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Positive Self-perceptions of Aging Promote Healthy Eating Behavior Across the Life Span via Social-Cognitive Processes

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Abstract

Objectives: Negative self-perceptions of aging (SPA) have been shown to result in lower levels of preventive behavior, health, and longevity. This study focuses on the understudied SPA effects on healthy eating across the life span. Moreover, it aims to provide longitudinal evidence of the psychological mechanisms behind this relationship.
Method: We investigated whether SPA (T1) can predict changes in eating behavior (T3) over 1 year in 1,321 participants (T1), aged 18–92 years. The explanatory role of social-cognitive processes (T1, T2) was tested via a two-step mediation analysis with multigroup modeling for different age and education levels.
Results: Baseline positive SPA predicted more healthy eating at T3 (b = 0.68, SE = 0.24, p = .01), controlling for baseline eating (T1), age, education, gender, BMI, and illnesses. Self-efficacy (T1) and intention to eat healthily (T2) serially mediated this effect, indirect effect: b = 0.04, p = .02, 95% CI (0.02, 0.08). SPA had stronger effects in older and less educated participants.
Discussion: This study provides important insights into the mechanisms behind positive SPA fueling successful health behavior change dynamics. Fostering more positive SPA through interventions might be especially important for vulnerable groups. Addressing SPA already in younger ages might help establish health-promoting life-span dynamics.

Keywords: Healthy dietary behavior, Images of aging, Intention, Life span, Self-efficacy

Self-perceptions of aging (SPA), the way we view our aging, appear to play a crucial role in health preservation and longevity (Westerhof et al., 2014). SPA have also been linked to individual health promotion and prevention behavior (Miche, Brothers, Diehl, & Wahl, 2015). Having lower expectations regarding aging was associated with placing less importance on seeking health care and with very low levels of physical activity (Sarkisian, Prohaska, Wong, Hirsch, & Mangione, 2005). Longitudinal data from the German Aging Survey showed higher instances of physical activity given positive SPA, even in relation to serious health events or chronic illness or multimorbidity (Wurm, Tomasik, & Tesch-Romer, 2010; Wurm, Warner, Ziegelmann, Wolff, & Schüz, 2013). Using the single-item health behavior sum score data on 50–80-year olds of the Ohio Longitudinal Study of Aging and Retirement, Levy and Myers (2004) showed that individuals with more favorable attitudes toward own aging in 1975 subsequently reported having performed more health-promoting activities over the interim 20 years in 1995, such as exercising,

limited alcohol and tobacco use, or eating a balanced diet. In a cross-sectional descriptive study, Huy, Schneider, and Thiel (2010) found that a cluster of 50–70-year olds with a "fit and performance hungry" view on aging showed a more favorable dietary pattern. Specifically, people in this cluster saw aging as a time of engagement for health, physical fitness, and sustained attractiveness, while regarding withdrawal as inappropriate and physical and social deficits as not necessarily part of the aging process. A recent qualitative interview study stated that a lifestyle change of dietary intake or physical activity related to perceptions of old age (Bardach, Schoenberg, & Howell, 2016). This first evidence hints at the need for a thorough investigation of the effects of SPA on eating behavior and nutrition. Generally, the mechanisms that underlie the behavioral and health effects of SPA remain an understudied issue.

SPA as a Driving Force of Health-Promoting Mechanisms

The summarized findings illustrate what is described as the behavioral pathway in the Stereotype Embodiment Theory (Levy, 2003; 2009). Being merely described as parallel paths, it is nevertheless likely that psychological processes influenced by SPA precede behavioral outcomes. As part of a heuristic framework it was recently suggested to regard self-regulatory processes as a prominent mediator linking SPA to productive activities and successful life-span development (Diehl et al., 2014). Cognitions, strategies, and expectations like perceived control (Levy et al., 2002) or self-regulation strategies (Wurm et al., 2013) were empirically shown to be partial mediators of health effects following SPA. A long tradition of health behavior change models suggests self-efficacy beliefs and goal setting along with intention formation as key social-cognitive predictors of health behavior. Reviewing classical and more recent approaches, Sheeran, Klein, and Rothman (2017) illustrated that the established health behavior theories overlap most in that the vast majority explicitly specifies self-efficacy and intentions as central antecedents of action. Classically described by Social Cognitive Theory, self-efficacy, that is beliefs of being able to adopt a behavior even in the face of obstacles and barriers, is fostered by positive experiences, particularly mastery experiences (Bandura, 1986). The prominent Theory of Planned Behavior (Ajzen, 1985) established that high self-efficacy feeds intentions that, in turn, are indispensable to healthy actions. Since then, large-scale empirical research, for example based on the Health Action Process Approach (e.g., Schwarzer, 2008), substantiated the prominent role of self-efficacy and resultant intention formation as mediators of behavior (Renner & Schwarzer, 2005; Schwarzer & Renner, 2000). Behavior-specific action self-efficacy was the strongest predictor in case of both diet (Renner et al., 2008) and physical activity (Renner, Hankonen, Ghisletta, & Absetz, 2012). The amount and importance of self-efficacy increase with age (Renner, Knoll, & Schwarzer, 2000; Schwarzer & Renner, 2000). Thus, it seems plausible that SPA as superordinate cognitive evaluations of aging—being closely linked to mastery experiences (Klusmann, Evers, Schwarzer, & Heuser, 2012)—are relevant to the practice of health enhancing behaviors by boosting important social-cognitive dynamics closely tied to the behavior (see Figure 1).

