

1 **Atypical Sexual Interests in Compulsive Sexual Behavior (CSB): Results from a**
2 **Phallometric Study**

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5 Castro-Calvo, J.¹, Giménez-García, C.², García-Barba, M.², Gil-Llario, M.D.³, &
6 Ballester-Arnal, R.^{2,*}

7

8 ¹ Dpto. Personalidad, Evaluación y Tratamientos Psicológicos, Universitat de València,
9 Estudi General, Spain

10 ² Dpto. Psicología Básica, Clínica y Psicobiología. Universitat Jaume I, Castellón, Spain

11 ³ Dpto. Psicología Evolutiva y de la Educación. Universitat de València. Estudi
12 General, Spain

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1 Abstract

2 The link between Compulsive Sexual Behavior (CSB) and atypical sexual interests is
3 elusive. This study aimed to provide preliminary insights into the relationship between
4 both aspects. The study sample comprised 61 self-identified straight men. CSB was
5 measured through a composite self-report index assessing symptoms of CSB, whereas
6 sexual interests –atypical and normophilic– were assessed objectively through penile
7 plethysmography. The CSB index had small, non-significant correlation with greater
8 sexual response to different sexual stimuli ($r_{\text{general sexual responsiveness}}=.127$ [95% CI: -.137,
9 .384]). In terms of overall sexual interest, increased scores on the CSB index had small,
10 non-significant correlation with a higher preference for younger sexual stimuli ($r=-.098$
11 [95% CI: -.499, .215]) and persuasive sex ($r=.10$ [95% CI: -.168, .316]). Finally, CSB
12 had a moderate correlation with sexual response when presented with stimuli depicting
13 “female toddler coercive” ($r=.27$ [95% CI: -.083, .544]). We conclude that our findings
14 do not support the hypotheses that CSB is significantly related to an increased
15 arousability across sexual stimuli. The study findings also suggest that CSB may be, to
16 a small degree, predisposed to experience sexual attraction toward children. Given the
17 preliminary nature of the study, these conclusions warrant further research. Alternative
18 explanations for the study findings related to the particular components of CSB that
19 may be related to typical and atypical sexual interests are also considered.

20 *Keywords:* Compulsive Sexual Behavior (CSB); atypical sexual interests;
21 objective sexual response; penile plethysmography.

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1 INTRODUCTION

2 No consensus exists on the appropriate nosological framework for Compulsive
3 Sexual Behavior (CSB), as evidenced by the number of competing models proposed for
4 its conceptualization and classification, the multiplicity of measures designed for its
5 assessment (Hook et al., 2010, 2014), and the various terms employed to designate this
6 clinical condition (e.g., «hypersexual disorder –HD–», «sexual addiction –SA–»,
7 «paraphilia-related disorder –PRD–», or «sexual compulsivity») (Kafka, 2010; Walton,
8 Cantor, Bhullar, et al., 2017). These terms have been used interchangeably to refer to
9 the same clinical condition (e.g., Reid & Meyer, 2016), reflecting a tacit overlap in
10 terms of definition and clinical characterization (Karila et al., 2014). In the sexual
11 offending literature, the term «sexual preoccupation» (defined as “*an abnormally*
12 *intense interest in sex that dominates psychological functioning*”; Mann et al., 2010, p.
13 198), has been used to describe the symptoms involved in CSB (Marshall et al. 2008).
14 More recently, the World Health Organization included the «Compulsive Sexual
15 Behavior Disorder» (CSBD) as a diagnostic entity in the 11th revision of the
16 International Classification of Diseases (ICD-11) (World Health Organization, 2019),
17 providing diagnostic guidelines (Stein et al., 2020).

18 Parallel to these models conceptualizing CSB as a discrete category –a clinical
19 diagnosis–, scholars found that individual differences in sexual behavior’ control are
20 dimensional (i.e., a matter of degree instead of a matter of kind or taxon). Out-of-control
21 sexual behavior is expressed along a continuum of severity in which a clinical diagnosis
22 (HD, SA, or CSBD) represents the upper end of the continuum. For example, Walters et
23 al. (2011) used taxometric methods in a sample of 2,101 males and females from
24 Sweden and 716 men who had sexually offended from the USA. These researchers
25 found that self-report indicators of CSB were dimensionally distributed along a

1 continuum rather than categorically distributed. Using a similar methodology to a
2 sample of 1,146 college students, Graham and colleagues (2016) found that a dimension
3 rather than a taxon best fit the construct of CSB. At a clinical level, both approaches
4 (i.e., the conceptualization of CSB as a dimension distributed according to the level of
5 severity and as a clinical diagnosis when the condition reaches a certain degree of
6 impairment) are compatible. However, whereas the former conceptualization provides a
7 natural cutoff for the classification of people displaying out-of-control sexual behaviors
8 into the taxon –or diagnostic category–, the latter requires the empirical determination
9 of a threshold for clinical purposes. That said, findings from these taxometric studies
10 suggest that results derived from self-report indicators of CSB are better treated from a
11 dimensional approach.

12 Certain consensus exists around the basic features of CSB. The ICD-11 clinical
13 guidelines for CSBD describes this condition as a “*persistent pattern of failure to*
14 *control intense, repetitive sexual impulses or urges, resulting in repetitive sexual*
15 *behaviour over an extended period (e.g., six months or more) that causes marked*
16 *distress or impairment in personal, family, social, educational, occupational or other*
17 *important areas of functioning*” (Kraus et al., 2018, p. 109). Another common feature of
18 CSB (included in the DSM-5 proposal for the diagnosis of HD but not retained in the
19 ICD-11 guidelines for CSBD) is the use of sex as a coping mechanism aimed to
20 compensate for unpleasant affective states or stressful life events (Kafka, 2010). These
21 out-of-control sexual behaviors lead an individual to engage in multiple and non-
22 pleasurable sexual activities, including excessive pornography consumption often
23 accompanied by compulsive masturbation (“pornographic binges”; Wordecha et al.,
24 2018), casual sex with multiple partners, excessive engagement in paid sexual services,
25 or compulsive sexual intercourse within a stable relationship (Reid et al., 2012; Wéry et

1 al., 2016). CSB can produce a significant personal and psychological distress (Reid et
2 al., 2009), as well as problems on various aspects of daily living (McBride et al., 2008).
3 As a result, individuals struggling with this condition often require psychiatric and/or
4 psychological treatments to gain control over their sexual behavior (Efrati & Gola,
5 2018a; Goslar et al., 2020). It is estimated that around 1-6% of adult population display
6 problems to control their sexual behavior (Bóthe et al., 2019; Walton, Cantor, Bhullar,
7 et al., 2017), with males comprising around 80% of patients seeking treatment (Kaplan
8 & Krueger, 2010).

