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Psychological flexibility in somatic symptom and related disorders: A case control study

René J.D.M. Selker [a], Tim Y. Koppert [b], Jan H. Houtveen [a], Rinie Geenen [a,c,*]

[a] Altrecht Psychosomatic Medicine Eikenboom, Voortgang 6, 3705 WD, Zeist, the Netherlands
[b] Institute of Psychology, Bachelor Education Unit, Leiden University, Wassenaarseweg 52, 2333 AK, Leiden, the Netherlands
[c] Department of Psychology, Utrecht University, Heidelberglaan 1, 3584 CS, Utrecht, the Netherlands

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ABSTRACT

A key diagnostic criterion of Somatic Symptom and related Disorders (SSD) comprises significant distress and excessive time-and-energy consuming thoughts, feelings, and behavior pertaining to somatic symptoms. This diagnostic criterion is lacking in central sensitivity syndromes (CSS), such as fibromyalgia, irritable bowel syndrome, and chronic fatigue syndrome. This strong emphasis on disturbed psychological processing of somatic symptoms, suggests that psychological flexibility is low in SDD. Psychological flexibility is defined as the ability to approach difficult or challenging internal states (thoughts, emotions, and bodily sensations) in a non-judgmental, mindful way, and being committed to pursue one's values. To clarify the potential significance of psychological flexibility in SSD, we examined its levels in 154 people referred to specialized treatment for SDD, as compared to reference groups from the general population encompassing 597 people with CSS and 1422 people without SSD or CSS (controls). Mean levels of psychological flexibility (adjusted for demographic covariates) were lowest for SSD and highest for controls ($F = 154.5$, $p < 0.001$, $p\eta^2 = 0.13$). Percentages of people with low psychological flexibility (<0.8 SD below the mean of controls) were: SSD 74%, CSS 42%, controls 21%. In SSD, higher psychological flexibility was associated with better mental health ($\beta = 0.56$, $p < 0.001$), but interaction analysis rejected that psychological flexibility preserved health when having more severe somatic symptoms ($\beta \leq 0.08$, $p \geq 0.10$). The results indicate that lower psychological flexibility is a prevalent problem in SSD that is associated with lower mental health. This suggests that it is worthwhile to take account of psychological flexibility in SSD in screening, monitoring, and therapy.

1. Introduction

The diagnostic criteria for 'somatic symptom and related disorders' (SSD) are one or more persistent (>6 months) somatic symptoms that are distressing or result in significant disruption of daily life as well as excessive responses relating to the somatic symptoms or associated health concerns; these responses are manifested by disproportionate and persistent thoughts about the seriousness of one's symptoms, persistently high level of anxiety about health or symptoms, or excessive time and energy devoted to these symptoms or health concerns (American Psychiatric Association, 2013; Löwe et al., 2022). Diagnostic criteria for SSD, differ from those for fibromyalgia, chronic fatigue syndrome (CFS), and irritable bowel syndrome (IBS), in which the presence of psychological features is not a required diagnostic criterion. Labels to summarize these three heterogeneous conditions are controversial (Samulowitz et al., 2018). However, to avoid repeatedly mentioning all conditions, we use the label central sensitivity syndromes (CSS) to describe these conditions (Yunus, 2008). CSS refers to conditions with persistent physical symptoms in which —besides other mechanisms— a sensitive central nervous system appears to be part of the etiology, maintenance, or expression of somatic symptoms.

Thus, while persistent somatic symptoms are key to both SSD and CSS, the presence of excessive time and energy consuming thoughts, feelings or behavior relating to these symptoms is characteristic for SSD but not CSS (Löwe et al., 2022; Rief and Martin, 2014). An underlying process enhancing excessive psychological reactions to adversity could be experiential avoidance, one's unwillingness to remain in contact with unpleasant internal experiences (Blakey et al., 2021; Hayes et al., 2004).

* Corresponding author. Department of Psychology, Utrecht University, Heidelberglaan 1, 3584 CS, Utrecht, the Netherlands.
E-mail addresses: R.Selker@altrecht.nl (R.J.D.M. Selker), t.y.koppert@FSW.Leidenuniv.nl (T.Y. Koppert), J.Houtveen@altrecht.nl (J.H. Houtveen), R.Geenen@uu.nl (R. Geenen).

