA and direct approach. For both, aging dissatisfaction and direct approach, sum scores based on item raw scores were used. Baseline scores were included as covariates and significance level was preset at 5%. Strengths of associations were documented by the effect size partial η^2 , calculated as $\eta_p^2 = SS_{\text{effect}} / (SS_{\text{effect}} + SS_{\text{error}})$, SS being the sum of squares (Cohen, 1988).

Simple mediation model

An SPSS macro of Preacher and Hayes (2004) was used to test the hypothesis that possible advantages of the exercise group over the active and the passive control group regarding aging dissatisfaction might be mediated through a high direct approach toward physical activity. Using ordinary least squares regression analysis the macro allows to estimate total and direct effects as well as the indirect effect of a causal variable on an outcome variable through a proposed mediator. The provided percentile-based bootstrap confidence interval (CI) is used to test the indirect effect (Hayes, 2009). A second macro was used to ensure the validity of the model controlling for possible age effects (Preacher & Hayes, 2008). For these analyses the group variable was introduced dichotomized, contrasting the exercise group to both the active and the passive control group. Sum scores of the aging dissatisfaction factor and of direct approach at follow-up measurement were used.

Results

Population and variables

Two hundred forty-seven women entered the main phase of the study. Eighty women of the physical exercise course, 81 of the computer course, and 69 of the control group, that is, 230 women were available for the 6-month follow-up (93.1% of baseline). Women having withdrawn consent after baseline measurement and women lost to follow-up did not significantly differ from the remaining sample regarding socio-demographic and performance variables. Sample characteristics ($N = 247$) and variables are shown in Table 1, and Table 2 summarizes the correlations between study variables.

Views on one's aging (VoA)

ANCOVA ($n = 229$) on post scores of the six-item sum score of aging dissatisfaction adjusted for baseline revealed a significant main effect for group, $F(2, 225) = 5.39, p = .005, \eta_p^2 = 0.05$. Planned contrasts showed that change in aging dissatisfaction was significantly lower in the exercise group than in the passive control group, $B = -1.67, SE = 0.52, 95\% CI = -2.70$ to $-0.64, \eta_p^2 = 0.04$, and in the active control group, $B = -1.11, SE = 0.50, 95\% CI = -2.10$ to $-0.12, \eta_p^2 = 0.02$. Both of those had higher scores on the aging dissatisfaction factor than the exercise group at post-testing. Mean (SD) of the exercise group at post-testing was 14.54 (4.32) for $n = 229$, that is, 14.63 (4.37) for $n = 230$, whereas that of the passive control group was 15.51 (4.30), and that of the active control group was 15.95 (4.57; see Fig. 1).

Table 1
Sample characteristics and variables.

Measure	Mean	(SD)	Range	Cronbach's Alpha
Age (years)	73.6	(4.2)	70–93	
Years of education	11.9	(2.6)	7–17	
Marital status				
Married n (%)	56	(22.7)		
Divorced n (%)	90	(36.4)		
Widowed n (%)	68	(27.5)		
Other n (%)	33	(13.4)		
Aging dissatisfaction	14.78	(4.63)	6–28	.73
Direct approach	12.81	(2.34)	5–15	.74

Note. $n = 247$ ($n = 246$ for aging dissatisfaction), SD = standard deviation; data of baseline assessment.

Table 2
Pearson correlations of exercise group, age, aging dissatisfaction, and direct approach.

Measure	Age	t1 aging dissatisfaction	t2 aging dissatisfaction	t1 direct approach	t2 direct approach
Exercise (1) vs. controls (0)	.01	.04	-.12 ^a	.05	.23 ^c
Age	–	.20 ^c	.17 ^b	.02	-.05
t1 Aging dissatisfaction		–	.69 ^c	-.16 ^b	-.13 ^b
t2 Aging dissatisfaction			–	-.12 ^b	-.16 ^b
t1 Direct approach				–	-.51 ^c
t2 Direct approach					–

Note. t1 = baseline with $n = 247$, t2 = 6-month follow-up ($n = 246$ and $n = 229$ for aging dissatisfaction, respectively). Sum scores of aging dissatisfaction ranged from 6 to 30, and those of direct approach toward physical exercise from 3 to 15.

^a $p < .10$.
^b $p < .05$.
^c $p < .01$.