9 Despite the increasing number of studies analyzing sociodemographic, clinical,
10 and sexual profile of adolescents and adults with CSB (Ballester-Arnal et al., 2020;
11 Bóthe et al., 2020; Castro-Calvo et al., 2020; Efrati & Gola, 2018b), there is an aspect
12 that still requires further research: how CSB is associated with the manifestation of
13 atypical sexual interests (mainly pedophilia and coercive sexual behavior). The aim of
14 this study was to provide preliminary insights into atypical sexual interests in people
15 with different degrees of CSB (i.e., dimensional approach) through a reliable and valid
16 assessment method (i.e., penile plethysmography).

17 **Atypical sexual interests in CSB**

18 In a recent study, Engel, Veit, et al. (2019) urged clinicians to “*assess criminal*
19 *history and potential sexual coercive behaviors in patients with HD*” (p. 12). This
20 recommendation was based on the finding that 81% and 70% of a sample of 47 patients
21 with HD consumed child pornography and engaged in coercive sexual behaviors
22 respectively. In a subsequent study, Engel, Kessler, et al. (2019) confirmed the link
23 between CSB and coercive sexual behavior in a large German-speaking community
24 sample ($n=1,194$). These researchers found that having fantasized about sexual coercion
25 predicted 11% of the variance of a scale assessing CSB, whereas reporting having

1 committed sexual coercion predicted around 7%. Dawson et al. (2016) found positive
2 and significant correlations between different measures of CSB and the ‘total paraphilia
3 score’ (an index indicating the level of interest in different paraphilic activities). In turn,
4 CSB seems to mediate between paraphilic sexual preferences and the frequency of
5 engagement in paraphilic behaviors, as men and women who exhibit paraphilic sexual
6 interests are more likely to engage in paraphilic behaviors at high levels of CSB
7 (Bouchard et al., 2017). In short, these studies suggest that individuals with high levels
8 of CSB have increased risk of sexual offending.

9 This conclusion is in line with results obtained with men with sexual offenses.
10 Hanson & Morton-Bourgon (2004) found that sexual preoccupation (i.e., the symptoms
11 involved in CSB) was one of the strongest predictors of sexual recidivism ($d=.39$; $k=95$;
12 $n=31,000$). In a sample of 109 men with sexual offenses, 55% were diagnosed with
13 CSB (Blanchard, 1990). Similarly, a series of studies conducted by Marshall and
14 colleagues (2007, 2008) estimated that around 44% of federally-incarcerated men with
15 sexual offenses met the criteria for SA. As a result, CSB in general and some of the core
16 constructs underlying this dimension (e.g., the proclivity to engage in impersonal sex or
17 the increased sexual drive) have been considered critical components of sexual
18 aggression (Knight & Sims-Knight, 2011).

19 In contrast, many researchers and clinicians claim that most men who have
20 sexually offended and patients with paraphilias do not qualify for CSB, and that most
21 patients with CSB are not sexually aggressive or qualify for a paraphilic disorder
22 (Marshall & Marshall 2007). In this line, both the HD criteria proposal (DSM-5)
23 (Kafka, 2010) and the CSBD guidelines (ICD-11) (Kraus et al., 2018) consider the
24 presence of paraphilic sexual interests as an exclusion criterion for the diagnosis of
25 these conditions. In a series of studies on HD, Kafka et al. (1994, 1999, 2003)

1 established a clear distinction between excessive and problematic normophilic sexual
2 behaviors (initially labelled as “paraphilia-related disorder” and then called HD) and
3 excessive and problematic paraphilic interests (better classified into the DSM category
4 of “paraphilic disorders”). Coleman et al. (2003) also distinguished between paraphilic
5 and nonparaphilic compulsive sexual behavior.

6 As a result of this tacit contradiction between the results from empirical studies
7 (suggesting that CSB is linked to atypical sexual interests) and the criteria proposed for
8 the diagnosis of CSBD or HD (considering the presence of atypical sexual interests as
9 an exclusion criteria), the boundaries between both clinical conditions are elusive.
10 Another important shortcoming is that, in all the empirical studies cited so far, atypical
11 sexual interests were assessed using self-reports (questionnaires or interviews).
12 Therefore, the reliability of their results relied on participants personal disposition to
13 disclose their ‘real’ sexual interests. Given that disclosing certain atypical sexual
14 behaviors may have legal implications, figures resulting from this assessment approach
15 tend to underestimate its real prevalence (Seto, 2004). Even in the absence of legal
16 sanctions (e.g., when a patient fantasized with having sex with a child but did not
17 actually engage in this behavior), personal and social implications of disclosing atypical
18 sexual interests often prevent people to admit these conditions when they are directly
19 asked (Yakeley & Wood, 2014). Thus, clinicians and researchers should be sceptical
20 about the veracity of the findings derived from self-reports (Laws, 2020; Seto, 2004). In
21 this context, Penile Plethysmography (PPG) have been considered as a “gold standard”
22 for the measurement of normal and deviant sexual preferences (Castro-Calvo et al.,
23 2017; Muller et al., 2014; Murphy et al., 2015).

24 The PPG (or “phallometry”) is a device that measures male sexual arousal (i.e.,
25 degree of erection) during the presentation of potentially erotic stimuli. Sexual arousal

1 is measured through changes in penis volume (volumetric method) or circumference
2 (circumferential method), allowing the pattern of sexual activation in response to a
3 variety of sexual stimuli to identify sexual preferences (Merdian & Jones, 2011). As in
4 the case of self-reports, PPG is also subject to duplicitous manipulations in situations in
5 which individuals may have reasons to lie about their real sexual interests (e.g., in the
6 assessment of paraphilic interests); however, people usually have a poor control over
7 their sexual responses, and therefore they are not easily able to suppress sexual arousal
8 in response to stimuli that match their sexual preferences, or to pretend that
9 “acceptable” sexual stimuli (e.g., male or female adults) arouse him. For example, a
10 study in which 1,136 men were instructed to inhibit their sexual arousal during PPG
11 found that most men with sexual offenses against children were unable to successfully
12 suppress their sexual arousal to children (Babchishin et al., 2017). In short, even when
13 the PPG is subject to limitations (e.g., lack of standardization or inconsistent results
14 around its specificity and sensitivity; Marshall 2014), it is considered the best approach
15 for a reliable and valid assessment of normophilic and paraphilic sexual interests (Laws
16 & O’Donohue, 2008).