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Experiential avoidance can be harmful, because unpleasant internal experiences —including physical symptoms— are often unresponsive or even paradoxically increased by efforts to control them (Hayes et al., 2004). The theoretical antipole of experiential avoidance is psychological flexibility, the ability to approach difficult or challenging internal states (thoughts, emotions, and bodily sensations) in a non-judgmental, mindful way, and being committed to pursue one's values (Hayes et al., 2006; Kashdan and Rottenberg, 2010). Psychological flexibility includes six processes that are considered antipoles of experiential avoidance: *acceptance* (willingness to fully experience unavoidable unwanted experiences), *contact with the present moment* (ongoing non-judgmental contact with one's thoughts and feelings), *self as context* (taking an observer perspective towards one's experiences), *cognitive defusion* (distancing oneself from unavoidable thoughts, without getting stuck in them), c*ommitted action* (engaging in value-based behavior), and *values* (chosen life directions that give direction to behavior) (Hayes et al., 2006). Psychological flexibility is at the core of the process of change in Acceptance and Commitment Therapy (ACT). Psychological flexibility has been shown to be associated with better well-being and functioning, and ACT has been indicated to improve these symptom-related health outcomes (Coto-Lesmes et al., 2020; Fang and Ding, 2022; Martinez-Calderon et al., 2023). The potential significance of psychological flexibility in SSD has not been established. If psychological flexibility is low in SSD, increasing it might support alleviating excessive psychological responsivity to somatic symptoms.

One indication about the significance of psychological flexibility for SSD may come from the comparison of psychological flexibility in SSD with other groups. Psychological flexibility was observed to be lower in participants with than without previous psychiatric or psychological treatment; Cohen's *d* effect size was 0.53 (Eisenbeck and Szabó-Bartha, 2018). In our study in the general population, psychological flexibility was observed to be lower in participants with than without a CSS; Cohen's *d* effect size was 0.49 for means unadjusted for demographic covariates (Koppert et al., 2021). The emphasis on excessive problematic thoughts, feelings, and behavior relating to the somatic symptoms in SSD, make us expect that lower psychological flexibility is even more prevalent in SSD than CSS.

Another indication of the significance of psychological flexibility may be derived from the association of psychological flexibility with mental and physical health. Cross-sectional studies showed that psychological flexibility, or one of its processes, was associated with better mental and physical health in the general population (Kroska et al., 2020; McCracken et al., 2021; Tyndall et al., 2020) as well as in patients with diverse diagnoses from a psychiatric hospital unit (Webb et al., 2019), patients with a diagnosis of psychosis from mental health services (White et al., 2013), people from the general population with CSS (Koppert et al., 2021), and people with fibromyalgia participating in a clinical trial (Pleman et al., 2019), from primary care centers (Rodero et al., 2013), and from social media-based support groups and services (Trainor et al., 2019). We expect similar findings in SSD.

Although associations between psychological flexibility and particularly mental health uniformly suggest that psychological flexibility preserves mental health (Dawson and Golijani-Moghaddam, 2020; McCracken et al., 2021), this inference from a cross-sectional observation is only tentative. Observed associations may reflect construct overlap, answering tendencies, demographics, or influences of third variables, such as neuroticism (Watson and Pennebaker, 1989). A stronger indication that psychological flexibility preserves mental health, can be obtained from interaction (moderator) analysis, because this analysis —at least partly— adjusts for these influences. Moderation by psychological flexibility has been examined in fibromyalgia. The association between adversities such as stress or fibromyalgia severity and several health variables was weaker in people with higher psychological flexibility or one of its components (Gloster et al., 2017; Pleman et al., 2019). However, a health-preserving role of psychological flexibility in case of adversities was not consistently indicated in CSS (Koppert et al., 2021; Leonidou et al., 2019). In SSD, the emphasis is on the excessive response to somatic symptoms. Theoretically (Hayes et al., 2006), for people with higher psychological flexibility, the consequences of somatic symptoms for mental and physical health are expected to be less than for people with lower levels of psychological flexibility. Finding such a health-protecting role would be an additional indication of the importance of psychological flexibility in SSD.

It is difficult to acquire research participants with SSD in the general population, because the diagnosis is made in psychiatric settings. The current study included patients from a tertiary care center for SSD. Our aim was to get insight into the potential significance of psychological flexibility in this group. Confirmation of three hypotheses was considered to support the importance of this construct for SSD. 1) The mean level of psychological flexibility in SSD is lower than in groups with and without CSS. In SSD, 2) a lower level of psychological flexibility is associated with lower levels of mental and physical health (main effects hypothesis), and 3) a higher level of psychological flexibility is associated with less strong negative associations of somatic symptom severity with mental and physical health (moderator/interaction hypothesis).

2. Methods

2.1. Participants

Participants with SSD (≥18 years) were recruited from February to November 2022 at Altrecht Psychosomatic Medicine, Zeist, The Netherlands, a specialized tertiary care center for patients with SSD. Patients in this center have impactful, severe, and enduring problems, exemplified by a history of ineffective treatments and often also the presence of somatic or psychiatric comorbidity (Van der Boom and Houtveen, 2014). DSM-5 classification criteria were checked during the clinical intake interview and established in a multidisciplinary consultation meeting including two professionals who did the intake. Patients in a crisis situation and patients with body dysmorphic disorder, addiction, or psychosis are not treated in the center, and were therefore not included in this study.