Life-span Dynamics and Educational Disparities

To date, existing studies on SPA in the context of health and health behavior entail samples over 40 or 50 years of age. However, images of aging seem to be formed early in life (Lineweaver, Roy, & Horth, 2017) and impact prospective future planning and developmental regulation starting in emerging and young adulthood already (Bowen & Skirbekk, 2017). Also, the strength of associations between a constructive view of aging and health behavior or health care use might vary in the time course from young adulthood to late life (Miche et al., 2015). Thus, it seems pivotal to study the life-span dynamics of the effectiveness of SPA using different age groups. This is especially important for eating behavior since prevalent unbalanced dietary habits pose a lifelong health threat (Brown, 2016). Given that there are marked differences in eating behavior depending on socioeconomic status (Pechey et al., 2013) and that SPA are typically more positive in highly educated people (Steverink, Westerhof, Bode, & Dittmann-Kohli, 2001), educational differences should be considered.

The Present Study

The present study aims to elucidate the underlying life-span dynamic mechanisms of the effects of SPA. Using 1-year longitudinal data from the Konstanz Life Study, a community-based cohort study, we investigated three questions: First, whether SPA do predict changes in eating behavior; second, if so, whether these effects of self-perceptions could be explained by SPA being a driver of established favorable, health-enhancing social-cognitive processes, namely, self-efficacy and intention. For the second question, we used a serial mediation analysis to test whether SPA predicted self-efficacy and then intentions for healthy eating that in turn result in healthier eating patterns (see Figure 1). Third, we used multigroup comparisons to test whether the relationship between SPA and healthier eating mediated by self-efficacy and intention varied across different age and education groups.

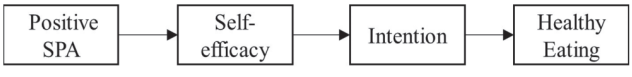


Figure 1. Conceptual model of favorable self-perceptions of aging (SPA) as a driving force for health-promoting mechanisms.

Method

Design and Procedures

Data were collected as part of the Konstanz Life Study, a longitudinal cohort study of 1,321 participants launched in spring 2012 (Klusmann, Musculus, Sproesser, & Renner, 2015; Renner, Sproesser, Klusmann, & Schupp, 2012). As part of the EATMOTIVE project, the Konstanz Life Study was funded by the Federal Ministry of Education and Research (BMBF, Grant 01EA1326 and Grant 01EL1420A, both granted to B. Renner). Participants were recruited via flyers, posters, billboards, and newspaper articles at Wave 1 (T1) in spring 2012 and invited to reattend via mail, e-mail, and phone calls at Waves 2 (T2) and 3 (T3) in autumn 2012 and spring 2013, respectively. Demographics (age, gender, education) as well as objective anthropometric, health, and functional fitness parameters were captured via a standardized check-up at T1. SPA were measured at study entry (T1). The healthiness of eating behavior was assessed at T1 and re-assessed one year later (T3). At an interval of about 6 months, T1 and T2 included two well-established social-cognitive predictors of health behavior changes, that is, self-efficacy (T1) and intention (T2) to eat healthily. At each study wave, participants received feedback on their objective health measures in relation to current norms.

Participants

Participants had to be at least 18 years old. Since bicycle ergometry was part of the objective physical fitness assessment, it was ensured that participants' blood pressure was in the normal range (i.e., systole below 150 mm HG and diastole below 100 mm HG), that participants had not had cardiovascular disease/events, lung disease, metabolic disorders, mental disorders with physical exercise counter indicated, epilepsy, multiple sclerosis, current antitumor therapy, major intervention or surgery within the last 12 months, or other severe chronic or acute diseases, and that women were not pregnant.