17 **The present study**

18 The purpose of the present study was to explore sexual response and atypical
19 sexual interests in straight men with different levels of CSB through the PPG. Different
20 a priori hypotheses were tested. Because current evidence suggests that patients with
21 CSB experience a high propensity for sexual excitation and a low sexual inhibition
22 (Walton, Cantor, Bhullar, et al., 2017), it was hypothesized that participants with higher
23 scores on a scale assessing CSB would show an increased sexual arousal toward most
24 sexual stimuli. Insofar as empirical studies demonstrated a link between CSB and
25 atypical sexual interests (Engel, Kessler, et al., 2019; Engel, Veit, et al., 2019), we also

1 hypothesized that participants with higher scores on a scale assessing CSB would have a
2 higher prevalence of pedophilic and/or coercive sexual interests.

3 We also hypothesized that the combination of both patterns of sexual response
4 during the PPG assessment would result in two different profiles. First, it was possible
5 that participants with higher scores on CSB experienced higher sexual arousal towards
6 most sexual stimuli, but not an increased preference for paraphilic sexual contents. In
7 this case, we expected to find a pattern of increased sexual response towards most
8 sexual stimuli (i.e., an increased average percentage of full erection towards most
9 stimuli regardless of the characteristics of the stimuli in terms of sex, age, and type of
10 sexual interaction) but not a clear preference for prepubescent or coercive sexual stimuli
11 in PPG indices indicating atypical sexual interests. It was also plausible that participants
12 scoring higher on CSB experienced higher sexual arousal towards most sexual stimuli,
13 together with an even more notable increase in the level of arousal while exposed to
14 pedophilic and/or coercive sexual stimuli. In this case, we expected to find a pattern of
15 increased sexual response towards most sexual stimuli together with a clear preference
16 for prepubescent and/or coercive sexual stimuli.

17 Method

18 Participants

19 The study sample comprised 61 straight men aged between 18-27 years old
20 ($M=20.74$; $SD=2.41$). Table 1 shows participants' characteristics. Around half of the
21 sample (52.5%) reported having a steady partner.

22 INSERT TABLE 1

23 Procedures

24 Participants in this research were recruited between 2012 and 2015. During this
25 period, a two-step targeted sampling was used to ensure the recruitment of participants

1 displaying high levels of CSB. Targeted sampling is advised when random sampling is
2 not feasible or is not appropriate (e.g., for the recruitment of hard-to-reach, hidden,
3 and/or low prevalent populations) (Magnani et al., 2005).

4 During the first study phase, a cross-sectional, street intercept survey method
5 was used to collect data on a large convenience sample of college students. Junior
6 members from the research team set an information table in the main entrance of
7 different higher education centers, actively approaching potential participants. Students
8 were asked to voluntarily collaborate with a research on sexual behavior (the specific
9 objective of the research was not mentioned so as not to bias the sampling process).
10 Those who accepted, completed a brief paper-and-pencil survey on basic
11 sociodemographic data and three standardized scales on CSB (see «composite index of
12 CSB symptoms» in measures section). In total, 684 male students completed the first
13 study phase, of whom 469 (68.6%) included their contact information to participate in
14 subsequent study rounds.

15 Sampling objective for the second study round was to obtain a representative
16 sample of participants with high levels of CSB. Given the intrusive nature of
17 phallometric assessment and the high cost of each PPG assessment, we limited the
18 number of participants to be recruited to 100 (ideally, 50 participants with low-to-
19 average scores and 50 with higher scores on CSB). According to our a priori calculus,
20 this sample size would let us identify average correlations ($r=.25-.30$) with appropriate
21 statistical power ($\alpha=0.05$; power $[1-\beta]=0.80$). Scores on the Sexual Compulsivity Scale
22 (SCS) in the first study round were screened to classify participants in two categories:
23 participants with low-to-moderate scores on a scale assessing CSB (defined as scoring
24 ≤ 23 in the SCS) and participants with high scores (scoring ≥ 24). This cutoff score has
25 been employed in multiple studies to identify individuals with “high levels of sexual

1 compulsivity” (e.g., Benotsch et al., 1999; Cooper et al., 2000; Hook et al., 2010;
2 Parsons et al., 2001), which in our research corresponded to the percentile 93th of the
3 SCS scores distribution in the first study phase. Based on this cutoff, 100 participants
4 from the first study phase (50 scoring ≥ 24 in the SCS and 50 scoring ≤ 23) were
5 randomly selected and contacted. A total of 85 participants answered and completed the
6 second study phase: 44 scoring ≥ 24 in the SCS and 41 ≤ 23 . A more detailed description
7 of participants’ classification and assessment is provided in Figure 1.

8 INSERT FIGURE 1

9 In the second study phase, participants completed the PPG assessment. In order
10 to maximize the reliability and validity of the results, participants were asked to refrain
11 from sexual activity for one day before testing, as well as from using substances that
12 may influence sexual arousal (such as cannabis, alcohol, cocaine, etc.; Huberman et al.,
13 2017). Before beginning, participants were asked to report their penis measures
14 (circumference flaccid and erect). Different approaches have been described in the
15 literature to determine penis size (Davoudzadeh et al., 2018; Veale et al., 2015). In this
16 research, penis circumference was measured fitting a paper ruler over the shaft of the
17 penis (the place in which the PPG is allocated). These measures were registered in cm.
18 Participants were encouraged to repeat the measurement twice to verify that penis
19 measures were registered correctly. Flaccid circumference (in cm) was employed to
20 select the appropriate strain gauge for the assessment through the PPG. The strain gauge
21 was then calibrated over six steps, with an increase in 0.5 cm per step. Once calibrated,
22 the experimenter (JCC, male) explained participants how to place the strain gauge on
23 the shaft of their penis and accompanied them to the phallometric laboratory.
24 Participants completed the PPG session seated alone in a testing room, whereas the
25 experimenter was located in an adjacent room. During the assessment, participants were

1 undressed from the waist-down and attached themselves the strain gauge while seated in
2 a comfortable recliner. Participants and experimenter were connected by an intercom.
3 This system was also employed for the presentation of audio stimuli. Visual stimuli
4 were presented using a projector onto a 2m² projection screen, located 2.5 meters in
5 front of the participant. Participants' sexual responses during the PPG assessment
6 session were recorded through a built-in data recording and analysis software. Average
7 time to complete the PPG was around two hours, and participants received 10€ as a
8 compensation.