Two reference groups comprised participants with and without CSS, both from the general Dutch-speaking population. Data were collected in two separate online surveys (November 2018 to May 2019 and March to May 2020) and were described in a previous publication (Koppert et al., 2021). Participants from this previous study were allocated to a CSS or non-CSS (control) group. Six participants who were also diagnosed with SSD were excluded from the CSS-group. Other exclusion criteria were not having completed the psychological flexibility questionnaire and age outside the range of the SSD sample (19–74 yrs). This was done to have a comparable age range for the three samples.

A total of 180 participants with SSD started to fill out the online-questionnaire. Of this group, 26 participants dropped out. Dropouts ($n = 26$) did not differ from completers ($n = 154$), in terms of mean[SD] age (43.7[14.1] vs. 46.2[13.7], $F = 0.78$, $p = 0.38$), gender ($n = 8$ [30.8%] vs. $n = 39$[25.3%] men, $\chi^2 = 0.34$, $p = 0.56$), or education level ($n = 12$[46.2%] lower vs. $n = 75$[48.7%] lower, $\chi^2 = 0.06$, $p = 0.81$) for dropouts and completers, respectively.

2.2. Procedure

The design is a case-control study. Participants filled out an online survey. Potential participants with SSD were informed by their case managers and through an information brochure. The two control groups had been recruited via a recruitment note including a link to the online information letter, informed consent, and questionnaire on social media (e.g., Facebook, Instagram, LinkedIn, local internet sites) and on social media and websites of associations including the Dutch national patient associations for fibromyalgia, CFS and IBS (Koppert et al., 2021).

After full explanation of the study and obtaining informed consent, a hyperlink to the online survey (housed on a secure university website) was provided to the participants. Data collection was anonymous. Participants were not compensated for participation. The study was conducted in accordance with the latest amendment of the Declaration of Helsinki (World Medical Association). Approval for the study in SSD was given by the Institutional Review Board of the mental health care center, Altrecht, Zeist, (CWO-nr 2109). Approval for the other samples was given by the Ethics Committee of Utrecht University, for data collection in 2018 (FETC17-120) and 2020 (FETC20-190).

2.3. Instruments

The Flexibility Index Test-60 (FIT-60) was used to measure psychological flexibility (Batink et al., 2012). This 60-item questionnaire includes six processes of psychological flexibility (Hayes et al., 2006). Participants can indicate to what extent each item applies to them on a numeric scale from 0 ('totally disagree') to 6 ('totally agree'). The theoretical range is from 0 to 360. Higher scores denote more flexibility. The internal reliability was acceptable to good, with Cronbach's alphas ranging from 0.69 to 0.87 on the six subscales and an alpha of 0.95 for the total scale (Batink and Delespaul, 2015). However, as a 6-factor solution did not differentiate between factors (Koppert, 2023), we will use the 1-factor psychological flexibility total score; Cronbach's alpha in our study was 0.95.

Mental health, physical health, and somatic symptom severity were measured with the RAND 36-Item Short Form Health Survey (SF-36) (VanderZee et al., 1996). This self-report questionnaire includes eight scales. The reliability and validity of the SF-36 are good. As an indicator of mental health, we used the mean of the standardized mean deviation from the norm scores (VanderZee et al., 1996) of Emotional well-being, Role limitations due to emotional problems (Role emotional), and Social functioning. Physical health was derived likewise using Physical functioning, Role limitations due to physical functioning (Role physical), and General health. Higher mental and physical health scores reflect better health. In the current study, Cronbach's alpha of these 3-scale composite scores was 0.79 for mental and 0.83 for physical health.

The severity of somatic symptoms was measured with the pain and vitality/fatigue scales of the SF-36. The pain scale comprises two items assessing the level of bodily pain and its interference. The fatigue scale includes two items assessing fatigue and two items on energy. After reversing scores, higher scores on the SF-36 reflect more pain and fatigue. We used the mean standardized deviation from the norm scores (VanderZee et al., 1996) of these pain and fatigue scales as a measure of somatic symptom severity. In this study, Cronbach's alpha of this 2-scale composite score was 0.77.

2.4. Statistical analyses

Skewness and kurtosis of the four continuous variables were inspected for the total sample and the three separate groups (Kim, 2013). Of the sixteen analyses, the kurtosis was always below the critical value, but the skewness of mental health (0.904) and physical health (0.858) was somewhat too high in SSD. We did not transform these data, because the residuals had a normal distribution.