Written informed consent was obtained prior to data collection and the local ethical review board (University of Konstanz) approved the study protocol. The present study focuses on longitudinal data, including three study waves over 1 year. Seven participants were excluded due to missing basic demographic data, resulting in a final baseline sample size of n = 1,314 for T1. Of these, 778 (59.2%) were female. Ages ranged from 18 to 92 years, with a mean (*SD*) age of 43.8 (17.6). Mean BMI (*SD*) was 24.0 (3.7) kg/m^2 (ranging from 15.9 to 44.8 kg/m^2). Participants had completed 15.6 years of education on average (*SD* = 2.5, ranging from 8 to 20 years, referring to years of school plus years of vocational or university training). Compared with German population data (Statistisches Bundesamt Destatis/Federal Statistical Office, 2017), this sample had a representative average age, comprised 8% more females, and had a slightly lower average BMI (the average BMI of the German population is 26 kg/m^2 according to Microcensus data from 2011). The attrition rate from baseline (T1) to 6 months was 41% (T2, N = 775) and 17% (T3, N = 557) to 12 months.

Measures

SPA at T1

A 4-item scale (Cronbach's α = 0.66) developed for the German Aging survey (Klaus et al., 2017) capturing aging-related self-knowledge and control was used to assess SPA. Following the item stem "Aging means to me…" the items were "… that I have a better idea of what I want," "… that I can deal with my physical weaknesses better," "…that I know myself better," "…that I am more relaxed about a lot of things." Items were used in their original German language (Kohli et al., 1997). Participants endorsed items on a 4-point scale ranging from 1 = *definitely false* to 4 = *definitely true*.

Self-efficacy at T1

Five items were used to measure action self-efficacy (Cronbach's α = 0.80) for a healthy and balanced diet. These were based on items developed by Schwarzer and Renner (2000) as well as Scholz, Sniehotta, and Schwarzer (2005). The general question "How certain are you that you could overcome the following barriers?" was followed by specific items (e.g., "I can manage to eat healthily and balanced, even if I have to rethink my entire way of nutrition"). A 4-point response format ranging from 1 = *very uncertain* to 4 = *very certain* was used.

Intention for healthy eating at T1 and T2

The intention for healthy eating was measured by a single item "I intend to eat healthily and in a balanced way in the future" on a 7-point scale with 1 = *not at all (0%)* and 7 = *absolutely (100%)*. This item was based on Schwarzer and Renner (2000; cf. Schwarzer, 2008).

Eating behavior at T1 and T3

Food intake was assessed with a validated food frequency questionnaire (Winkler & Döring, 1998). Participants were asked how often on average they eat food items from 15 different selected food categories (e.g., whole meal products, vegetables, fruits, chocolate, cake, meat, and salty snacks), ranging from 1 = *nearly once a day* to 6 = *never*. These 15 food categories were accumulated into a food frequency index reflecting dietary quality with a possible range of 0 to 30.

Grouping variables

According to common classifications (Bowen & Skirbekk, 2017; Rechel et al., 2013) three *age groups* were specified, with younger adults ranging from 18 to 35 years (n = 525),

middle-aged adults ranging from 36 to 64 years (n = 562), and older adults at 65+ years (n = 227). Educational level was assessed according to the International Standard Classification of Education (ISCED; UNESCO, 2011). Of all participants, 6.4% (n = 84) reported a low (at most 9 years of education), 30.9% (n = 406) a medium (secondary school), and 62.7% (n = 824) a high (qualifying for university admission) level of education.

Controls

Besides age and educational level (except when used as grouping variables), control variables in all analyses were gender (female = 0, male = 1), BMI, and number of illnesses as well as baseline intention and eating behavior. BMI was calculated as weight in kilograms divided by height in meters squared. Height was determined to the nearest 0.1 cm using a wall-mounted stadiometer and weight was measured using a digital scale (Omron Body Composition Monitor, BF511) to the nearest 0.1 kg. The number of illnesses was assessed using a list of 10 self-reported health problems: heart and circulatory complaints, including heart attack, stroke, or heightened blood pressure, heightened cholesterol, liver or kidney diseases, gall diseases, diabetes, adiposity, gout diseases or heightened uric acid, or chronic obstructive pulmonary disease (COPD). Number of illnesses ranged from 0 to 5, with 186 (14.2%) participants reporting at least one health problem. Table 1 displays the means and/or frequencies as well as the bivariate relationships among study variables.