Direct approach motivation

ANCOVA ($n = 230$) on postscores of the direct approach item sum score adjusted for baseline with 95% CI revealed a significant main effect for group, $F(2, 226) = 6.97, p = .001, \eta_p^2 = 0.06$. Planned contrasts revealed that change in the direct approach toward physical activity was significantly better in the exercise group than in the passive control group, $B = 1.03, SE = 0.32, 95\% CI = 0.40$ to $1.66, \eta_p^2 = 0.04$, and in the active control group, $B = 0.98, SE = 0.31, 95\% CI = 0.37$ to $1.58, \eta_p^2 = 0.04$. Both of those had lower scores on direct approach than the exercise group at post-testing. Mean (*SD*) of the exercise group at post-testing was 13.50 (2.04), that of the passive control group was 12.32 (2.20), and that of the active control group was 12.43 (2.48; Fig. 1).

Mediation analysis

Pearson correlation coefficients (Table 2) showed that being participant of the exercise group involved higher direct approach and less aging dissatisfaction at the 6-month follow-up. Also, direct approach was negatively correlated to aging dissatisfaction and higher age was associated with higher aging dissatisfaction.

The simple mediation model ($n = 230$) argues in favor of the hypothesized indirect effect of the exercise intervention on aging dissatisfaction through direct approach (Fig. 2). Percentile-based bootstrapping intervals ($N = 5000$) accounted for a significant indirect effect, $B = -0.31, bootstrapped mean = -0.31, SE = 0.16; 95\% CI = -0.68$ to -0.05 . Total effect of exercise on aging dissatisfaction was $B = -1.11, SE = 0.61, p = .07$, and total effect of exercise on direct approach was $B = 1.12, SE = 0.31, p < .001$. Direct effects were: regressing aging dissatisfaction on direct approach controlling for exercise, $B = -0.28, SE = 0.13, p = .03$, and regressing aging

dissatisfaction on exercise group controlling for direct approach, $B = -0.80, SE = 0.62, p = .20$. Even when introducing age as a covariate, the mediation model fit well. Age had a significant partial effect on aging dissatisfaction, $B = 0.17, SE = 0.07, \beta = 0.16, SE = 0.06, p = .01$, and the model paths for total, direct, and indirect effects of the mediation remained unchanged.

Discussion

In this randomized controlled trial we showed, first, that engagement in physical exercise positively influences aging dissatisfaction (our measure of VoA). Second, exercise also leads to high direct approach orientation toward physical activity on the motivational level and results indicated, third, that the effect of exercise on VoA is mediated through high direct approach orientation.

To our knowledge this is the first intervention study directly addressing the effects of exercise on VoA. Our results support that it is possible to influence the self-perception of one's aging by interventions, albeit this had been questioned in the recent literature (Moor et al., 2006). We demonstrated that newly engaging in physical exercise is beneficial for VoA, a finding that is supported by results from a cross-sectional study. Denk and Pache (1999) reported that in physically inactive people, especially in women, attitudes toward aging were negative and became even more negative with increasing age. The attitudes in the group of the exercisers, in contrast, remained significantly more positive irrespective of the amount of physical activity.

We demonstrated that physical activity is able to buffer aging dissatisfaction even in a sample of older women. Kleinspehn-Ammerlahn et al. (2008) observed that declines of aging satisfaction over a 6-year observation interval were more pronounced in women. Similarly, the heightened vulnerability in older women

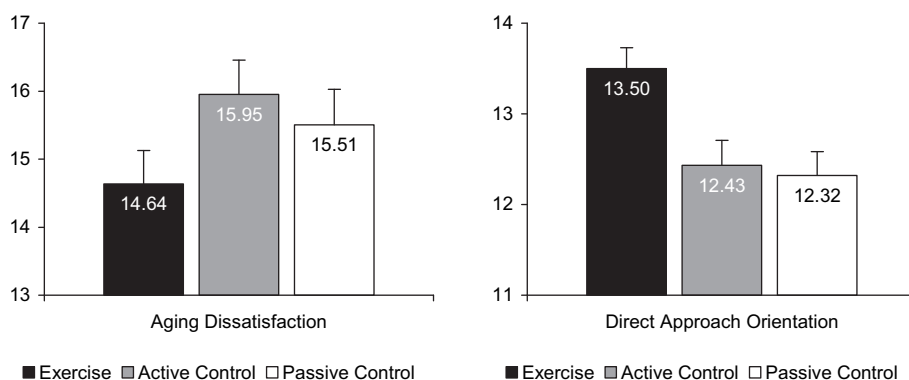


Fig. 1. Aging dissatisfaction and direct approach at follow-up. $n = 230$; sum scores of aging dissatisfaction ranged from 6 to 30, and those of direct approach toward physical exercise from 3 to 15.

