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Maxime Deshayes, Karine Corrion, Raphael Zory, Olivier Guérin, Frédéric Chorin, et al.. Relationship between personality and physical capacities in older adults: The mediating role of subjective age, aging attitudes and physical self-perceptions. *Archives of Gerontology and Geriatrics*, 2021, 95, pp.104417. 10.1016/j.archger.2021.104417 . hal-03209231

HAL Id: hal-03209231

<https://hal.science/hal-03209231>

Submitted on 24 Apr 2023

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Title:

Relationship between personality and physical capacities in older adults: the mediating role of subjective age, aging attitudes and physical self-perceptions

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Declarations of interest : none

1 **Abstract**

2
3 Walking speed and muscular strength are two main markers of health in adulthood.
4 Previous studies have shown that personality traits may predict these two outcomes. However,
5 little is known about the mechanisms underlying these relationships. Thus, the present study
6 examined whether personality traits are associated with walking speed and muscular strength
7 through the mediating role of subjective age (how young or old individuals experience
8 themselves to be), attitudes toward aging and physical self-perceptions.

9 Community-dwelling older women ($N = 243$; $M_{\text{age}} = 73.0$; $SD_{\text{age}} = 6.5$) were recruited.
10 For reasons of recruitment feasibility, participants were only older women. They were
11 requested to complete a questionnaire measuring personality, subjective age, attitudes toward
12 aging and physical self-perceptions. Following this, their walking speed and their muscular
13 strength were investigated. Data were analyzed using structural equation modeling. In line
14 with the literature, we extended the associations between extraversion, neuroticism,
15 conscientiousness and walking speed and between conscientiousness, neuroticism, openness
16 and muscular strength. Physical self-perceptions appear to be a robust mediator between
17 personality traits and walking speed whereas attitudes toward aging and subjective age
18 mediated the personality traits/muscular strength relationship.

19 This study provides evidence, for the first time, that the associations between
20 personality traits and physical capacities are different according to the physical capacities
21 investigated. Based on these results, it could be interesting to adapt physical activity
22 interventions to the psychological profile of older adults.

23
24 Key-words: personality; physical capacities; aging; subjective age; physical self-
25 perceptions; attitudes toward aging

33 **Introduction**

34 Aging is a gradual, highly variable, life-long process notably characterized by a
35 progressive impairment of physical capacities, such as a reduction in walking speed or a
36 decrease in strength (e.g., Milanovic et al., 2013). These capacities are considered as major
37 health-related markers with increasing age (Fried et al., 2001). This physical deconditioning
38 has been linked to a multitude of maladaptive effects, such as a decrease in quality of life, the
39 emergence of the frailty syndrome or an increase in mortality risk (e.g., Fried et al., 2001;
40 Fusco et al., 2012; Landi et al., 2016). In order to limit these negative effects, effective
41 approaches to help older people to maintain a healthy and active life are urgently needed.
42 Several authors have therefore attempted to identify protective psychosocial markers, such as
43 personality traits, with regard to functional limitations (e.g., Jaconelli, Stephan, Canada, &
44 Chapman, 2013; Krueger, Wilson, Shah, Tang, & Bennett, 2006; Terracciano, Stephan,
45 Luchetti, Albanese, & Sutin, 2017; Stephan, Sutin, Luchetti, Bosselut, & Terracciano, 2018;
46 Wilson, Mendes de Leon, Bennett, Bienias, & Evans, 2004). The present study focused on the
47 extent to which functional capacities reflect individuals' personality traits and the mediators
48 of the relationships between them.

49 At present, the factorial model of personality known as the Big Five is the most
50 extensively used option in clinical and healthcare settings and research. The five explanatory
51 elements of personality were suggested for the first time by McDougall (1932) and then
52 supported by the work of Norman (1963). Despite criticisms of the Big Five (e.g., Mischel,
53 1976), this model has been refined through empirical studies and factorial analyses and has
54 demonstrated replicability, suggesting a certain consistency in the personality structure. The
55 Five-Factor model (Digman, 1990) consists of five broad trait dimensions of personality:
56 conscientiousness (the tendency to be disciplined and thoughtful), extraversion (the tendency
57 to experience positive emotions and to be sociable), openness (the tendency to be curious and
58 to entertain new ideas), agreeableness (the tendency to be altruistic and cooperative) and
59 neuroticism (i.e., the tendency to experience distress and anxiety). Several instruments have
60 been designed to measure it, such as the Big Five Inventory (i.e., BFI; John, Donahue, &
61 Kentle, 1991), the Revised Neo Personality Inventory (i.e., NEO-PI-R; Costa & McCrae,
62 1992), the Midlife Development Inventory (i.e., MIDI; Lachman & Weaver, 1997), and the
63 Big Five Questionnaire (BFQ; Caprara, Barbaranelli, & Borgogni, 1993).

64 Over the past decades, personality traits have been linked to many health-related
65 outcomes such as the risk of death (e.g., Wilson et al., 2004), incident disabilities (e.g.,
66 Krueger et al., 2006), cognitive declines (e.g., Terracciano et al., 2017), participation in

67 physical activities (e.g., Stephan et al., 2018), and self-reported physical capacities (e.g.,
68 Jaconelli et al., 2013). More recently, personality traits have been shown to be linked to
69 objective physical capacities, especially walking speed and muscular strength (e.g., Buchman
70 et al., 2013; Mueller et al., 2016; Stephan, Sutin, Bovier-Lapierre, & Terracciano, 2018;
71 Stephan, Sutin, Canada, & Terracciano, 2017; Sutin, Stephan, & Terracciano, 2018; Tolea,
72 Costa et al., 2012; Tolea, Terracciano, Milaneschi, Metter, & Ferrucci, 2012), considered as
73 two of the major markers of the frailty syndrome (Fried et al., 2001). These studies found, for
74 example, that older individuals who have lower neuroticism and higher conscientiousness,
75 extraversion and openness have higher walking speed (e.g., Stephan et al., 2017; Sutin et al.,
76 2018; Tolea, Costa et al., 2012) and higher muscular strength (e.g., Mueller et al., 2016;
77 Tolea, Terracciano et al., 2012).