Data Analyses

Data were analyzed using Mplus 7 with full information maximum likelihood estimation (FIML) to account for missing data and longitudinal drop-out. FIML uses all baseline information to estimate models accounting for biases of selective longitudinal sample attrition (Little & Rubin, 2002). The direct effect of SPA (T1) on eating behavior (T3) was estimated as multiple regression model, controlling for baseline eating behavior. Thus, effectively, change in eating from T1 to T3 was predicted. The serial mediation models, specified in accordance with Hayes (2013), were estimated for the whole sample. Indirect effects were evaluated with 95% confidence intervals using 1,000 bootstraps. Age and educational differences were tested via multigroup models. The paths for the mediation were step by step constrained to be equal, using χ^2-difference tests to assess change in model fit. First, the effect was set equal across all three groups. Given a significant χ^2-difference, indicating group differences in strength of effects, equality constraints were repeatedly set for two of the three groups to determine which groups were different.

Results

Drop-out Analysis

Of the initial sample at T1 (N = 1,321), 764 participants were lost to attrition over time. The longitudinal sample (N = 557) did not differ from the drop-out sample in terms of gender (57% vs 61% women), $\chi^2(1) = 2.20$, $p = .14$, BMI (24.2 vs 23.9 kg/m^2), $t(1300) = 1.46$, $p = .15$, or study variables (i.e., SPA, self-efficacy, eating behavior), $|t| \leq 1.50$, $p \geq .13$. The longitudinal sample was on average 7 years older than the drop-out sample, 47.9 versus 40.8 years, $t(1312) = 7.40$, $p < .001$, and slightly better educated, 15.8 versus 15.4 years of education, $t(1284) = 3.39$, $p = .001$.

Table 1. Descriptive Statistics and Bivariate Correlations of Study Variables

		Mean *(SD)* or %	1	2	3	4	5	6	7	8	9	10
1	Age (18–92 years)	43.8 (17.6)	1									
2	Gender (% female)	59.2	−0.05	1								
3	Years of education (8–20)	15.6 (2.5)	−0.01	0.05	1							
4	BMI T1 (15.9–44.8 kg/m^2)	24.0 (3.7)	0.24***	0.17***	−0.11***	1						
5	Illnesses T1 (0–5) (% ≥ 1)	14.2	0.34***	0.08**	−0.07*	0.22***	1					
6	SPA T1 (1–4)	3.04 (0.46)	−0.08**	−0.06*	−0.05	−0.02	−0.02	1				
7	Eating behavior T1 (0–30)	15.1 (3.5)	0.27***	−0.15***	0.05	−0.04	0.06*	0.05	1			
8	Eating behavior T3 (0–30)	15.3 (3.6)	0.30***	−0.12**	0.05	−0.04	0.09*	0.12**	0.69***	1		
9	Self-efficacy T1 (1–4)	2.56 (0.55)	0.01	−0.01	−0.01	−0.12***	−0.07*	0.14***	0.27***	0.27***	1	
10	Intention T2 (1–7)	5.48 (1.07)	0.02	−0.11**	0.02	−0.08*	0.00	0.14***	0.25***	0.31***	0.33***	1

Note: Descriptive statistics refer to the raw, unweighted data without imputations. Potential value ranges are in parentheses. All of the variables were coded such that higher values indicate "more" of the construct. BMI = Body mass index; ISCED = International Standard Classification of Education; SD = Standard deviation; SPA = Self-perceptions of aging. *$p < .05$; **$p \leq .01$; ***$p < .001$.

Impact of SPA on Change in Eating Behavior

The results of the multiple regression analyses are displayed in Table 2. Most importantly, more positive SPA predicted more healthy eating from T1 to T3, $b = 0.68$, $SE = 0.24$, $p = .01$. Furthermore, eating behavior patterns were slightly more favorable in older adults, $b = 0.03$, $SE = 0.01$, $p < .001$, and in women, $b = -0.53$, $SE = 0.23$, $p < .001$. Level of education per se did not significantly relate to healthiness of eating, nor did BMI or number of illnesses. The regression model explained 50.1% of variance in change in eating behavior from T1 to T3. In sum, results reveal a direct effect of positive SPA on more favorable eating behavior over one year.