9 Finally, we conducted certain post-hoc data treatments to ensure the reliability
10 and interpretability of the study findings. From the 85 participants assessed in the
11 second study phase, we deleted data from four men for which we identified unreliable
12 PPG results (e.g., abnormal data, problems during the assessment, etc.). As the pattern
13 of sexual response during PPG assessment is conditioned by sexual orientation and we
14 cannot ensure that the impact of CSB on sexual arousal is equivalent in gay and straight
15 participants, we also deleted data from 12 gay participants. Through this approach, we
16 prevented misinterpretations of the study findings (e.g., attributing to CSB results better
17 explained by participants' sexual orientation) or the artifactual reduction of the
18 covariation between CSB and sexual response towards sexual stimuli of a certain kind
19 (e.g., there is no reason to expect non-straight men to show significant sexual response
20 towards female stimuli, regardless of their scores on CSB). Finally, we identified and
21 deleted PPG nonresponsive participants (i.e., "flat-line profiles"). As highlighted by
22 Lykins et al. (2010), there are a myriad of criteria for identifying nonresponsive PPG
23 profiles. In this study, we considered participants as nonresponsive when they did not
24 reach an increment of 0.47 cm in penis circumference in response to, at least, one sexual
25 stimulus (Kuban et al., 1999). According to this threshold, 11.6% of the remaining 69

1 participants ($n=8$) were considered PPG nonresponsive and deleted from further
2 analysis. This reduced the number of participants to 61 (definitive study sample).

3 The study procedures were carried out in accordance with the Declaration of
4 Helsinki. The Institutional Review Board of the Jaume I University approved the study.
5 Volunteer participants in the research were informed about the study aim and completed
6 an informed consent.

7 **Measures**

8 *Basic sociodemographic data*

9 Participants were asked to report their age, whether they were engaged or not in
10 a stable relationship, and sexual orientation.

11 *Composite index of CSB symptoms*

12 CSB was assessed dimensionally through a new composite index based in three
13 previously validated scales: the Hypersexual Behavior Inventory (HBI, Ballester-Arnal
14 et al., 2019; Reid et al., 2011), the Sexual Compulsivity Scale (SCS, Ballester-Arnal et
15 al., 2013; Kalichman & Rompa, 1995), and the Sexual Addiction Screening Test
16 (SAST, Carnes, 1983; Castro-Calvo et al., 2018). Independently, these measures tend to
17 be excessively narrow in the assessment of CSB, not covering the wide range of
18 symptoms that should be explored to accurately assess this condition (Womack et al.,
19 2013); however, altogether these scales offer a very comprehensive assessment of CSB
20 symptoms and severity. To deal with the problem of using these scales independently,
21 Castro-Calvo et al. (2020) developed and validated the composite index of CSB
22 symptoms, an empirically derived index resulting from the selection of 41 items from
23 the SCS, HBI, and SAST. Items from the SCS and the HBI were rated on a 4 and 5-
24 point Likert scale, whereas items from the SAST were rated on a dichotomous scale
25 (i.e., respecting the original response options). The composite index of CSB symptoms

1 assessed the following empirically-derived subscales: (a) impaired control over sexual
2 behavior, (b) neglecting health, personal care or other interests, activities, and
3 responsibilities due to sexual behavior, (c) repetitive but unsuccessful efforts to control
4 or reduce sexual fantasies, urges or behaviors, (d) continued engagement despite
5 interference, (e) use of sex to cope with unpleasant emotional states, and (f)
6 preoccupation, salience, and self-perceived sexual problems. In the initial validation
7 study (Castro-Calvo et al., 2020), reliability for this composite index ranged between
8 .67-.89 (paper-and-pencil format) and .68-.91 (online version). In a subsequent study
9 (Ballester-Arnal et al., 2020), reliability for the total score ($\alpha=.93$) and subscales (α
10 between .70-.88) was even better. As for its validity, findings derived from these studies
11 supported the usefulness of this composite index to distinguish between individuals with
12 and without CSBD: in particular, participants classified as sexually compulsive
13 analyzing scores on this scale through data clustering techniques were characterized by
14 higher levels of sexual sensation seeking and erotophilia, increased offline and online
15 sexual activity, more depressive and anxious symptoms, and poorer self-esteem (Castro-
16 Calvo et al., 2020), as well as by an increased prevalence of different psychiatric
17 conditions (Ballester-Arnal et al., 2020)¹. These results resonate with the clinical
18 characterization of CSBD, supporting validity of this index for the assessment of this
19 condition. In the present study, scale reliability was also appropriate ($\alpha_{\text{total score}}=.95$;
20 $\alpha_{\text{subscales}}=.67-.89$).

21 ***Penile plethysmography (PPG)***

¹ Participants in the present study were part of the sample employed in the two previous studies using the composite index of CSB symptoms (Ballester-Arnal et al., 2020; Castro-Calvo et al., 2020). Therefore, characteristics from the CSB index reported in these studies are partially derived from –and generalizable to– participants in this study.

1 Men's genital responses were measured with an indium-gallium strain gauge
2 that recorded changes in penile circumference during sexual arousal (Behavioral
3 technology, Inc. [Monarch 21]). Circumference changes were obtained by computing
4 the difference between baseline penile state (captured at the beginning of each stimulus)
5 and maximal penile response during the stimulus presentation. Movement artifacts were
6 detected through individual visual inspection of response curves and removed manually.

7 As for the experimental stimuli, we employed the Monarch 21 PPG built-in
8 standardized set of stimuli for the assessment of participants' sexual preferences.
9 Participants were initially presented with a 3-minute long neutral stimulus (pictures of a
10 natural landscape accompanied by an audio telling story). Subsequently, participants
11 were presented with 16 segments ("core stimuli") varying by age, gender, and type of
12 sexual interaction: (a) four segments assessing sexual preference for toddlers (ages 3-5),
13 (b) four assessing preference for preteen children (ages 6-11), (c) four for teens (ages
14 16-18); and (d) four for adults (ages 20-30). For each age group, two stimuli showed
15 females (one depicting persuasive sex [i.e., consensual sex] and the other depicting
16 coercive sex [i.e., sexual harassment and rape]) and the remaining two showed males
17 (again, depicting both persuasive/coercive sex). Each segment was presented for 130
18 seconds, and consisted of both audio and visual stimuli: each segment started with a
19 photo of a partially clothed individual of the corresponding age and gender (5 seconds
20 to prime the subject for the audio), followed by an 85-second audio narrative (integrated
21 in the standardized assessment system) describing a sexual contact with the person from
22 the photo. The final 40 seconds consisted of four new images of the corresponding age
23 range and gender. Besides these "core stimuli", five additional segments were
24 presented. These segments consisted of a visual storyboard including photos and audio
25 with an increased degree of sexual explicitness. The contents depicted in these five

1 additional segments included: (a) two adult females (suggestive); (b) one adult male
2 (suggestive); (c) explicit heterosexual pornography; and (d) a sexual conversation with a
3 female through an Internet chat. Stimuli were separated by an interval of at least 45
4 seconds. An extra detumescent time of 3 minutes was given to those participants whose
5 genital arousal level did not return to baseline within this lapse. A recent study in which
6 103 male adolescents who have had sexually offended underwent a PPG assessment
7 with this standardized set of stimuli demonstrated its reliability and discriminant
8 validity in the assessment of sexual preferences (Mackaronis et al., 2014).