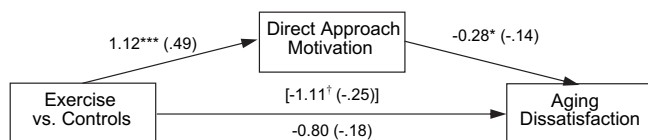


Fig. 2. Results of regression analysis for mediation model. $n = 230$; *** $p < .001$; * $p < .05$; † $p < .10$; effect estimates of the unstandardized (B) solution and of the standardized (β) solution (in parentheses); total effect of aging dissatisfaction regressed on exercise in brackets.

was demonstrated in a meta-analysis of 300 studies about gender differences in self-concept and in well-being by Pinqart and Sörensen (2001): They reported on lower subjective well-being and a less positive self-concept in women compared to men in several measures. Higher levels of loneliness due to widowhood and disadvantages in social resources, health, and socioeconomic status of older women contributed to these constraints. Furthermore, older people's physically inactive behavior makes them prone to serious health problems (Kruger, Ham, & Sanker, 2008; Singh, 2002). Even when being involved in social programs women experience an increase in functional limitations (Hong & Morrow-Howell, 2010). Considering all of the above, our results are of crucial importance. By newly engaging in an intensive physical exercise program subjective VoA of older women can be effectively modulated positively.

Given the detrimental consequences of a negative VoA, it is of pivotal importance to stop the age-associated progression of dissatisfaction. In a striking review, Diener and Chan (2011) recently summarized the evidence that high subjective well-being causes better health and longevity. Moreover, previous studies have demonstrated that more positive self-perceptions of aging in particular are beneficial for functional and subjective health and health behaviors, e.g., healthy diet and regular doctors' consultations; and positive VoA were even found to coincide with lower mortality rates (Levy & Myers, 2004; Levy et al., 2002; Maier & Smith, 1999; Wurm et al., 2008, 2010).

The VoA factor that we used in this study was primarily characterized by social disengagement, feelings of uselessness, and the perception of a general age-associated worsening of life. Other aspects, e.g., dependence on others, degree of self-determined life or self-acceptance, physical pain, or being energetic or being as happy now as in younger age (Kotter-Grühn, Kleinspehn-Ammerlahn, Gerstorff, & Smith, 2009; Lawton, 1975), might be better described as possible predictors of aging satisfaction as opposed to actual or inherent parts of aging satisfaction. Thus, these are rather distinct phenomena that are related to the process of aging. Hence, we would advise to assess VoA by unambiguous evaluations.

Previous studies demonstrated that – despite the multiple benefits of physical activity for objective and also subjective health, especially in old age (Nelson et al., 2007; Ransford & Palisi, 1996) – there are generally more negative attitudes with increasing age, lower self-efficacy, and less positive outcome expectancies in relation to physical activity, especially in women (Netz & Raviv, 2004; Wilcox & Storandt, 1996). Wilcox and Storandt (1996) found that among non-exercisers there was a decrease of the belief that exercise would be enjoyable and beneficial. Our study, however, demonstrated that it is indeed possible to encourage older women to newly engage in exercise behavior and to follow an exercise regimen over a long time period (i.e., at least 6 months).

Furthermore, we found that it is possible to boost direct approach orientation toward physical activity. This is beneficial because, first, approach orientation ensures positive emotional experiences derived from the activity. Second, it increases the likelihood of further exercise behavior, because of the promoting effect of

perceived enjoyment which strengthens direct approach. Hardcastle and Taylor (2005) found that older women changed their sense of exercise identity over the course of a 10-week exercise intervention, including increased feelings of achievement and control. By doing so, it leads to “wanting” more of the source of which these positive incidents are derived from, which means more active behavior also in the long-run (Strachan, Brawley, Spink, & Glazebrook, 2010; Vohs & Baumeister, 2008; Williams et al., 2005).