Social-Cognitive Processes as Partial Serial Mediators

The results of the serial mediation model for the whole sample are shown in Figure 2. All relevant paths of the mediation model were significant: SPA predicted self-efficacy ($b = 0.17$, $SE = 0.04$, $p < .001$) that in turn predicted intention half a year later ($b = 0.62$, $SE = 0.08$, $p < .001$) and resulted in healthier eating over the time course of one year ($b = 0.38$, $SE = 0.12$, $p = .001$). The indirect effect of SPA on eating behavior via self-efficacy and intention was significant, $b = 0.04$, $p = .02$, 95% CI [0.02, 0.08]. Indicating partial mediation, the direct effect of SPA on eating behavior remained significant, $b = 0.52$, $SE = 0.23$, $p = .02$. The model explained 51.6% of variance in change of eating behavior over 1 year. In sum, results support the serial mediation of SPA on eating behavior via self-efficacy and intention.

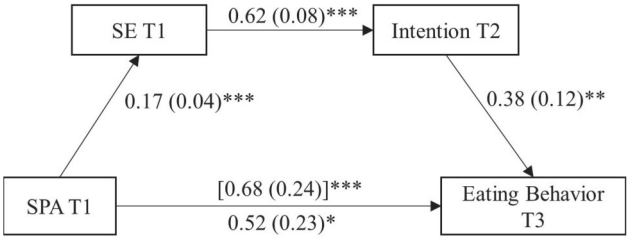
Age Group Differences

Figure 3A shows the results of the serial mediation models for the three age groups. First, all paths of the serial mediation were freely estimated for the three age groups. The first model was defined without any constraints, resulting in a perfect fit, $\chi^2 = 0$, $df = 0$, RMSEA = 0, CFI = 1. Setting the effects of control variables and the paths not included in the serial mediation (self-efficacy on eating behavior and SPA on intention) equal across age groups did not significantly reduce model fit, $\Delta\chi^2 = 38.00$, $\Delta df = 30$, $p = .15$. This model serves as the baseline for the following model comparisons. Step by step the paths were set equal and models

Table 2. Unstandardized and Standardized Coefficients of the Multiple Regression Model Predicting Eating Behavior at T3 by Self-perceptions of Aging at T1 and Control Variables

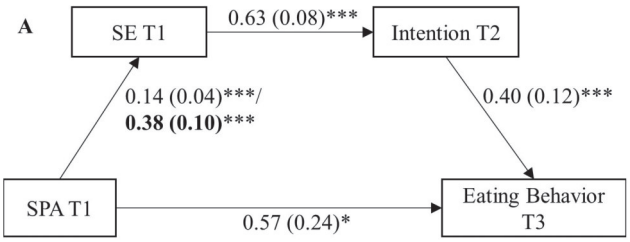
	b (*SE*)	*β* (*SE*)	*p*
Age	0.03 (0.01)	0.15 (0.04)	<.001
Gender (female = 0, male = 1)	−0.53 (0.23)	−0.07 (0.03)	.02
Education (ISCED)	0.35 (0.20)	0.06 (0.03)	.08
Eating behavior T1	0.65 (0.03)	0.63 (0.03)	<.001
BMI T1	−0.02 (0.03)	−0.02 (0.03)	.48
Illnesses T1	0.21 (0.20)	0.03 (0.03)	.31
SPA T1	0.68 (0.24)	0.09 (0.03)	.01

Note: BMI = Body mass index; ISCED = International Standard Classification of Education; SE = Standard error; SPA = Self-perceptions of aging.

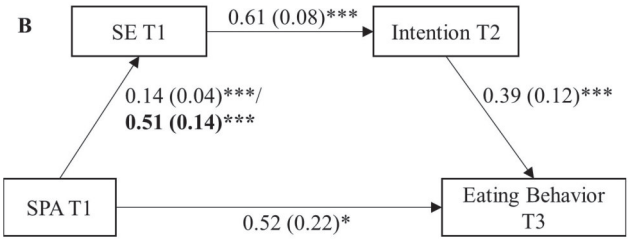


Indirect effect SPA via SE, intention on eating behavior $b = 0.04$, $p = .02$, CI95[.02, .08]

Figure 2. Results of the serial mediation of the direct effect of self-perceptions of aging (SPA) on eating behavior via self-efficacy (SE) and intentions. *$p < .05$; **$p < .01$; ***$p < .001$; effect estimates of the unstandardized (b) solution and standard errors (in parentheses); total effect of eating behavior on self-perceptions of aging (SPA) in brackets; controlling for gender, age, education, body mass index, number of illnesses, intention T1, eating behavior T1.