9 To address concerns related to attention during the assessment and manipulation
10 of responses, the PPG included a built-in signal detection task. In this task, participants
11 were instructed to press a button when presented with a star in a corner of the screen
12 (randomly located in different places of the screen). This task prevented participants
13 from avoiding sexual excitation by focusing their gaze outside the screen. At the same
14 time, participants were requested to press a button one time when hearing a tone during
15 the audio narrative of a persuasive sexual stimulus, and twice when hearing the tone
16 during the audio narrative of coercive sexual stimulus. This task prevented participants
17 from avoiding sexual excitation by focusing their attention on non-sexual stimuli.
18 Signal detection tasks have been shown to prevent manipulation without interfering
19 with the natural response to sexual stimuli (Quinsey & Chaplin, 1988).

20 **Data Analysis**

21 Statistical data analysis was performed with SPSS (version 26.0). First, we
22 tested whether participants' penile-response profile were or were not interpretable by
23 identifying PPG non-responders or "flat-line profiles" (i.e., individuals who exhibited
24 no clinically significant arousal to any sexual stimuli) (Mackaronis et al., 2014).
25 Discriminant validity (e.g., for identifying pedophilic preferences) of PPG results from

1 individuals displaying a “flat-line profile” is no better than chance (Lykins et al., 2010);
2 therefore, participants who did not show a significant penile response according to a
3 pre-established criterion were excluded from further analysis.

4 Then, PPG raw scores (i.e., circumference change from initial baseline penile
5 state at each measurement) were transformed to ensure their interpretability. Raw scores
6 allow for within-subjects comparisons (i.e., individual changes in penile circumference
7 across stimulus modalities), but not for between-subjects comparisons. The reason is
8 that individual differences in genital characteristics (i.e., penis size) prevent the
9 comparison of raw scores between participants (Earls et al., 1987; Harris et al., 1992).
10 We addressed this issue through different procedures. First, we transformed raw scores
11 into percentages of full erection. As the percentage of full erection is independent from
12 the penis size (i.e., expresses the magnitude of change as a percentage of the magnitude
13 at full erection), this index is appropriate for between-subjects comparisons (Barbaree &
14 Mewhort, 1994). The percentage of full erection was calculated using two different
15 approaches: (a) taking maximum recorded erection during PPG as a reference of full
16 arousal or (b) taking self-reported circumference size in erection as a reference of full
17 arousal. Second, we also transformed raw scores into ipsative z scores. Finally, we
18 calculated three indices of sexual preferences (the “sex preference index”, “age
19 preference index”, and the “type of sexual interaction index”) and an index of overall
20 sexual response. These indices of sexual preferences (e.g., the “sex preference index”)
21 were calculated by subtracting average z scores to a category of stimuli (female stimuli)
22 from the average z scores to stimuli of the opposite category (male stimuli); thus, the
23 sign and size of the resulting figure indicates the degree of sexual preferences toward
24 one type of stimuli or the other (in this example, higher scores indicate an increased
25 sexual interest in opposite sex partners). This straightforward calculus has demonstrated

1 its usefulness for providing an overall picture of individual sexual preferences (Chivers
2 et al., 2004; Suschinsky et al., 2009). Finally, we estimated the index of “general sexual
3 responsiveness” by averaging the % of full erection in each stimulus condition into a
4 single score.

5 All these indices were finally correlated (Pearson’s r) with the total score from
6 the composite index of CSB symptoms to analyze the relationship between CSB
7 (measured dimensionally) and sexual preference. Confidence interval (CI) for r ’
8 estimates were based on 1,000 bootstrapped samples. Supplemental Figure S1 shows
9 participants’ distribution according to their total scores on the composite index of CSB
10 symptoms.

11 Results

12 Correlations between CSB and Sexual Interests

13 Figure 2 shows correlations between average percentage of full erection in
14 response to different sexual stimuli and total score on the composite index of CSB
15 symptoms. In general, scores on the CSB index had small non-significant correlations
16 with sexual response towards most male and female stimuli (r between .037 and .266).
17 The only correlation that reached traditional threshold of statistical significance was the
18 correlation between the CSB index and the average percentage of full erection when
19 exposed to one female stimulus: “toddler coercive” ($r=.266$; $p=.045$). As the CI for r
20 intersected with zero (95% CI: -.083, .544), this result should be interpreted with
21 caution: even when normal theory estimated p value was significant, bootstrapped CI
22 suggests that the correlation between CSB and sexual arousal towards infant stimuli
23 (“toddler coercive”) may not be significant.

24 INSERT FIGURE 2

1 Similar results were obtained when the correlation between out-of-control sexual
2 behaviour and genital responses was explored through alternative indices, such as
3 average percentage of full erection employing maximum recorded erection during PPG
4 as a reference of full sexual arousal (Supplemental Figure S2) or ipsative *z* scores
5 (Figure S3). Ipsative *z* scores are not suitable for comparisons between individuals
6 (these scores are dependent on average intra-subject sexual arousal); however, they
7 provide interesting insights into intra-individual sexual interests. Scores on the
8 composite index of CSB symptoms positively correlated with ipsative *z* scores while
9 exposed to stimuli depicting “female toddlers coercive” ($r=.369; p=.014$). Once again,
10 CI for *r* intersected with zero (95% CI: -.113, .680), meaning that this correlation may
11 not be significant according to its bootstrapped CI.

12 In order to provide a more general overview of participants’ sexual interests, we
13 estimated three indices of sexual preference (the “sex preference index”, the “age
14 preference index”, and the “type of sexual interaction index”) and one index of “general
15 sexual responsiveness” (Figure 2). We found small non-significant correlations for men
16 with higher levels of CSB to prefer younger sexual stimuli ($r=-.098$) and persuasive
17 sexual contents ($r=.100$). Similarly, there was a small non-significant correlation
18 between the CSB index and sexual response during the PPG assessment ($r=.127$).