78 While the associations between personality traits and physical capacities appear to be
79 robust, very few studies have attempted to explain the mechanisms through which these
80 relations operate. However, defining these mediators may be important to identify people at
81 risk and could enable more individualized care. In the present research, we focused on three
82 potential mediators: (i) subjective age (how young or old individuals experience themselves to
83 be, measured with 4 items used in several studies (e.g., Stephan, Caudroit, & Chalabaev,
84 2011)), (ii) physical self-perceptions, and (iii) attitudes toward aging. These mediators were
85 chosen for several reasons: firstly, a growing body of research has shown that personality
86 traits are linked to these three variables (e.g., Bryant et al., 2016; Stephan, Demulier, &
87 Terracciano, 2012; Takahashi, Edmonds, Jackson, & Roberts, 2013) and, secondly, these
88 same variables have been associated with physical capacities (e.g., Amesberger, Finkenzeller,
89 & Müller, 2011; Robertson, Savva, King-Kallimanis, & Kenny, 2015; Stephan, Sutin, &
90 Terracciano, 2015). For example, studies have highlighted that individuals with higher
91 openness and extraversion have been shown to have a younger subjective age (Stephan et al.,
92 2012; see also Canada, Stephan, Caudroit, & Jaconelli, 2013; Takatori, Matsumoto, Miyazaki,
93 Yamasaki, & Moon, 2019). In addition, participants with a younger subjective age
94 demonstrated higher muscular strength and walking speed (e.g., Stephan, Chalabaev, Kotter-
95 Grünh, & Jaconelli, 2013; Stephan et al., 2015; see also Takatori & Matsumoto, 2018). In the
96 same vein, some personality traits (e.g., conscientiousness; openness to experience) have been
97 linked to physical self-perceptions (e.g., Emile, Chalabaev, Stephan, Corrion, & d'Arripe-
98 Longueville, 2014; Takahashi et al., 2013; see also Su, Li, Yu, & Sun, 2017; Yu, Chao, &
99 Cheng, 2014), and these physical self-perceptions are associated with physical capacities such
100 as muscular strength (e.g., Amesberger et al., 2011; see also Amesberger, Finkenzeller,

101 Müller, & Würth, 2019; Sales, Levinger, & Polman, 2017). Finally, some personality traits
102 are related to positive attitudes toward aging (e.g., extraversion, agreeableness) while others
103 are linked to negative attitudes (e.g., neuroticism) (e.g., Bryant et al., 2016; see also, Kornadt,
104 Siebert, & Wahl, 2019). Attitudes toward aging have also been linked to physical capacities
105 (e.g., Robertson et al., 2015; see also Singh, Ibrahim, Kei, & Subramaniam, 2018). For
106 example, Robertson et al. (2015) found that negative attitudes toward aging were negatively
107 associated with walking speed. However, no studies have explored the potential mediating
108 role of these three variables in the relationship between personality traits and physical
109 capacities. Based on these studies, it is reasonable to expect that these variables may mediate
110 these relations.

111 Thus, the current cross-sectional study was initiated to investigate the association
112 between personality traits and two major physical capacities: walking speed and muscular
113 strength, and the underlying psychological mechanisms. As we now know that findings in
114 psychological research have issues of low reproducibility and replicability (see Open Science
115 Collaboration, 2015), the first aim was to observe whether previous results showing an
116 association between personality traits and walking speed or muscular strength could be
117 replicated (e.g., Buchman et al., 2013; Mueller et al., 2016; Stephan, Sutin, Bovier-Lapierre et
118 al., 2018; Stephan et al., 2017; Sutin et al., 2018; Tolea, Costa et al., 2012; Tolea, Terracciano
119 et al., 2012). Based on the literature, the second aim was to identify to what extent subjective
120 age, physical self-perceptions and attitudes toward aging mediate the relationships between
121 personality traits and walking speed and between personality traits and muscular strength in
122 older adults.

123

124 **Method**

125

126 **Research design and data collection**

127 This study employed a quantitative approach, with data collected from adults aged 60 or
128 older. Participants were drawn from the *Frailty* project, which aims to identify the
129 multidisciplinary markers of aging. Approval of the study protocol was obtained (n° 2015-
130 A01188-41). For the present research, 243 voluntary, community-dwelling older women (M_{age}
131 = 73.0; SD_{age} = 6.5) were recruited and invited to the laboratory for a single session, lasting
132 approximately one hour. Only women were included because recruitable participants were
133 mostly women and thus the number of men would not have been large enough to compare
134 their results with those of women. All participants signed an informed consent agreeing to
135 clinical evaluations and had to be free from orthopedic and neurological disturbances. They

136 were informed that the collected data would remain strictly confidential. During the visit,
137 participants were invited to answer a questionnaire measuring personality, subjective age,
138 attitudes toward aging and physical self-perceptions. All questionnaire sessions were held in
139 standardized conditions. Each participant answered the printed questionnaire individually in a
140 quiet room; they were sitting on a chair and there was no communication between the
141 participant and the experimenter. Then, they were requested to perform several physical
142 evaluations. Among them, walking speed and muscular strength were assessed.