Analyses of covariance, with Bonferroni-corrected post hoc tests, was used to test the difference in psychological flexibility between the three groups: SSD, CSS, and control. Covariates were age, gender, and education level. Effect sizes were expressed using partial eta squared ($p\eta^2$), with values of 0.01, 0.06 and 0.14 representing small, medium, and large effects, respectively (Tabachnick and Fidell, 2007).

To get insight into the number of participants within groups with medium or large deviating psychological flexibility scores, we calculated for each individual, deviation scores using the mean psychological flexibility score and standard deviation of our non-CSS general population control group as reference; values greater than 0.5 and 0.8 represent medium and large deviations (Cohen, 2016).

In participants with SSD, both bivariate (Pearson correlations) and multivariate associations (linear regression analyses) of psychological flexibility with mental and physical health were examined. Multicollinearity between independent variables and violations of linearity, additivity, and homoscedasticity were checked using variance inflation factor (VIF) and inspection of residuals by Levene's tests and normal probability plots. Main effects analyses (separately for mental and physical health) examined the association of both somatic symptom severity and psychological flexibility with health while adjusting for age, gender, and education level. To test moderation, the multiplication of centered somatic symptom severity and centered psychological flexibility was included in regression analyses. To interpret results of the regression models, regression lines for individuals with low (−1 SD) and high (+1 SD) scores on the two interacting variables (somatic symptom severity and psychological flexibility) were plotted (Aiken and West, 1991).

Statistical analyses were done using the IBM SPSS package version 28.0.1. All tests were two-tailed; $p < 0.05$ was considered significant.

3. Results

3.1. Group characteristics

Table 1 shows the characteristics of the SSD (n = 154), CSS (n = 597), and control (n = 1422) groups. The groups did not differ in age: $F(2,2171) = 0.42$, $p = 0.66$. The majority of participants was female, with particularly few men with CSS: $\chi^2(2) = 126.71$, $p < 0.001$. More participants of the control-group had a higher education level: $\chi^2(2) = 113.92$, $p < 0.001$. Many participants with SSD were not in a relationship: $\chi^2(2) = 13.68$, $p = 0.001$.

The SSD diagnosis was confirmed for 108 of 154 participants with SSD: 77 had a single SSD diagnosis and 31 one or two additional SSD diagnoses. The diagnoses were: somatic symptom disorder (n = 86, 55.8%), illness anxiety disorder (n = 12, 7.8%), and functional neurological disorder (conversion), n = 46, 29.9%). The groups that had received (n = 108) vs. waited for a confirmed diagnosis (n = 46) did not differ on mental health ($p = 0.13$), physical health ($p = 0.92$), symptom severity ($p = 0.25$), or psychological flexibility ($p = 0.47$).

Ninety-five participants (61.7%) with SSD were in the phases of intake or waiting-list for treatment, and 59 were receiving ambulatory treatment (n = 29, 18.8%), intensive 3-day a week treatment (n = 6, 3.9%), or inpatient treatment (n = 24, 15.6%). For the treatment subgroup, treatment duration until now was 1–3 months (n = 16, 10.4%), 3–6 months (n = 12, 7.8%), or >6 months (n = 31, 20.1%). The groups that waited for treatment (n = 95) and started treatment (n = 59) did not differ on mental health ($p = 0.83$), physical health ($p = 0.35$), symptom severity ($p = 0.45$), or psychological flexibility ($p = 0.71$).

Health was poorest in SSD and best in controls, whereas CSS had an intermediate position, all tests were highly significant: mental health, $F(2,2172) = 321.5$, $p < 0.001$; physical health, $F(2,2172) = 596.0$, $p < 0.001$; somatic symptom severity, $F(2,2172) = 716.2$, $p < 0.001$. Post hoc tests showed significant ($p < 0.001$) differences between each pair of groups for these health variables.

3.2. Psychological flexibility

The uncorrected means of psychological flexibility are shown in Table 1. Analyses of covariance was used to test the difference in psychological flexibility between SSD, CSS and controls. The estimated marginal means (with standard error and [95% confidence interval]) after correction for gender, age, and education level for the three groups were 166 (3.79 [159,173]) for SSD, 215 (2.00 [211, 219]) for CSS, and 234 (1.27 [231, 236]) for controls. The differences between these groups were highly significant: $F(2,2160) = 154.5$ ($p < 0.001$), $p\eta^2$ effect size was 0.13, observed power $1\text{-}\beta = 1.00$.

Post hoc pairwise comparisons with Bonferroni adjustment showed that each group differed from each other group ($p < 0.001$). Cohen's

Table 1
Characteristics of participants with somatic symptom disorder (SSD), central sensitivity syndrome (CSS), and those without an SSD or CSS (control).