It is of great relevance to have identified an activity type in which direct approach motivation can manifest itself, given the shift of motivational orientations toward loss-related avoidance in old age (Heckhausen, 1997). If individuals have a prevention focus (which means avoidance orientations), success is the absence of a negative event (a non-loss) and results in quiescence-related emotions such as feeling calm or relaxed. In contrast, if individuals have a promotion focus (which means approach orientations), success is the presence of a positive outcome (a gain) and evokes cheerfulness-related emotions such as feeling happy (Shah & Higgins, 2001). The more proximal or direct these outcomes are to the behavior itself, the more likely an expected emotional experience will occur (Mees & Schmitt, 2008). This linkage was similarly described by the concept of intrinsic motivation in the self-determination theory (Deci, 1975; Deci & Ryan, 2000). The increasing focus on loss-prevention in old age might amplify the fact that positive affect becomes increasingly rare in old age, which results in lowered well-being (Smith, 2001). In a recent study, inactive older adults stated that a predominant motivator for physical activity were health concerns for the future, which means a focus on indirect avoidance, whereas only few people thought about enjoyment (Buman, Yasova, & Giacobbi, 2010). Thus, it seems crucial to promote direct approach orientations because these regulate the motivational structure by counterbalancing the progressing focus on losses in old age. Moreover, direct or immediate emotional gains correspond to the predominant striving for emotional goals when the remaining lifetime is perceived as limited (Carstensen, Isaacowitz, & Charles, 1999; Carstensen & Mikels, 2005).

In the context of social cognitive theory, direct approach orientation can be regarded as a special case of outcome expectancies (Bandura, 1997). The classical concept of outcome expectancies, however, disregards the differences between direct or indirect approach or avoidance motivation. These coincide with distinct emotional reactions, though (Higgins, 1997, 2008; Mees & Schmitt, 2008). Interestingly, Williams et al. (2005) criticized that emotional reactions to exercise are an understudied class of outcome expectancies and emphasized the importance of proximal positive outcomes for physical activity behavior. This underscores the significance of direct approach in contrast to the other types of motivational orientations and argues in favor of refining the framework of outcome expectancies.

In summary, we suggest that exercise optimally serves the needs of older people. Basically, this can be explained by the holistic features of physical activity stimulating both body and mind. Exercise promotes direct approach orientations which ensure proximal emotional gains and therefore greatly facilitate that positive exercise-related experiences can successively expand into a person's VoA.

Limitations

As a matter of course, the VoA factor that we used in this study has to be further validated in future studies. However, we feel that the factor analyses (see the online Appendix for the psychometric evaluation of the measures used) and experts' ratings of high content validity argue in favor of the VoA measure used. Furthermore, it seems reasonable and tenable in the light of the provided

evidence to have revised the VoA concept so that it only comprises definite and unambiguous subjective evaluations of one's own aging process.

Our mediation model which describes the beneficial effects of exercise on VoA through high direct approach orientations is certainly not exhaustive. Other factors such as mastery experiences and self-efficacy (McAuley et al., 2007; Netz et al., 2005) could be included in future studies. With regard to alternative behaviors, such as sedentary behavior or social disengagement in old age, it might be interesting to study also avoidance orientations or more extrinsic forms of motivation.

A further task would be to agree on a consistent conceptual framework and, preferably, also on a common terminology when describing motivational processes that guide behaviors and that determine the emotional outcomes that follow from being active.

Conclusion

The tendency of older people, and women in particular, to be sedentary puts them at risk for serious health problems. Exercising, however, not only contributes to physical health, but also enhances mental abilities. Here, we have provided evidence that exercising also considerably blunts aging dissatisfaction. It was demonstrated that exercise provides proximal emotional responses which are, on the one hand, strongly needed to increase positive experiences in old age and which, on the other hand, promote motivation for future activity and thus help to establish and perpetuate active behavior and a non-sedentary lifestyle. Importantly, exercise contributes to the most age-sensitive facet of subjective well-being in old age through buffering against negative views on one's own aging.

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Appendix. Supplementary data

Supplementary data related to this article can be found online at [doi:10.1016/j.psychsport.2011.11.001](https://doi.org/10.1016/j.psychsport.2011.11.001).

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