143

144 **Materials and measures**

145 In the present study, the variables assessed were: personality (i.e., independent
146 variable), walking speed and muscular strength (i.e., dependent variable), and subjective age,
147 attitudes toward aging and physical self-perceptions (i.e., mediators).

148

149 *Personality*

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151

152 Personality was assessed with the validated French short version of the Big Five
153 Inventory (Courtois et al., 2020; Rammstedt & John, 2007). This scale contains 10 self-
154 descriptive statements that assess neuroticism, conscientiousness, extraversion, openness, and
155 agreeableness (Table 1). Each item was rated on a 7-point Likert scale ranging from 1
156 (strongly disagree) to 7 (strongly agree).

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Instruction: How well do the following statements describe your personality?

167

I see myself as someone who ...

... is reserved [est réservé.e]

... is generally trusting [fait généralement confiance aux autres]

... tends to be lazy [a tendance à être paresseux.se]

... is relaxed, handles stress well [est relaxe, détendu.e, gère bien le stress]

... has few artistic interests [est peu intéressé.e par tout ce qui est artistique]	168
...	169
... is outgoing, sociable [est sociable, extraverti.e]	170
...	171
...	172
... tends to find fault with others [a tendance à critique les autres]	173
...	174
...	175
... does a thorough job [travaille consciencieusement]	176
...	177
...	178
... gets nervous easily [est facilement anxieux.se]	179
...	180
...	181
... has an active imagination [a une grande imagination]	182
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...	184

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Table 1. Big Five Inventory-10 (BFI-10) questionnaire

Note. 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree).

203 *Physical capacities*

204 **Walking speed.** Walking speed was measured using the widely used and validated 10-
205 meter walking test (for a review, see Graham, Ostir, Fisher, & Ottenbacher, 2007). A
206 physiotherapist trained in the use of this measure administered the test in a quiet room. All
207 participants received the same instructions before the test; they were asked to walk at a
208 comfortable speed in an undisturbed 10-m indoor, level, hospital room. Participants
209 performed this test twice in a row, and an Optogait system (OptoGait, Microgate, Bolzano,
210 Italy) was used to quantify the spatiotemporal parameters of the gait cycle. As in previous
211 studies investigating the association between personality traits and walking speed, the best
212 performance was chosen for statistical analyses (e.g., Stephan, Sutin, Luchetti et al., 2018).

213 **Muscular strength.** To evaluate participants' strength, measurements were carried out
214 using an isokinetic ergometer chair (Biodex Medical Systems, Inc, Shirley, NY) with the
215 backrest reclined 5° from vertical, and straps fixing the trunk, waist and distal thigh. The
216 lateral femoral epicondyle was used as the body landmark for matching the rotation axes of
217 the knee joint and the lever arm of the dynamometer. The dynamometer strap was then

218 fastened around the leg 5 cm proximally to the medial malleolus and the subjects performed a
219 series of submaximal contractions for familiarization. Once in position, they were requested
220 to contract the knee extensors as hard as possible at six angular velocities (i.e., 30°/s, 60°/s,
221 90°/s, 120°/s, 150°/s, 180°/s). For each velocity, participants performed three contractions and
222 the best contraction was chosen for data analyses, as in Tolea, Terracciano et al.'s (2012)
223 study, using a similar protocol. A 1-min resting time was allowed between the six angular
224 velocities. The maximum torque was identified as the highest value reached during movement
225 at each constant speed. The linear moment-speed relationship was obtained from the
226 maximum torque value obtained at each imposed speed. The theoretical maximum moment
227 (M_{MAX}) is given by the ordinate at M=0, obtained by extrapolation of the linear relation. All
228 of these relationships and parameters were processed by creating a Matlab script (R2008b,
229 The Mathworks, Natick, Massachusetts, USA).

230 *Mediators*

231 **Subjective age.** Subjective age was assessed using a French version of the valid and
232 reliable scale developed by Barak (1979, 1987). This subscale is composed of 4 items and has
233 demonstrated good psychometric properties in previous French samples (e.g., Stephan et al.,
234 2011). Participants were asked to specify, in years, how old they feel ('I feel as if I was...
235 years'), act ('I act as if I was... years'), look ('I look as if I was... years'), and the age that
236 reflects their interests ('My interests are those of someone who is... years'). The responses of
237 the four items were averaged for statistical analyses.

238 **Physical self-perceptions.** Physical self-worth was assessed with the corresponding
239 subscale of the validated French version of the Physical Self-Perception Profile (i.e., PSI-25;
240 Fox & Corbin, 1989; Ninot, Delignières, & Fortes, 2000). This subscale is composed of 5
241 items including, for example, "*Overall, I am satisfied with my physical capacities.*"
242 Participants were asked to answer these items using a 6-response Likert scale ranging from 1
243 (completely disagree) to 6 (completely agree). A good internal consistency was found for this
244 scale (Cronbach $\alpha = .92$).

245 **Attitudes toward aging.** This variable was measured with the validated French
246 version of the Attitudes Toward Own Aging scale (ATOA; Liang & Bollen, 1983). This scale
247 is composed of 5 items including for example "*I am happier now than I was before.*"
248 Respondents were requested to indicate their agreement for each item on a 7-response Likert
249 scale from 1 (completely *disagree*) to 7 (completely *agree*). The internal consistency of the
250 subscale was satisfactory (Cronbach $\alpha = .70$).