Variables	SSD *n* = 154	CSS *n* = 597	control *n* = 1422	All *n* = 2173
Age (years)				
Mean (SD)	46.2 (13.7)	47.3 (12.3)	47.3 (15.0)	47.2 (14.2)
Range	19 - 74	19 - 73	19 - 74	19 - 74
Gender[a], *n* (%)				
Men	39 (25.3)	26 (4.4)	371 (26.1)	436 (20.1)
Women	112 (72.7)	571 (95.6)	1051 (73.9)	1734 (79.8)
Other	3 (1.9)	0 (0.0)	0 (0.0)	3 (0.1)
Education level[b], *n* (%)				
Low	75 (48.7)	321 (53.8)	422 (29.7)	818 (37.6)
High	79 (51.3)	271 (45.4)	993 (69.8)	1343 (61.8)
Missing	0 (0.0)	5 (0.8)	7 (0.5)	12 (0.6)
Marital status, *n* (%)				
Single	64 (41.6)	172 (28.8)	423 (29.7)	659 (30.3)
In a relation	78 (50.6)	409 (68.5)	962 (67.7)	1449 (66.7)
Unknown	12 (7.8)	16 (2.7)	37 (2.6)	65 (3.0)
Health (SF-36)[c], Mean (SD)				
Mental health	−2.19 (0.88)	−1.09 (1.05)	−0.37 (0.91)	−0.70 (1.08)
Physical health	−1.86 (0.63)	−1.23 (0.84)	−0.13 (0.82)	−0.56 (1.01)
Somatic symptom severity[d]	1.92 (0.78)	1.37 (0.79)	0.15 (0.80)	0.61 (1.02)
Psychological flexibility (FIT-60)[e], Mean (SD)	164 (52.4)	211 (51.5)	236 (46.0)	224 (52.0)

[a] In analyses, the three participants who answered 'Other' were allocated to the category women (the largest category).
[b] Education level: low: lower general secondary education or lower; high: higher general secondary education or higher.
[c] SF-36 = RAND Short form-36.
[d] This score is the mean deviation from the general adult population for pain and fatigue/vitality in standard score units (VanderZee et al., 1996). Scores were reversed: higher scores reflect more pain and fatigue.
[e] FIT-60 = Flexibility Index Test-60; this total score ranges from 0 to 360, with higher scores reflecting more psychological flexibility.

d effect-sizes of the comparison of estimated marginal (covariate-adjusted) means were −0.95 for SSD vs. CSS, −1.30 for SSD vs. controls, and −0.36 for CSS vs. controls. Percentages of participants with (very) low psychological flexibility (<-0.8 SD) were: SSD 74%, CSS 42%, control 21% (Fig. 1).

3.3. Ancillary analysis

In the total sample, the distribution of the residuals of psychological flexibility was normal, but Levene's test showed unequal error variance of the samples: $F(2,2158) = 12.0$, $p < 0.001$. To be sure that group differences were not due to differences in sample size, variance, or demographics, we created three groups of 141 participants matched on gender, age, and education (n = 141 instead of n = 154, because the CSS sample included only 26 men). After matching, samples did not differ on gender, age, and education (all p = 1.00), while samples still showed differences on all health variables (all $p < 0.001$).

Levene's test in analysis of covariance of psychological flexibility in the three matched groups now indicated equality of error variance (p = 0.32). Estimated marginal means (standard error [95% confidence interval]) were: 165 (4.23 [157,173]) for SSD, 213 (4.23 [205, 221]) for CSS, and 225 (4.23 [216, 233]) for controls. The difference between