Young and middle aged adults: Indirect effect SPA via SE and intention on eating behavior $b = 0.03$, CI95[.01, .07]
Older adults: Indirect effect SPA via SE and intention on eating behavior $b = 0.10$, CI95[.03, .20]



Lower educated group: Indirect effect SPA via SE and intention on eating behavior $b = 0.12$, CI95[.04, .25]
Middle and high educated groups: Indirect effect SPA via SE and intention on eating behavior $b = 0.03$, CI95[.01, .08]

Figure 3. Results of the serial mediation of the direct effect of self-perceptions of aging (SPA) on eating behavior via self-efficacy (SE) and intentions in the three age groups (A) and three educational groups (B). *$p < .05$; ***$p < .001$; coefficients printed in bold for oldest age group and lowest educational group if significantly different from the other two groups, respectively; (A) controlled for gender, education, BMI, illnesses, intention T1, eating behavior T1; (B) controlled for gender, age, BMI, illnesses, intention T1, eating behavior T1.

were compared via χ^2-difference tests. The direct effect of SPA on eating behavior was of equal strength in all three groups, $b = 0.57$, $\Delta\chi^2 = 4.98$, $\Delta df = 2$, $p = .08$. The effect of SPA on self-efficacy could not be set equal across the three age groups without significant loss of fit, $\Delta\chi^2 = 6.25$, $\Delta df = 2$, $p = .04$. While the coefficient of the younger age group could be set equal with that of the middle age group, $b = 0.14$, $\Delta\chi^2 = 1.09$, $\Delta df = 1$, $p = .29$, it was significantly lower than that of the older age group, $b = 0.38$, $\Delta\chi^2 = 5.16$, $\Delta df = 1$, $p = .02$. The effect of self-efficacy on intention was equal across all three age groups, $b = 0.63$, $\Delta\chi^2 = 5.00$, $\Delta df = 2$, $p = .08$. Similarly, the regression coefficient of intentions on eating behavior was equal in all age groups, $b = 0.63$, $\Delta\chi^2 = 0.43$, $\Delta df = 2$, $p = .81$.

Despite the indirect effect appearing stronger in older adults, $b = 0.10$, 95% CI [0.03, 0.20], as compared to middle-aged or younger adults, $b = 0.03$, 95% CI [0.01, 0.07], the overlap in confidence intervals indicates a non-significant difference. The models for young, middle and older adults explained 49.4%, 45.6%, and 54.4% of variance in eating behavior over 1 year, respectively. In sum, results show that the relationship between SPA and self-efficacy that longitudinally coincides with more healthy eating behavior is stronger in older ages.

Testing the moderation effect with a continuous instead of categorical age variable showed highly similar results with a significant moderation of the path SPA on self-efficacy ($b = .01$; $p = .02$). No significant age differences were found in the indirect effect.

Educational Differences

Figure 3B shows the results of the serial mediation models for the three educational groups. First, all paths of the serial mediation were freely estimated for the three educational groups resulting in a perfect model fit, $\chi^2 = 0$, $df = 0$, RMSEA = 0, CFI = 1. Setting the effects of control variables and the paths not included in the serial mediation (self-efficacy on eating behavior and SPA on intention) equal across educational groups did not significantly reduce model fit, $\Delta\chi^2 = 33.59$, $\Delta df = 30$, $p = .30$. Step by step the paths of the mediation were set equal and models were compared via χ^2-difference tests. The direct effect of SPA on eating behavior was of equal strength in all three educational groups, $b = 0.52$, $\Delta\chi^2 = 5.85$, $\Delta df = 2$, $p = .053$, whereas the effect of SPA on self-efficacy was not, $\Delta\chi^2 = 9.85$, $\Delta df = 2$, $p = .01$. Whereas model fit decreased substantially by setting the coefficient equal across low and middle educational groups, $\Delta\chi^2 = 6.35$, $\Delta df = 1$, $p = .01$, or low and high educational groups, $\Delta\chi^2 = 9.78$, $\Delta df = 1$, $p = .001$, the effect was of equal strength in middle and high educational groups, $b = 0.14$, $\Delta\chi^2 = 0.64$, $\Delta df = 1$, $p = .42$. The effect of SPA on self-efficacy was significantly stronger for the lower educated group ($b = 0.51$, $p < .001$) as compared to the middle and high educational groups. There were no educational differences in the effects of self-efficacy on intention, $b = 0.61$, $\Delta\chi^2 = 0.87$, $\Delta df = 2$, $p = .65$, and of intentions on eating behavior, $b = 0.39$, $\Delta\chi^2 = 1.58$, $\Delta df = 2$, $p = .45$.