251

252 **Statistical analysis**

253 Data analyses were performed using SPSS.23 and AMOS.23. The analysis allowed the
254 replacement of missing values by using multiple imputation (Li, Stuart & Allison, 2015).
255 Several methods were used for the statistical analyses. We began with descriptive analyses
256 (i.e., mean, standard deviation) and assessed the reliability of the questionnaires with
257 Cronbach's alpha for internal consistency. Pearson bivariate correlations were computed to
258 assess the significance of the relationships between all variables (i.e., extraversion,
259 agreeableness, conscientiousness, neuroticism, openness, subjective age, physical self-
260 perceptions, attitudes toward aging, walking speed and muscular strength; see Table 2).

261 In this study, we tested different hypothetical models using structural equation
262 modeling (SEM). For this, we examined the relationships between personality traits (i.e.,
263 conscientiousness, extraversion, openness, agreeableness and neuroticism) and two physical
264 capacities (i.e., muscular strength and walking speed) through the mediating role of subjective
265 age, physical self-perceptions and attitudes toward aging, using path analysis. For this
266 purpose, several competing mediation models were tested (see Figure 1). For walking speed,
267 the first model tested was a parallel mediation model in which the independent variables (IV)
268 were the five personality traits; subjective age, physical self-perceptions and attitudes toward
269 aging were the mediators; and walking speed was the dependent variable (see Figure 1A).
270 This parallel model was tested as the three potential mediators have been linked to both
271 personality traits and physical capacities (e.g., Amesberger et al., 2011; Bryant et al., 2016;
272 Emile et al., 2014; Robertson et al., 2015; Stephan et al., 2012, 2015; Takahashi et al., 2013).
273 The second model tested was a sequential mediation model in which constructs function as a
274 causal chain. In this case, personality traits (IV) would predict subjective age, which would in
275 turn impacting walking speed. In addition, personality traits would therefore predict attitudes
276 toward aging (first mediator), which would in turn predict physical self-perceptions (second
277 mediator), with an overall effect on walking speed (DV) (see Figure 1B). This sequential
278 model was tested as previous research showed that attitudes toward aging predict physical
279 self-perceptions (e.g., Emile et al., 2014). Concerning muscular strength, the same two models
280 were tested with muscular strength instead of walking speed as the dependent variable (see
281 Figure 1).

282 The robust maximum likelihood estimate was employed. As recommended by several
283 authors (e.g. Byrne, 2005; Hu & Bentler, 1999; Vandenberg & Lance, 2000), goodness of fit was
284 assessed by examining several indices. Four indexes were selected to express model fit: chi-
285 square (χ^2), the root-mean square error of approximation (RMSEA), the Bentler comparative

286 fit index (CFI) and the Tucker-Lewis index (TLI). RMSEA values ≤ 0.08 at 90% confidence
 287 interval (RMSEA CI 90%) in combination with a value for CFI and TLI ≥ 0.90 suggest
 288 acceptable model fit (Byrne, 2005; Hu & Bentler, 1999).
 289

	M	SD	1	2	3	4	5	6	7	8	9	10	
1. Extraversion	3.96	1.10	-										
2. Agreeableness	5.36	.99	.07	-									
3. Conscientiousness	5.64	1.01	.19*	.14*	-								
4. Neuroticism	3.74	1.37	-.05	-.22**	.01	-							
5. Openness	4.86	1.09	.23**	.03	.17*	.02	-						
6. Subjective Age	62.49	9.66	-.18*	-.03	-.15*	.02	-	-					
								.18*					
7. Physical self-perceptions	3.83	1.03	.08	.14*	.12	-.16*		-.09	-				
								.06					
8. Attitudes toward aging	4.03	.62	-.02	.05	.02	-.25**		-.08	.23**	-			
								.02					
9. Walking speed	1.17	.21	.26**	.04	.07	.01		-.24**	-	.16*	-		
								.08		.24**			
10. Muscular strength	196.55	48.90	-.06	-.05	-.03	-.11		-	-.27**	.09	.13*	.18*	-
								.03					

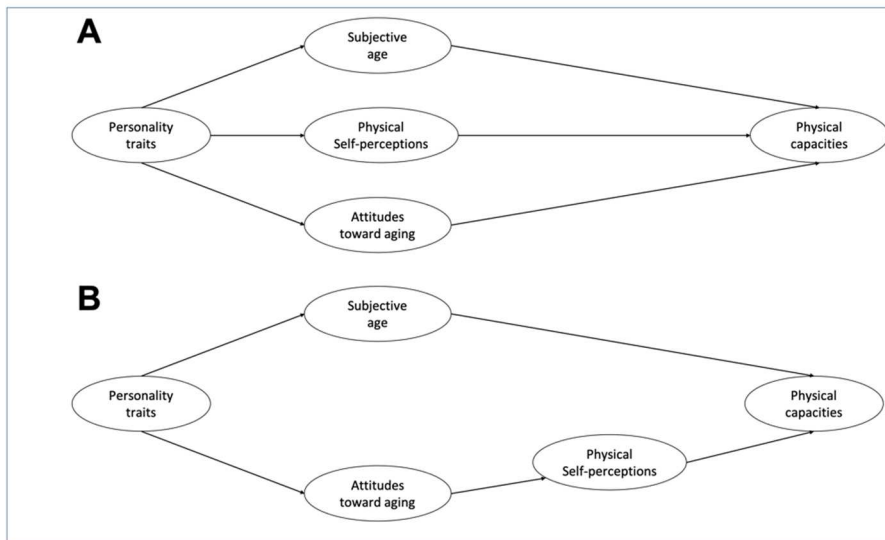
290 **Table 2.** Descriptive statistics and correlation matrix for Pearson's r of measured variables ($N = 243$)

291 *Notes.* M : means; SD : standard deviations; * $p < .05$, ** $p < .01$.