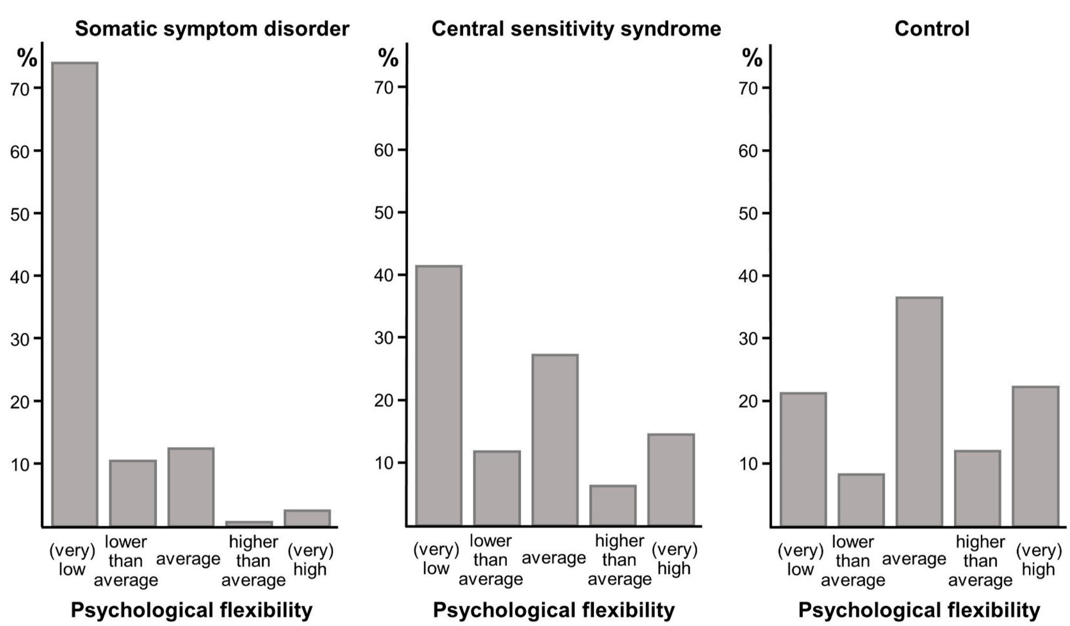

Fig. 1. Percentages of participants with (very) low to (very) high psychological flexibility in the somatic symptom disorder (n = 154), central sensitivity syndrome (n = 597), and control (n = 1422) groups, based on individual effect sizes (Cohen's d). Meaning of the categories: (very) low: $d \leq -0.8$, lower than average: $-0.8 < d \leq -0.5$, average: $-0.5 < d < 0.5$, higher than average: $0.5 < d < 0.8$, (very) high: $d \geq 0.8$.

groups was again highly significant: F(2,422) = 55.8 ($p < 0.001$), $p\eta^2 = 0.21$, observed power 1-β = 1.00. In post hoc pairwise comparisons, SSD differed from the other two groups ($p < 0.001$), but CSS did not differ from controls (p = 0.16). Cohen's d effect sizes were −0.96 for the difference between SSD and CSS, −1.19 for the difference between SSD and controls, and −0.23 for the difference between CSS and controls. Percentages of participants with (very) low (<-0.8 SD) psychological flexibility were SSD 64%, CSS 30%, control 21%.

3.4. Psychological flexibility and health

Table 2 shows the correlations of psychological flexibility with health variables. Higher psychological flexibility was significantly associated with better mental and physical health and lower somatic symptom severity. Of the demographic covariates, only gender was significantly related to mental health: women reported better mental health.

Table 3 shows the results of linear regression analyses of the association of mental health and physical health with symptom severity, psychological flexibility and its interaction; Fig. 2 shows the main effects and interactions. No violations of multicollinearity and assumptions occurred: VIFs varied from 1.02 to 1.23, residuals were symmetrically distributed, and normal probability plots showed scores close to the diagonal. While taking account of all other variables, somatic symptom severity remained negatively associated with both mental ($p < 0.001$) and physical health ($p < 0.001$) and psychological flexibility remained positively associated with mental ($p < 0.001$) but not physical health. Interactions of somatic symptom severity and psychological flexibility were not significant.

4. Discussion

The results of our study partly confirm the importance of psychological flexibility in SSD. In confirmation of the first hypothesis, psychological flexibility was lower in SSD than CSS or controls (both large deviations); low psychological flexibility was observed in 74%, 42%, and 21% of SSD, CSS and controls, respectively. In support of the second hypothesis, in SSD, higher psychological flexibility was associated with better mental (large correlation) and physical health (small correlation) and lower somatic symptom severity (medium correlation). Psychological flexibility and somatic symptom severity were additively associated with mental but not physical health. The third —moderator— hypothesis was rejected. A higher level of psychological flexibility was not associated with less strong negative associations of somatic symptom severity with mental or physical health.

Table 2
Pearson correlations (significance levels) between mental health, physical health, somatic symptom severity, psychological flexibility, and demographic variables in participants with somatic symptom disorder (N = 154).

Variables	1	2	3	4
1. Mental health (SF-36)				
2. Physical health (SF-36)	0.33 (<0.001)			
3. Somatic symptom severity (SF-36)	−0.57 (<0.001)	−0.60 (<0.001)		
4. Psychological flexibility (FIT-60)	0.71 (<0.001)	0.25 (0.002)	−0.41 (<0.001)	
5. Gender[a]	0.23 (0.004)	0.15 (0.07)	−0.06 (0.45)	0.13 (0.11)
6. Age	−0.14 (0.09)	−0.15 (0.07)	0.13 (0.11)	−0.09 (0.27)
7. Education[b]	0.02 (0.84)	0.01 (0.88)	−0.00 (0.98)	0.06 (0.46)

SF-36 = RAND Short form-36 (VanderZee et al., 1996), FIT-60 = Flexibility index test-60 (Batink et al., 2012).
[a] Gender: 0 = men (n = 39), 1 = women (n = 112) and other (n = 3).
[b] Education level: 0 = lower general secondary education or lower; 1 = higher general secondary education or higher.