19 Discussion

20 The main aim of this research was to explore sexual response and atypical sexual
21 interests (measured via PPG) in people with different levels of CSB. Though individuals
22 scoring higher on CSB tended to show a slightly increased sexual arousal towards most
23 stimuli (regardless of the characteristics of the stimuli in terms of sex, age, and type of
24 sexual interaction), most of our correlations did not reach statistical significance. Thus,
25 our findings dismiss the hypothesis that CSB is related to an increased arousability in

1 front of most sexual stimuli. The nonsignificant correlation of .13 between the score on
2 the composite index of CSB and the index of “general sexual responsiveness” leads us
3 to a similar conclusion: whereas CSB seems to be related to a slight increase in the level
4 of general sexual responsiveness, the lack of statistical significance and the small size of
5 this correlation calls into question the existence of a relationship between CSB and
6 sexual arousal, as well as whether this relationship may explain a significant proportion
7 of the sexual behavior of straight men with CSB. At a clinical level, one might wonder
8 whether these small and nonsignificant correlations may have implications for
9 understanding the etiology of CSB, for predicting clinical features of this condition
10 (e.g., its manifestation or severity), or explaining real-life sexual behavior of individuals
11 with CSB (e.g., their sexual preference).

12 At a theoretical level, the fact that CSB only showed small and nonsignificant
13 correlations with the level of sexual arousal in response to most sexual stimuli weakens
14 models proposing that one of the core features explaining CSB is the presence of an
15 increased sexual excitation, together with a decreased sexual inhibition (e.g., the «dual
16 control model» [Bancroft & Vukadinovic, 2004] and the «sexhavior cycle» [Walton,
17 Cantor, Bhullar, et al., 2017]). According to these models, individual variations in the
18 expression of sexual excitation and inhibition may explain much of the variability in
19 human sexual desire, including why certain people are predisposed to experience an
20 excessive and uncontrolled sexual drive (Bancroft et al., 2009). So far, these theories
21 received some preliminary support from studies conducted in community (Walton,
22 Cantor, & Lykins, 2017; Winters et al., 2010) and clinical samples (Bancroft &
23 Vukadinovic, 2004). As a case in point, Winters et al. (2010) found a correlation of .38
24 (men) and .41 (women) between a measure of CSB and a scale assessing sexual
25 excitation in a sample of individuals seeking treatment for sexual compulsivity; in men

1 and women who never had sought treatment for sexual compulsivity, correlations
2 between CSB and sexual excitation were also positive and significant (.35 and .45). The
3 way that these studies measured sexual excitation may explain why their results differs
4 from those obtained in our research. In these studies, sexual excitation was assessed
5 through self-report (the Sexual Excitation Scale [SES, Janssen et al., 2002]). In this
6 scale, sexual excitation is assessed using items describing potential sexual situations and
7 the hypothetical occurrence of a sexual response (e.g., “*When I think someone sexually*
8 *attractive wants to have sex with me, I quickly become sexually aroused*” or “*Just*
9 *thinking about a sexual encounter I have had is enough to turn me on sexually*”)
10 (Janssen et al., 2002). Given that some studies have found that there is not a “perfect”
11 correspondence between subjective estimates of sexual arousal and objective measures
12 of genital response (Nobre et al., 2004), and these studies relied on a subjective measure
13 of sexual excitation (i.e., subjects appraised their level of sexual response based on their
14 subjective perception), it is possible that men with CSB tended to overestimate their
15 level of sexual excitation. This may have artifactually increased the correlation between
16 CSB and the subjective assessment of sexual excitation, explaining why we only found
17 small and nonsignificant correlations between CSB and objective sexual response.

18 The lack of covariation between CSB and objectively measured sexual arousal
19 found in our research may be also explained by the scale used to assess out-of-control
20 sexual behavior. Recent studies suggest that CSB comprises two correlated but
21 independent components: (a) problematic sexuality (including “traditional” symptoms
22 of CSB, such as lack of control, interference, or the use of sex to cope with unpleasant
23 emotional states) and (b) sexual drive (including aspects such as high sexual excitement,
24 sex drive, sexual fantasy involvement, and predilection for impersonal sex) (Carvalho et
25 al., 2015; Knight & Du, 2021). The former constitutes the focus of the DSM-5 and the

1 ICD-11 diagnostic approaches and is typically assessed for clinical purposes (i.e., the
2 diagnosis of CSB), whereas the later may be more intimately linked to objective
3 measures of sexual arousal (such as the PPG). The composite index of CSB symptoms
4 used in this research is appropriate for assessing the first component but limited when it
5 comes to measuring the second one. This means that a patient scoring high on the CSB
6 index may show average or low sexual drive (e.g., in the case of individuals feeling that
7 their sexual behavior is out-of-control due to moral incongruence) (Kraus & Sweeney,
8 2019). Thus, we cannot preclude that the use of a measure capturing both components
9 would have resulted in an increased covariance between CSB and sexual arousal.

10 Examining whether CSB was related to an increased preference toward atypical
11 sexual stimuli (stimuli depicting coercive sexual interactions or prepubescent stimuli)
12 was more complex than initially postulated. Initially, we hypothesized that individuals
13 with higher scores on CSB would display increased coercive and pedophilic sexual
14 preferences; however, this hypothesis was only partially supported by our findings. The
15 CSB index had a small non-significant correlation with preference toward persuasive
16 sex ($r=.10$; ns), dismissing the hypothesis that CSB increases the preference for
17 coercive sexual interactions. This finding goes against etiological models and empirical
18 studies proposing that CSB contributes to sexual coercion and constitutes a risk factor
19 for sexual recidivism (Hanson & Morton-Bourgon, 2004; Knight & Sims-Knight,
20 2011). As indicated before, the sexual offending literature has used the term «sexual
21 preoccupation» to describe the symptoms involved in CSB. Sexual preoccupation, as
22 defined by these models and studies, refers mainly to the second subcomponent of CSB:
23 sexual drive. Therefore, our finding might be explained by the fact that sexual drive
24 (and not the component of CSB assessed in this study –i.e., sexual problems–) is the
25 major aspect of CSB that disinhibits coercive sexual interests.