292

293

294



295

296

Figure 1.

297

Hypothetical models of the mediating role of subjective age, attitudes toward aging and physical self-perceptions between personality traits and physical capacities. Figure 1A: parallel model; Figure 1B: sequential model.

298

299

Results

300

Findings are presented in Figures 2 and 3, including all path coefficients that were significant at the 0.05 level.

302

303

Walking speed

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For this first dependent variable, two identified models emerged, with similar satisfactory fit indexes: one using a parallel mediation model (see Figure 2A) and the other with a sequential mediation model (see Figure 2B).

306

307

Parallel mediation model. This model yielded satisfactory fit indexes [χ^2 (57, N= 243) = 119.73, CFI = 0.91, TLI = 0.88, RMSEA = 0.066, CI RMSEA 0.052/0.086]. It accounted for 10% of the variance in walking speed. Our findings indicated that extraversion was positively associated with walking speed both directly ($\beta = 0.22, p < .05$) and through the mediating role of physical self-perceptions. Extraversion was positively related to physical self-perceptions ($\beta = 0.14, p < .05$) which in turn positively predicted walking speed ($\beta = 0.19, p < .05$). In addition, neuroticism was negatively associated with physical self-perceptions ($\beta = -0.25, p < .05$), while this variable positively predicted walking speed ($\beta = 0.19, p < .05$). Also, whereas neuroticism negatively affected attitudes toward aging ($\beta = -0.81, p < .05$), this variable was not related to walking speed. Finally, results indicated that conscientiousness did not predict walking speed, either directly or indirectly, though it was negatively associated with subjective age ($\beta = -0.50, p < .05$). This variable had no effect on walking speed.

319

320 *Sequential mediation model.* This model yielded satisfactory fit indexes [χ^2 (57, N=

321 243) = 115.26, CFI = 0.91, TLI = 0.89, RMSEA = 0.065, CI RMSEA 0.049/0.083]. It

322 accounted for 10% of the variance in walking speed. Firstly, results indicated that

323 extraversion positively predicted walking speed directly ($\beta = 0.21, p < .05$). Secondly,

324 conscientiousness was positively related to walking speed, not directly, but through the

325 mediating role of attitudes toward aging and physical self-perceptions. Conscientiousness was

326 positively related to attitudes toward aging ($\beta = 0.27, p < .05$), which was positively related to

327 physical self-perceptions ($\beta = 0.48, p < .05$), and this in turn predicted walking speed ($\beta =$

328 $0.21, p < .05$). Whereas conscientiousness was negatively associated with subjective age ($\beta = -$

329 $-0.51, p < .05$), this variable did not affect walking speed. Finally, neuroticism was related to

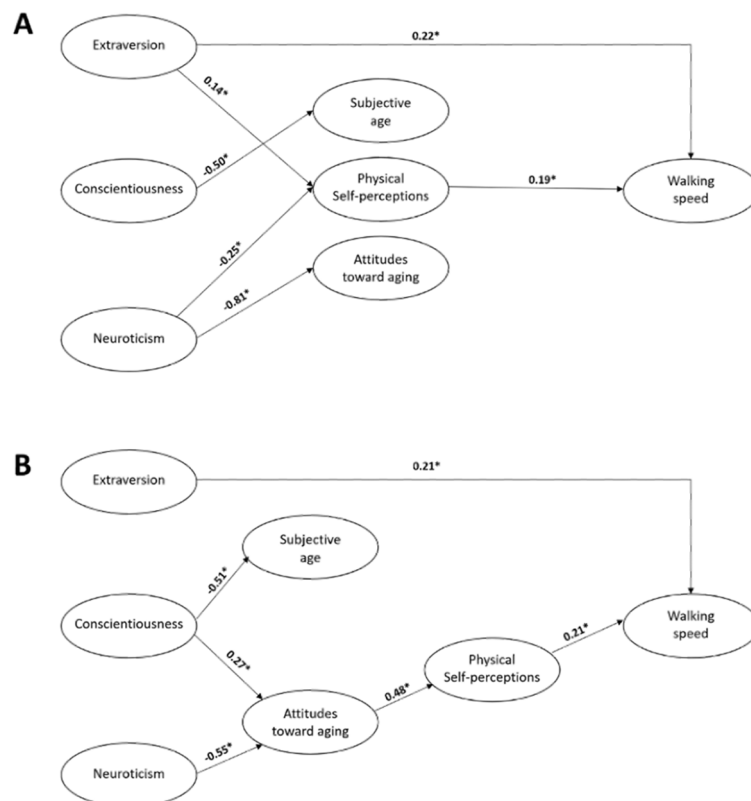
330 walking speed indirectly, through the mediating role of attitudes toward aging and physical

331 self-perceptions. Specifically, neuroticism negatively predicted attitudes toward aging ($\beta = -$

332 $0.55, p < .05$), and this variable was positively associated with physical self-perceptions ($\beta =$

333 $0.48, p < .05$).