Table 3
Results of linear regression analyses examining the association of mental health and physical health (SF-36) with demographic variables, symptom severity (pain & fatigue, SF-36), psychological flexibility (FIT-60), and the two-way interaction of somatic symptoms severity, and psychological flexibility in somatic symptom disorder (n = 154)[a].

Mental health	*b*	(SE)	β	*t*	*p*
Constant	−2.359	0.204		−11.56	<0.001
Gender[b]	0.261	0.106	0.13	2.47	0.01
Age	−0.001	0.003	−0.01	−0.28	0.78
Education[c]	−0.023	0.090	−0.01	−0.26	0.80
Somatic symptom severity (SSS)	−0.371	0.063	−0.33	−5.89	<0.001
Psychological flexibility (PF)	0.009	0.001	0.56	10.07	<0.001
SSS x PF	−0.002	0.001	−0.08	−1.66	0.10
Physical health	***b***	**(SE)**	**β**	***t***	***p***
Constant	−1.870	0.189		−9.95	<0.001
Gender[b]	0.147	0.098	0.10	1.51	0.13
Age	−0.002	0.003	−0.05	−0.67	0.50
Education[c]	0.004	0.083	0.003	0.05	0.96
Somatic symptom severity (SSS)	−0.470	0.058	−0.59	−8.10	<0.001
Psychological flexibility (PF)	−0.00008	0.001	−0.01	−0.09	0.93
SSS x PF	0.0002	0.001	0.01	0.17	0.87

b, unstandardized regression coefficient; SE, standard error; β, standardized regression coefficient.
[a] Overall statistics. Mental health: F(6,147) = 41.4, $p < .001$, $R^2 = 61.3\%$; physical health: F(6,147) = 14.4, $p < .001$, $R^2 = 34.4\%$.
[b] Gender: 0 = men, 1 = women or other.
[c] Education: 0 = lower general secondary education or lower; 1 = higher general secondary education or higher.

The diagnostic emphasis on psychological responses in SSD, led to the hypothesis that psychological flexibility is lower in SSD than CSS. This hypothesis was clearly confirmed. However, the large difference between SSD and both CSS and controls found in the current study holds for SSD in tertiary care. To get a broader overview, future research should also examine psychological flexibility in an SSD sample from the general population and in other psychiatric groups in tertiary care. To confirm that low psychological flexibility is a characteristic feature in SSD as compared to CSS, further research is needed in samples undergoing similar diagnostic procedures and matched on symptom severity and treatment status. Despite limitations that hamper interpretation, the high frequency of lower psychological flexibility observed in our study, suggests that it is worthwhile to use assessments of psychological flexibility in screening, monitoring and evaluation of therapy in people with SSD. Moreover, it is worthwhile to examine whether psychological flexibility improves more after ACT than after more classic cognitive-behavioral therapy and whether baseline psychological flexibility is associated with effects of ACT.

Consistent with our results, previous studies showed that psychological flexibility is associated with mental and physical health (Dawson and Golijani-Moghaddam, 2020; McCracken et al., 2021; Pleman et al., 2019; Rodero et al., 2013). This may reflect a health-protective role of psychological flexibility, however, also other influences including construct/item overlap, impact of health on psychological flexibility, and influences of third factors, e.g., trait-like negative affectivity (neuroticism) and response tendencies (e.g., acquiescence, social desirability). After adjustment for somatic symptom severity, psychological flexibility was still associated with mental health. This additive (independent) association reflects that somatic symptom severity and psychological flexibility have a different relation with mental health. This implies that both somatic symptom severity and psychological flexibility should be taken into account when trying to understand or improve mental health.