1 Similarly, scores on CSB also had a small non-significant correlation with
2 increased preference for younger sexual stimuli ($r=-.10$; ns), initially dismissing the
3 hypothesis of an increased preference for infant stimuli; however, we found a moderate
4 and significant correlation with the level sexual excitation when presented with stimuli
5 depicting “female toddler coercive” ($r=.27$; $p=.045$). Confirming this point, the
6 correlation between the score in the CSB index and the ipsative z score while exposed to
7 stimuli depicting “female toddlers coercive” was $.37$ ($p=.014$), meaning that participants
8 scoring higher in out-of-control sexual behaviors showed increased intra-individual
9 sexual preferences for prepubescent stimuli. In sum, our findings suggest that CSB may
10 be, to a small degree, predisposed to experience sexual attraction toward children. A
11 central issue now is whether this slightly increased sexual preference for prepubescent
12 stimuli may increase the risk of committing sexual offenses against children. In a recent
13 study by Bouchard et al (2017), these researchers found that CSB mediated between the
14 preference for paraphilic interests and the frequency of engagement in these behaviors:
15 in particular, paraphilic interests were more strongly associated with paraphilic
16 behaviours among individuals with high CSB. However, this mediation was only
17 present when CSB was measured through a scale focused on sexual drive (the second
18 component of CSB), not when out-of-control sexual behavior was measured by a scale
19 focused on sexual problems (such as the index of CSB symptoms used in this research).
20 Thus, the covariance between CSB and sexual interest for prepubescent stimuli found in
21 our research may not necessarily imply an increased risk of sexual offense.

22 This study is not without limitations. First, this research is correlational and
23 therefore, do not address whether CSB determines the presence of a greater arousability
24 and certain atypical sexual interests or, on the contrary, previous high arousability and
25 preference toward atypical sexual interests increase the vulnerability to develop CSB.

1 Second, the limited sample size prevents us to provide definitive conclusions on the
2 relationship between out-of-control sexual behavior and sexual deviance. Linked to this
3 limited sample size, it is important to note that this study is statistically underpowered.
4 With our definitive sample size ($n=61$), critical r value for identifying significant results
5 with $\alpha=0.05$ and power $[1-\beta]>0.90$ was around .21. This means that correlations that in
6 other studies tend to be small but significant (typically, around .10-.20), in our research
7 did not reach traditional thresholds of statistical significance. As an example, required
8 sample size to achieve statistical significance for a one-tailed $r=.127$ (e.g., the value of
9 the correlation between CSB scores and the “general sexual responsiveness” index) with
10 $\alpha=0.05$ and power $[1-\beta]=0.80$ was around 382 participants (i.e., six times the sample
11 recruited for this study). For that reason, we should consider this study as preliminary.
12 Another limitation of our research was related to the stimuli employed for the
13 assessment of sexual preferences: despite we employed a previously validated set of
14 stimuli for the assessment of a wide variety of sexual preferences (Mackaronis et al.,
15 2014), not all the age ranges were adequately covered by these stimuli (e.g., preference
16 for children between 12-15 years old was not adequately covered by the assessment
17 protocol). Also linked to the assessment of sexual interests, we did not include an
18 equivalent self-report measure to assess these interests (which may be useful to
19 contextualize –corroborate– our PPG findings).

20 As for the self-report used to measure CSB, the composite index of CSB
21 symptoms has shown promising results around its validity; however, much more
22 research is needed in order to confirm that this new index captures the central aspects of
23 CSB. Similarly, it would be of interest to include a measure of sexual drive to control
24 whether CSB still contributed to the understanding of sexual responsiveness and
25 preferences after controlling the effect of this variable. Finally, our study sample was

1 extremely homogeneous (straight males under 30 years old), meaning that knowing
2 whether our findings may be generalizable to other populations (e.g., gay men, older
3 people, etc.) still requires further research. Similarly, it would be desirable to replicate
4 our study in women (assessing female's sexual response through vaginal
5 photoplethysmography).

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Table 1

Participants' characteristics

	% (<i>n</i>) or <i>M</i> (<i>SD</i>)
Sociodemographic data	
Age (range 18-27)	20.74 (2.41)
Steady partner (yes)	52.5% (<i>n</i> =32)
Hypersexual Behavior Inventory (HBI)	
Total score (range 19-95)	38.46 (13.22)
Sexual Compulsivity Scale (SCS)	
Total score (range 10-40)	18.06 (5.88)
Sexual Addiction Screening Test (SAST)	
Total score (range 0-25)	6.85 (4.27)
Composite index of CSB Symptoms	
Impaired control (range 5-25)	9.81 (4.26)
Neglect (range 4-19)	7.42 (3.11)
Unable to stop (range 2-13)	5.55 (3.15)
Continued engagement despite interference (range 5-28)	8.96 (3.43)
Coping (range 7-36)	16.16 (6.32)
Preoccupation, salience, and self-perceived severity (range 3-16)	6.96 (3.18)
Total score (range 26-137)	54.90 (19.76)

Figure 1

Participant flow chart.