334



335

336 Figure 2.

337 Models of the effects of personality traits on walking speed and the mediating role of subjective age, attitudes toward aging

338 and physical self-perceptions. Path values are standardized coefficients. Figure 2A: parallel model; Figure 2B: sequential

339 model.

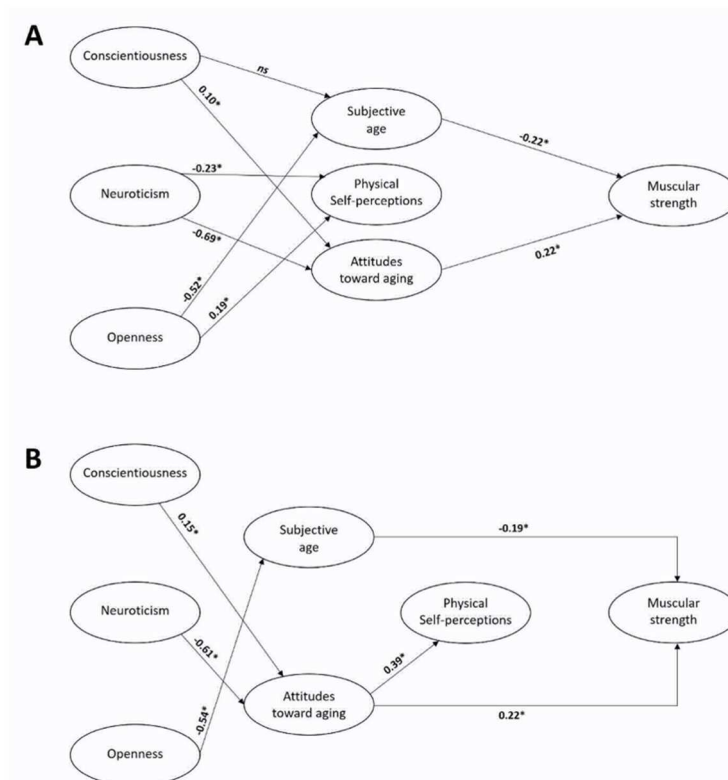
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Muscular strength

For this second dependent variable, the two hypothetical models (the parallel mediation model [Figure 3A] and the sequential mediation model [Figure 3B]) yielded satisfactory fit indexes.

Parallel mediation model. This model yielded satisfactory fit indexes [χ^2 (55, N= 243) = 95.13, CFI = 0.94, TLI = 0.91, RMSEA = 0.055, CI RMSEA 0.036/0.073]. It accounted for 10% of the variance in muscular strength. Our findings indicated that conscientiousness was positively-associated with muscular strength through the mediating role of attitudes toward aging. Specifically, conscientiousness was positively related to attitudes toward aging ($\beta = 0.10, p < .05$), which predicted muscular strength ($\beta = 0.22, p < .05$). In addition, neuroticism was negatively associated with attitudes toward aging ($\beta = -0.69, p < .05$), predicting in turn muscular strength ($\beta = 0.22, p < .05$). Also, openness was positively indirectly associated with muscular strength through the mediating role of subjective age; openness was negatively related to subjective age ($\beta = -0.52, p < .05$), and this variable negatively predicted muscular strength ($\beta = -0.22, p < .001$). Finally, whereas neuroticism and openness to experience were related to physical self-perceptions ($\beta = -0.23, p < .05$; $\beta = 0.19, p < .05$, respectively), this variable did not mediate the relationships between these personality traits and strength.

Sequential mediation model. This model yielded satisfactory fit indexes [χ^2 (57, N= 243) = 93.32, CFI = 0.94, TLI = 0.92, RMSEA = 0.05, CI RMSEA 0.038/0.074]. It accounted for 9% of the variance in muscular strength. Our results indicated that personality traits such as conscientiousness and neuroticism indirectly predicted muscular strength through the mediating role of attitudes toward aging. Indeed, conscientiousness was positively associated with attitudes toward aging ($\beta = 0.15, p < .05$), predicting in turn muscular strength ($\beta = 0.22, p < .05$). In the same vein, neuroticism was negatively related to attitudes toward aging ($\beta = -0.61, p < .05$), which was positively associated with muscular strength ($\beta = 0.22, p < .05$). Finally, openness was related to muscular strength through subjective age. Specifically, this personality trait was negatively associated with subjective age ($\beta = -0.54, p < .05$), which in turn negatively predicted muscular strength ($\beta = -0.19, p < .05$).



374
 375 Figure 3.
 376 Models of the effects of personality traits on muscular strength and the mediating role of subjective age, attitudes toward
 377 aging and physical self-perceptions. Path values are standardized coefficients. Figure 3A: parallel model; Figure 3B:
 378 sequential model.

379
 380
 381 **Discussion**

382 Using a cross-sectional approach, the present research examined the association
 383 between personality traits (i.e., extraversion, conscientiousness, agreeableness, neuroticism,
 384 openness) and physical capacities (i.e., walking speed, muscular strength), through the
 385 mediating role of subjective age, aging attitudes and physical self-perceptions. Overall, the
 386 results showed that both physical capacities were predicted by personality traits and that these
 387 relations were mediated by the different mediators investigated. However, these relationships
 388 appeared different for walking speed and muscular strength.