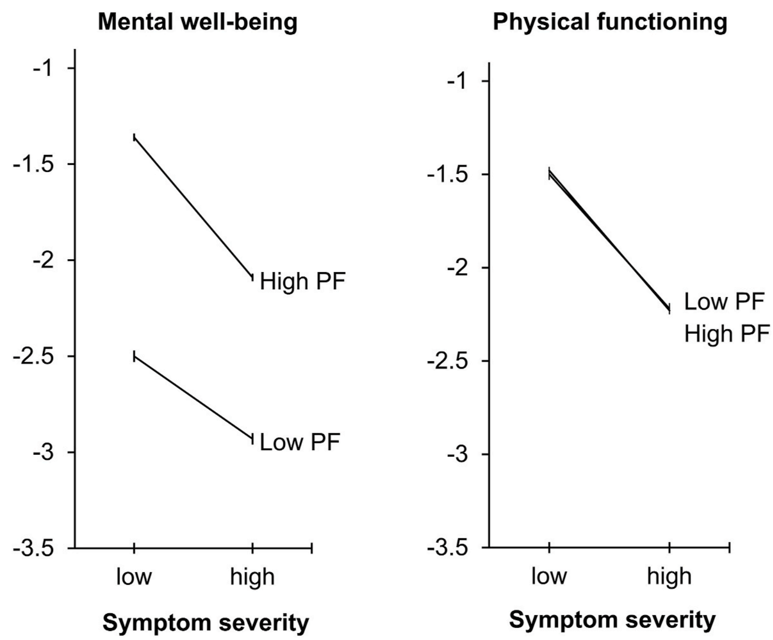

Fig. 2. Regression scores on mental health and physical health as a function of low (−1 SD) and high (+1 SD) psychological flexibility (PF) and low (−1 SD) and high (+1 SD) somatic symptom severity in participants with somatic symptom disorder (n = 154).

A health-protecting role of psychological flexibility would have been clearer if psychological flexibility had been indicated to be particularly effective in preserving health when having more severe somatic symptoms. However, the interaction of the two variables was not associated with mental health. The interaction even tentatively suggested that the higher level of psychological flexibility was associated with a *stronger* negative association of somatic symptom severity with mental health instead of the hypothesized *weaker* association. This suggests that the strength and directionality of relations between psychological flexibility, somatic symptom severity, and mental health differ across and within individuals. Overall, the associations observed in our study indicate the relevance of psychological flexibility in SSD. The meaning for individuals in varied circumstances could be derived from in-depth clinical interviews and sophisticated single-case observational studies (Houtveen et al., 2022).

A strength of the current study is the large size of the control samples. The SSD sample was large enough to find at least medium effects ($f^2 = 0.15$) in regression analysis: fixed model R^2, three independent variables (2 main, 1 interaction), three covariates, $\alpha = 0.05$, $1\text{-}\beta = 0.99$ (Faul et al., 2007). Other strengths are the comprehensive assessment encompassing all six processes of psychological flexibility, the use of a control group from the general population also including people with chronic diseases, and the inclusion in analyses of demographic confounders. The cross-sectional design of the study allows to draw observational inferences about the importance of psychological flexibility related to group differences and associations between variables, but it is not possible to draw inferences about causality or prediction.

A main restriction of external validity in our study is the comparison of groups from different settings in different phases of life in terms of treatment intention, i.e., a group with SSD referred to tertiary care and two heterogeneous reference groups from the general population. Therefore, it is unclear to what extent the findings generalize to SSD not currently treated in tertiary care. While the SSD group was homogeneous in terms of being referred to tertiary care, the group was heterogeneous in terms of having received a diagnosis or being in treatment. However, this heterogeneity did not affect the examined variables. Another limitation is that data collection in the general population was partly during the COVID-19 crisis, while data collection in SSD was mostly after the crisis. Overall, prospective studies comparing mental health before and during the COVID-19 crisis, showed symptom change estimates close to zero (Sun et al., 2023). This also holds for our own studies (Koppert et al., 2021, 2022). It is unknown to what extent participants with SSD were affected by the COVID-19 crisis, but it is unlikely that the crisis explains the large between-group differences observed in this study. Further limitations are that no instruments were used in the diagnostic intake of the SSD sample and that results of the general population sample do not generalize beyond self-reported illnesses and samples with an overrepresentation of highly educated women. Nevertheless, the analyses adjusted for demographic covariates and in groups matched on covariates showed that many participants with SSD reported lower psychological flexibility.

In conclusion. The high prevalence of low psychological flexibility in the specific SSD group that participated in this study indicates the significance of psychological flexibility in this group. This relevance is also supported by associations between psychological flexibility and mental health. These results of our observational design suggest that it is worthwhile to use assessments of psychological flexibility in screening, monitoring, and evaluation of therapy in SSD as well as to examine whether psychological flexibility is associated with and mediates the outcome of acceptance and commitment therapy.

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CRediT authorship contribution statement

René J.D.M. Selker: Conceptualization, Methodology, Project administration, Writing – original draft, Writing – review & editing, Resources. **Tim Y. Koppert:** Writing – review & editing, Investigation, Resources. **Jan H. Houtveen:** Data curation, Supervision, Writing – review & editing. **Rinie Geenen:** Conceptualization, Formal analysis, Methodology, Project administration, Writing – original draft, Writing – review & editing, Resources.

Declaration of competing interest

The authors declare no conflicts of interest.

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