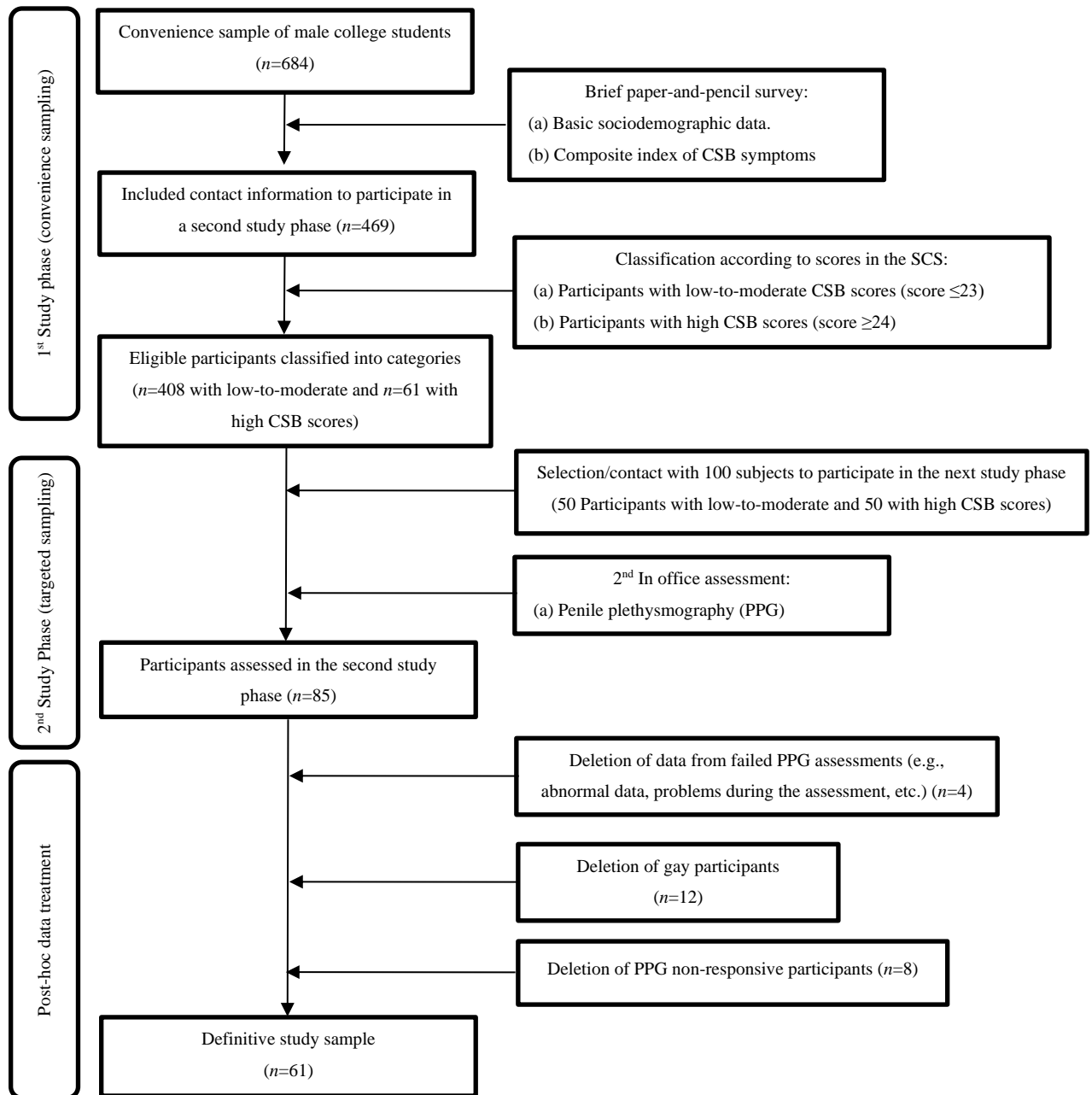
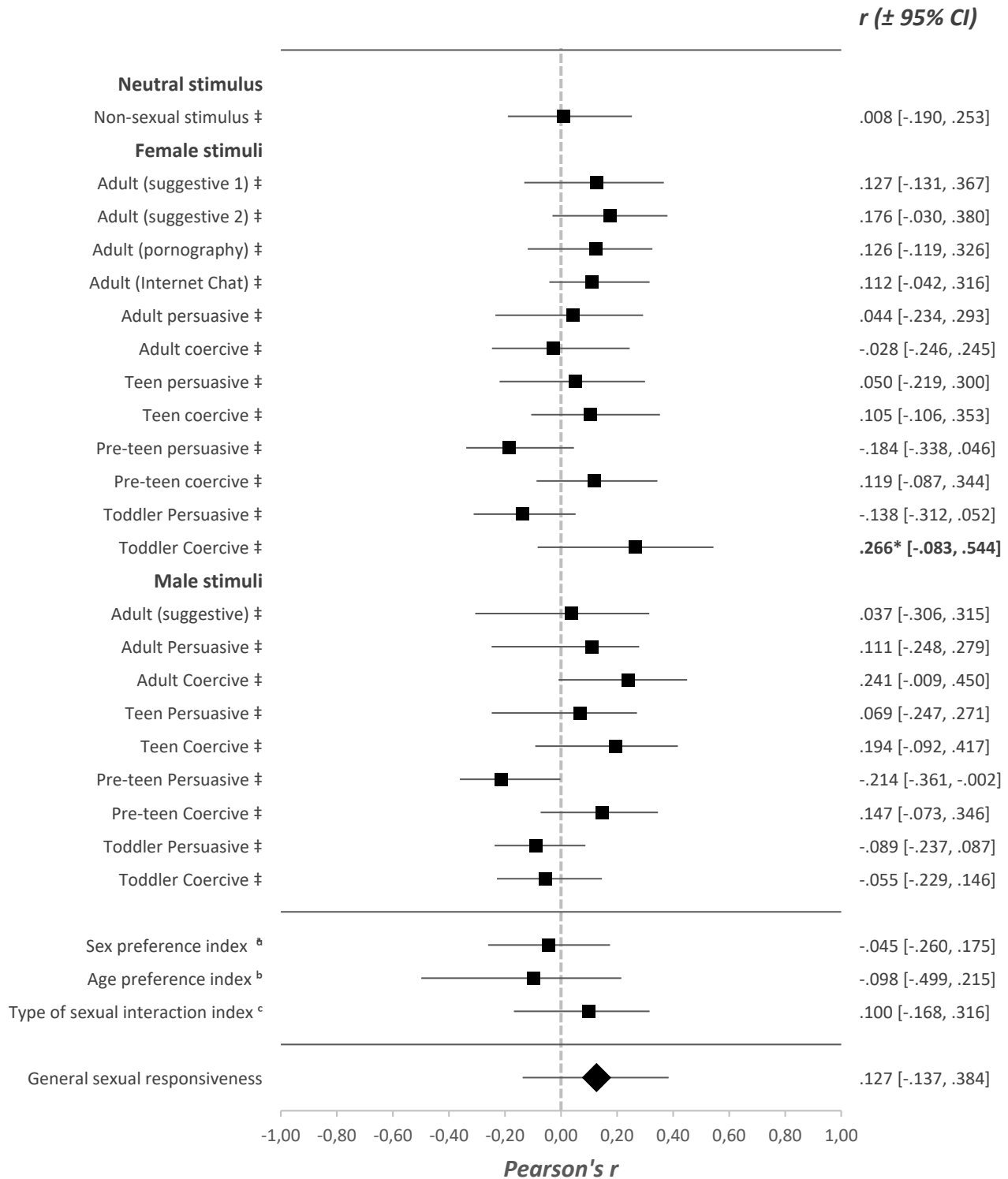


Figure 2

Correlations (Pearson's *r*) between the total score in the composite index of CSB symptoms and different sexual response' indices.



Note: ‡=Average percentage of full erection taking self-reported circumference size in erection as a reference of full arousal; ^a=higher scores indicate an increased sexual interest in opposite sex partners; ^b= higher scores indicate an increased sexual interest in adult sex partners; ^c= higher scores indicate an increased sexual interest in persuasive sexual contents; *p<0.05.