389 Firstly, concerning the dependent variable “walking speed”, both models (i.e., parallel
 390 and sequential) confirmed the associations between extraversion, conscientiousness,
 391 neuroticism and this outcome (e.g., Stephan, Sutin, Bovier-Lapierre et al., 2018; Sutin et al.,
 392 2018; Tolea, Costa et al., 2012). For example, Stephan et al. (2018) found that lower
 393 neuroticism, higher extraversion and higher conscientiousness are related to higher walking

394 speed. In the same vein, Tolea, Costa et al. (2012) and Sutin et al. (2018) found that higher
395 conscientiousness predicted higher walking speed. However, we found no association
396 between agreeableness or openness and walking speed. For agreeableness, this result appears
397 in line with Stephan, Sutin, Bovier-Pierre et al.'s (2018) and Terracciano et al.'s (2013)
398 studies that found no consistent relation between agreeableness and walking speed,
399 strengthening the idea that agreeableness is not a strong predictor of walking speed.

400 Concerning openness, the absence of an effect is in line with Tolea, Costa et al. (2012)
401 who observed that openness was not associated with walking speed, but it is not in line with a
402 more recent study that found that openness was positively related to walking speed (Stephan,
403 Sutin, Bovier-Lapierre et al., 2018). However, the latter result was observed when each trait
404 was examined separately. When personality traits were investigated simultaneously, openness
405 did not appear as a predictor of walking speed. The different statistical analyses in these two
406 studies may also explain the absence of results. A last explanation of the discrepant results
407 concerning openness could be the measures used. Stephan, Sutin, Bovier-Lapierre et al.
408 (2018) used the Big Five Inventory and the Midlife Development Inventory; Tolea, Costa et
409 al. (2012) used the NEO-Five-Factor Inventory; and we used the French short version of the
410 Big Five Inventory (Courtois et al., 2020; Rammstedt & John, 2007). Furthermore Stephan,
411 Sutin, Bovier-Lapierre et al. (2018) and Tolea, Costa et al. (2012) measured openness to
412 experience whereas we assessed open-mindedness. The differences between these scales may
413 therefore explain in part the discrepant results concerning openness. Through these different
414 studies, openness did not appear as a strong predictor of walking speed. However, it needs to
415 be confirmed in future studies with, for example, an assessment of different facets of
416 openness, as Sutin et al. (2018) did for conscientiousness.

417 We identified two satisfactory models, one using a parallel mediation model and the
418 other using a sequential mediation model. However, while the same personality traits and the
419 same mediators were examined, some relationships appeared different in these two models.
420 For example, in both models, higher extraversion directly predicted higher walking speed.
421 Nevertheless, in the parallel mediation model, extraversion also predicted walking speed
422 indirectly through physical self-perceptions. Furthermore, in the parallel model,
423 conscientiousness was not related, directly or indirectly, to walking speed. However, in the
424 sequential mediation model, conscientiousness predicted attitudes toward aging, which in turn
425 predicted physical perceptions, with an overall effect on walking speed. Finally, these two
426 models also revealed that, among the three mediators tested, physical self-perceptions were
427 the most relevant to predict walking speed, as they played a significant role in both models,

428 although with different routes, whereas subjective age never predicted walking speed, and
429 attitudes toward aging only predicted walking speed through physical self-perceptions.

430 Secondly, concerning the dependent variable “muscular strength,” this study echoes
431 previously reported associations between this capacity and openness, conscientiousness and
432 neuroticism (e.g., Mueller et al., 2016; Sutin et al., 2018; Tolea, Terracciano et al., 2012). For
433 example, Mueller et al. (2016) found that higher neuroticism and lower openness were related
434 to lower muscular strength. Also, Sutin et al. (2018) noted that most of the facets of
435 conscientiousness were positively related to muscular strength. These personality traits seem
436 robust to predict strength whatever the dependent variables measured or the limbs
437 investigated. All the studies exploring the relationship between personality traits and muscular
438 strength used different methodologies. For example, Mueller et al. (2016) and Sutin et al.
439 (2018) measured handgrip strength while Tolea, Terracciano et al. (2012) and the present
440 research measured muscular strength of the knee extensors. Also, Tolea, Terracciano et al.
441 (2012) quantified strength at one angular velocity (i.e., 30°/s) while in the present research we
442 measured the theoretical maximal moment based on contractions performed at six angular
443 velocities (30°/s, 60°/s, 90°/s, 120°/s, 150°/s, and 180°/s). However, among the five traits of
444 personality, we found no associations of agreeableness or extraversion with muscular
445 strength. Concerning agreeableness, the present research is, to the best of our knowledge, the
446 first to explore the predictive role of this personality trait on muscular strength. It suggests
447 that agreeableness would not be a predictor of muscular strength. Most studies investigating
448 the predictive role of agreeableness on other physical capacities found no consistent
449 predictive effect (e.g., Stephan, Sutin, Bovier-Pierre et al., 2018; Terracciano et al., 2013)
450 although a few studies found a positive effect (see Stephan et al., 2017; Terracciano, Stephan,
451 Luchetti, Gonzalez-Rothi, & Sutin, 2017). For example, Terracciano et al. (2017) found that
452 agreeableness positively predicted lung function. More research is needed to identify which
453 physical capacities can be predicted by agreeableness. For extraversion, this result may be
454 considered surprising as extraversion has been linked with many physical capacities, such as
455 walking speed (e.g., Stephan, Sutin, Bovier-Lapierre et al., 2018), aerobic capacity
456 (Terracciano et al., 2013) and lung function (Terracciano et al., 2017). However, in previous
457 studies exploring muscular strength, the results were not as clear as for the other dependent
458 variables investigated. For example, Mueller et al. (2016) did not find any association
459 between muscular strength and extraversion, only that low grip strength attenuated the
460 increase in extraversion several years later. Moreover, in Tolea, Terracciano et al.’s (2012)
461 work, among the different tested models, extraversion was only associated with muscular

462 strength when lifestyle practices were included in the model. In these later studies and the
463 present research, extraversion did not appear as a strong predictor of muscular strength.