The indirect effect seemed to be strongest in the low educational group, $b = 0.12$, 95% CI (0.05, 0.25), and of equal strength in the middle and highly educated groups, $b = 0.03$, 95% CI (0.01, 0.08), but again, the overlap in confidence intervals indicates a non-significant difference. The models for the low, middle, and highly educated adults explained 57.6%, 52.2%, and 49.7% of variance in eating behavior over 1 year, respectively. In sum, results demonstrate that the relationship between SPA and self-efficacy fostering more healthy eating behavior over one year is stronger in lower educated persons as compared to higher educated persons.

Discussion

Using 12-month observational data of a general population sample aged 18–92 years, this study demonstrated that, first, more positive SPA predicted a healthier eating pattern and that, second, these effects were partially mediated via higher action self-efficacy and in turn increased intentions for healthy eating. Third, although these mechanisms were valid in all groups of age and educational level, the influence of aging self-perceptions on self-efficacy was strongest in people above 65 years of age or low in education (at most 9 years of education).

Concerning our outcome measure, it is important to point out that, for the first time, we demonstrated the longitudinal effects of SPA using a detailed food-frequency questionnaire. Before, the link between SPA and nutrition or eating behavior was only roughly studied subsuming a nutrition single-item into a combined health behavior measure (Levy & Myers, 2004; Stewart, Chipperfield, Perry, & Weiner, 2012) or qualitatively describing the health behavior of different aging perception types or dispositions in cross-sectional research (Bardach et al., 2016; Huy et al., 2010).

Furthermore, our study allows opening the black box of the specific mechanisms and dynamics of the health enhancing effects of SPA. To elucidate the behavioral path suggested by the Stereotype Embodiment Theory (Levy, 2003; 2009) and combine it with psychological processes, we consulted the ontological depth of validated health behavior models (see Sheeran et al., 2017, for an overview). Specifically, we assumed that SPA as superordinate cognitive evaluations of aging might link to pertinent behavior-specific social-cognitive predictors, namely motivational self-efficacy that substantially contributes to forming an intention, which is a volitional precondition for more favorable eating behavior (see Figure 1). The coaction of established constructs from health behavior change theories has extensively been shown to be valid irrespective of age and culture (see Sheeran et al., 2017). Hence, it seems plausible that relationships between self-efficacy, intention, and healthy eating were stable across age and

education groups. Interestingly, the influence of aging self-perceptions on self-efficacy was stronger in older and less educated people than in younger and more educated people. Adding to the knowledge on life-span formation and outcomes of SPA, however, results still showed that effects of SPA—albeit being more pronounced in older adults—were already meaningful in younger and middle-aged participants. It seems that SPA as a crucial factor for identity and development of the self (Diehl et al., 2014) are not only shaped from younger ages on (Levy, 2003), but even gain behavioral relevance early in life. Given an increased priority of health and health-related goals with advancing age together with even more salient aging experiences and higher awareness of aging-related changes (Diehl et al., 2014; Levy, 2009), it makes also sense that SPA effects culminate in old age.

As such this study serves as a primer demonstrating the utility of combining the two lines of research concerning developmental processes and health outcomes of views on aging and pertinent social-cognitive determinants of health behavior. Future research needs to substantiate the validity of this theoretical synthesis, possibly also referring to relevant motivation theories (cf. Robertson, Savva, King-Kallimanis, & Kenny, 2015). Microlongitudinal study designs could further our understanding of in-depth dynamics and should be accompanied by seminal model building and calibration that will guide the development of effective interventions.

Both increasing age and a lower educational level are crucial risk factors for a healthy diet in older adults. Little education is a well-known risk factor for health and health behavior per se, while simultaneously entailing the risk for poverty, dependency, and depression, which are discrete nutritional risk factors themselves (Brown, 2016). Physiological risks like not meeting the increased need for nutrient-density or the sociostructural risks of being widowed, living alone, and eating alone accelerate the risk of malnutrition in old age (de Castro, 2002; Vesnaver & Keller, 2011). Moreover, through the increased hazards of low socioeconomic resources, loneliness, and low education, along with negative SPA, older people face a cumulated risk of impaired health behavior and, in particular, eating behavior (Dogra, Al-Sahab, Manson, & Tamim 2015; Shatenstein et al., 2013). The fact that SPA tackle a favorable and productive health behavior dynamic, especially in these vulnerable groups of older and less educated people, underpins the significance of our results.

Implications

Given the compelling evidence for the health-related effects of aging self-perceptions (e.g., Miche et al., 2015; Westerhof et al., 2014) and the pertinent role of SPA in the dynamics underlying healthy eating that our study revealed, the recommendation to also tackle SPA to foster health and health behavior suggests itself. For the domain of physical activity, it was recently shown that combating negative views on aging by small-group interventions resulted in improvements of views on aging and subsequently higher levels of physical activity (Brothers & Diehl, 2017; Wolff, Warner, Ziegelmann, & Wurm, 2014). Multicomponent interventions combined established health behavior-change techniques with correcting false beliefs about aging and practicing to modify counterproductive automatic thoughts (Wolff et al., 2014) or, similarly, with combatting age myths and explaining self-stereotyping (Brothers & Diehl, 2017). Other approaches proposed to change individual SPA are subliminal strengthening of positive age-stereotypes (Levy, Pilver, Chung, & Slade, 2014) and physical activation providing positive aging-related mastery experiences (Klusmann et al., 2012).

On a societal level, promoting positive intergenerational interactions, education about age and aging, and changing media portrayals of older people have been suggested (Kotter-Grühn, 2015). Since age-stereotypes are formed in early life and internalized over the life span, it seems vital to foster more positive age perceptions in younger people (Randler, Vollmer, Wilhelm, Flessner, & Hummel, 2014; Wurtele & Maruyama, 2013). The sustainability of these approaches and the systematic study of target groups and sociodemographic factors like socioeconomic status and education are matters for future research.

Limitations and Future Research

As typical of longitudinal field studies (e.g., Renner et al., 2008; Wurm et al., 2010), our community-based sample showed drop-outs over time. We used FIML estimation to account for missing data using all baseline information for the estimation of models to account for biases of selective longitudinal sample attrition (Little & Rubin, 2002). Nevertheless, our rather highly educated sample (62.7% of participants had an educational level qualifying for university admission as opposed to 27.9% in the German general population in 2013) was recruited from a region with a low unemployment rate and relatively high economic status. Still, our participants can be regarded as representative of the German population in terms of gender, BMI, mean age, and age distribution (Federal Statistical Office/Statistisches Bundesamt Destatis, 2017). In future research, specific information on reasons for non-show at study waves might help clarifying potential sample biases that go beyond drop-out analyses of sociodemographic variables.

Views on aging are conceptualized in many different manners in the literature and it is not quite clear what the difference between various operationalizations is. According to Diehl and colleagues (2014), an explicit understanding of one's own aging-process seems crucial for allowing people to take active control in terms of planning and acting for good health and quality of life. In line with this notion, we

assessed SPA via explicit judgments of one's aging-related self-regulatory capacities rather than capturing general feelings about age and aging (e.g., felt age or attitudes towards own aging). However, it would be important to investigate whether this assumption holds in future research.

The serial mediation model across three measurement points is not able to rule out the directionality of the path between SPA and self-efficacy as both concepts were measured at study entry. Future studies could try to capture the directionality of effects more adequately using even more measurement points and might also consider dynamic feedback loops among the variables. Especially in old age, successfully enacting health behavior provides meaningful mastery experiences that, in turn, might help to counteract unfavorable SPA (Klusmann et al., 2012).

Aging self-perceptions' effects were only partially mediated via the social-cognitive chain. Thus, future studies could consider including additional variables like, for example, outcome expectancies, risk perceptions, subjective norms, or degree of self-determination (Klusmann, Musculus, Sproesser, & Renner, 2016; Klusmann & Notthoff, in press). By focusing on self-efficacy and intentions, however, we included the most well-established constructs of health-behavior models with empirically proven significance (Renner & Schwarzer, 2005; Schwarzer & Renner, 2000). Given the age- and education-differential importance of SPA as regards the health-enhancing social-cognitive chain that our study revealed, thorough model building should also address life span and socioeconomic peculiarities (cf. Diehl et al., 2014).

Conclusion

Using 1-year longitudinal general population data from a sample aged 18–92 years, our study is the first to demonstrate *that* and *how* aging self-perceptions do influence changes in eating behavior. Integrating the well-established constructs of self-efficacy and intention from health behavior models, we succeeded in opening the black box of aging self-perceptions' efficacy. Specifically, we were able to show that the perception of increasing self-knowledge accompanying aging helps activate a productive health behavior change dynamic via a twofold mediation process. Self-perceptions nudge self-efficacy, a precondition for building an intention for health behavior that in turn drives healthy eating (see Figure 1). Importantly, the effects of SPA on self-efficacy were most meaningful for the vulnerable groups of older adults and those with low education. These findings have important implications for interventions seeking to increase healthy eating and health in general. An additional focus on SPA will likely increase the success of health programs. Reaching crucial importance in old age and given low education, it seems nevertheless straightforward to tackle SPA already at younger ages to initiate lifelong productive development.

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