464 Interestingly, two satisfactory models emerged, a parallel mediation model and a
465 sequential mediation model. However, contrary to the “walking speed” variable, most of the
466 relationships appeared identical in the two models. Indeed, for both models, neuroticism and
467 conscientiousness predicted muscular strength through attitudes toward aging, and the
468 relationship between openness and muscular strength was mediated by subjective age.
469 Although personality traits predicted physical self-perceptions, they did not mediate the
470 relationships between personality traits and muscular strength.

471 The present study had several strengths, including the investigation of different
472 physical capacities, the use of structural equation models, and the identification of the
473 mediators of the personality traits/physical capacities relationships. However, there are also
474 some limitations. First, for recruitment feasibility reasons, our sample was composed only of
475 women. Yet, some studies have shown that the factors explaining older adults’ physical
476 capacities may differ between men and women (e.g., Inoue et al., 2017), and the results might
477 have been different if we had recruited men. It would thus be interesting to conduct this study
478 again with a gender-balanced sample to compare the results between older men and older
479 women. Second, the psychological measures were self-reported and may thus have been
480 subject to social desirability bias. Third, we used the French short version of the Big Five
481 Inventory (Courtois et al., 2020; Rammstedt & John, 2007). Participants had to answer
482 multiple questionnaires and performed several physical tests. In order to have an acceptable
483 session duration for our participants (i.e., not more than one hour), we used short
484 questionnaires. This short version is especially recommended and considered a valuable tool
485 for personality assessment when it is not possible/not adapted to use longer scales (e.g.,
486 Courtois et al., 2020). However, it would be interesting to replicate this study with another
487 scale to corroborate and extend our results. Fourth, the data were collected and analyzed
488 according to a cross-sectional design. Such data are important for establishing relations as
489 highlighted in the present work, but they are not appropriate to demonstrate causal
490 relationships. Thus, it would be worthwhile to study longitudinal associations to examine
491 whether personality traits predict long-term changes in these physical markers. It has been
492 shown that personality traits can predict the evolution of physical capacities with aging (e.g.,
493 Buchman et al., 2013; Stephan et al., 2017) but the mediators of these relations remain
494 unexplored. Conversely, it might also be interesting to examine the reciprocal relation
495 between physical capacities and personality traits. Although studies have suggested that

496 personality traits are relatively stable, it is unclear whether a modification in physical
497 capacities – induced, for example, through a physical activity program – would influence
498 older adults’ personality traits. This hypothesis echoes Cloninger et al.’s (1993, 1997)
499 findings suggesting that some dimensions of personality are less stable and may be influenced
500 by such factors as experience, learning or interpersonal relationships. Finally, the present
501 research focused on three mediators, chosen for their multiple associations with personality
502 and physical capacities. As the different models defined accounted for approximately only
503 10% of the variance in walking speed and muscular strength, it would be useful to explore
504 other psychological mediators, such as self-rated health or aging stereotypes, which have also
505 been shown to be related to either personality traits (e.g., Emile et al., 2014; Stephan et al.,
506 2020) or physical capacities such as walking (e.g., Neufeld, Machacova, Mossey, &
507 Luborsky, 2013). These variables also appear relevant according to Cloninger et al.’s (1993)
508 initial work, showing that personality is closely related to the way people learn from
509 experience and adapt their feelings, thoughts and actions.

510 From an ecological point of view, these results may shed light on older adults’ daily
511 lives. Indeed, neuroticism appears to be an important risk factor with the increase in age.
512 Results showed that it was negatively related to both walking speed and muscular strength.
513 These physical capacities have been linked to many maladaptive effects such as the incidence
514 of falls (e.g., Yang et al., 2018), hospitalization (e.g., Montero-Odasso et al., 2005), frailty
515 (Fried et al., 2001) and even survival (e.g., Studenski et al., 2011). Conversely, extraversion,
516 conscientiousness and openness seem to be important protective factors for aging as they are
517 related to greater walking speed and muscular strength. In closing, the present study has some
518 practical implications. Assessing individuals’ personality traits may provide information
519 about those at risk of poor physical functions throughout adulthood. Therefore, physical
520 activity interventions could be adapted to the psychological profile of older adults in order to
521 reduce mobility limitations and promote an active lifestyle, which is recommended with the
522 increase in age. Finally, as it is difficult to modify the personality traits of a person,
523 interventions could be focused on the mediators in order to temper or enhance some
524 associations.

525 In conclusion, we applied structural equation models in this research to examine for
526 the first time the mediators of the personality traits/physical capacities relationships. Our
527 results both corroborate and extend previous findings and show (1) the significant role of four
528 personality traits (i.e., extraversion, conscientiousness, neuroticism and openness) and (2) the
529 mediating role of physical self-perceptions, subjective age and attitudes toward aging.

530 Notably, we found that the mediators are different depending on the physical capacity
531 investigated, with (1) the main role of physical self-perceptions being in the personality
532 traits/walking speed relationship and (2) subjective age and attitudes toward aging mainly
533 mediating the personality traits/muscular strength relationship. These results suggest that
534 physical activity interventions could be adapted to the psychological profile of older adults.
535 Finally, future studies should identify other significant mediators of the personality/physical
536 capacities relationships and also focus on other physical capacities.

537

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