

# Bondage-Discipline, Dominance-Submission and Sadomasochism (BDSM) From an Integrative Biopsychosocial Perspective: A Systematic Review



Nele De Neef, MD,<sup>1</sup> Violette Coppens, PhD,<sup>2,3</sup> Wim Huys, MSc,<sup>2</sup> and Manuel Morrens, MD, PhD<sup>2,3</sup>

## ABSTRACT

**Introduction:** BDSM (bondage and discipline, dominance and submission, and sadism and masochism) increasingly receives attention from the scientific community. Where earlier research efforts mainly focused on epidemiologic characteristics, psychological and biologic factors driving BDSM preferences have recently gained interest as well.

**Aim:** To bring together all the existing scientific literature on BDSM from a biopsychosocial perspective.

**Methods:** Based on the PRISMA guidelines, the current systematic review brings together all the existing literature on BDSM from a biopsychosocial perspective.

**Main Outcome Measure:** Prevalence rates of BDSM interests were investigated in the literature, as well as the associations between BDSM interests on one hand and personality traits, adverse childhood experiences, education levels, sexual orientations and biological markers on the other.

**Results:** Biologic factors such as gender identity, sex hormone levels, and the neurologic constitution of the brain's pain and reward systems influence BDSM orientation. With regard to psychological factors, both personality traits (eg, higher levels of openness or extraversion) and the presence of a personality disorder have been associated with a heightened interest in BDSM, although only limited supporting evidence is available. Additionally, sensation-seeking levels and impulsivity seem to contribute, because they presumably guide one's drive to explore new or more-intense kinks. Whereas attachment styles impact couple dynamics, they also influence willingness to explore limits in a BDSM context. Lastly, education levels impact relational and sexual dynamics.

**Strengths and Limitations:** The limitations of the current review reflect those of the topical scientific literature. Although the number of studies focused on all aspects of BDSM is exponentially growing, most of these are only descriptive, and very few focus on underlying driving processes.

**Conclusion:** From this biopsychosocial perspective, we offer a dimensional approach while integrating the factors driving the onset and evolution of BDSM interests. **De Neef N, Coppens V, Huys W, et al. Bondage-Discipline, Dominance-Submission and Sadomasochism (BDSM) From an Integrative Biopsychosocial Perspective: A Systematic Review. Sex Med 2019;7:129–144.**

Copyright © 2019, International Society for Sexual Medicine. Published by Elsevier Inc. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

**Key Words:** BDSM; Biopsychosocial; Kink; Masochism; Sadism; Sadomasochism

Received September 14, 2018. Accepted February 3, 2019.

<sup>1</sup>Europe Hospitals, Campus St Michel, Brussels, Belgium;

<sup>2</sup>Collaborative Antwerp Psychiatric Research Institute (CAPRI), University of Antwerp, Antwerp, Belgium;

<sup>3</sup>University Psychiatric Hospital Antwerp, Campus Duffel, Duffel, Antwerp, Belgium

Copyright © 2019, International Society for Sexual Medicine. Published by Elsevier Inc. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).  
<https://doi.org/10.1016/j.esxm.2019.02.002>

Sex Med 2019;7:129–144

## INTRODUCTION

BDSM, previously known as *sadomasochism* (or SM), is an overarching abbreviation of bondage and discipline, dominance and submission, and sadism and masochism and refers to a physical, psychological, and sexual role-play involving power exchange between consensual participants.<sup>1–3</sup> Historically, these practices and interests have been pathologized (for review, see reference<sup>4</sup>); Krafft-Ebing<sup>5</sup> pioneered in classifying sadism and masochism as pathologies in his *Psychopathia Sexualis*, a reference work of 19th century sexology. These views were later reflected

in Freud's<sup>6</sup> theories on sexuality. The perception of BDSM as being pathologic influenced scientific articles from the 1970s and 1980s, which tended to focus on (non-consensual) sexual sadism from a forensic perspective and incidental SM-related fatalities.<sup>7–9</sup> These historical views still have an impact on the most prominent contemporary psychiatric classification systems, the International Classification of Diseases (ICD; 10th edition: ICD-10) on one hand the Diagnostic and Statistical Manual of Mental Disorders (DSM; 5th edition DSM-5) on the other.<sup>10–13</sup> Ever since, the BDSM community is subjected to misconceptions and stigmatization.

The recent success of the *Fifty Shades of Grey* books and movies, among others, have led to an increased awareness of this expression of intimacy and sexuality. Contemporary mainstream interest in BDSM is mirrored in the exponential growth seen during the last decade of scientific research focusing on all kinds of BDSM aspects and, as such, has enriched the existing literature, thereby nuancing its initial pathologic classification.

This increased availability of BDSM-related scientific literature inspired us to bring together the existing literature on biopsychosocial aspects of BDSM in the current systematic review, the first in its kind. An integration of biologic, psychological, and social knowledge about BDSM may contribute to the understanding and destigmatization of this form of sexual expression, as well as challenge its place in psychopathological classifications.

## METHODS

The current systematic review was conducted according to PRISMA-P (preferred reporting items for systematic review and meta-analysis protocols) guidelines.<sup>14</sup>

### Terminology

Different sources may refer variously to individual parties involved in a BDSM interaction. In this review, solely the terms “dominant” and “submissive” are used to respectively refer to either participants providing stimulation, orders, or structure or those being physically constrained, receiving stimulation, or following orders. A “switch” is an individual who shifts between both the dominant and submissive roles, depending on the context and play partner.

### Inclusion Criteria

A literature search was performed using the following inclusion and exclusion criteria: (i) research articles with a focus on BDSM generating original data were included; (ii) case reports on consensual sexual masochism and submission were included; (iii) opinion articles, (comment) letters, and essays without original data were excluded; (iv) given the focus on consensual sexual sadism or masochism, forensic articles on sexual offenders were excluded. These inclusion criteria were driven by the generally accepted scientific hierarchy of evidence.

## Information Sources

A PubMed database search (1970–April 2018) for English-language articles was conducted using the following search terms: BDSM OR masochism OR sadomasochism OR sexual sadism OR bondage OR sexual submissive OR sexual submission OR sexual kink.

## Study Selection

Titles and abstracts were screened to eliminate irrelevant articles. Full texts of potentially relevant articles were read and screened for further eligibility; the final selection was made in consensus by N.D.N. and M.M.. See [Figure 1](#) for PRISMA Flow Diagram (based on reference<sup>15</sup>).

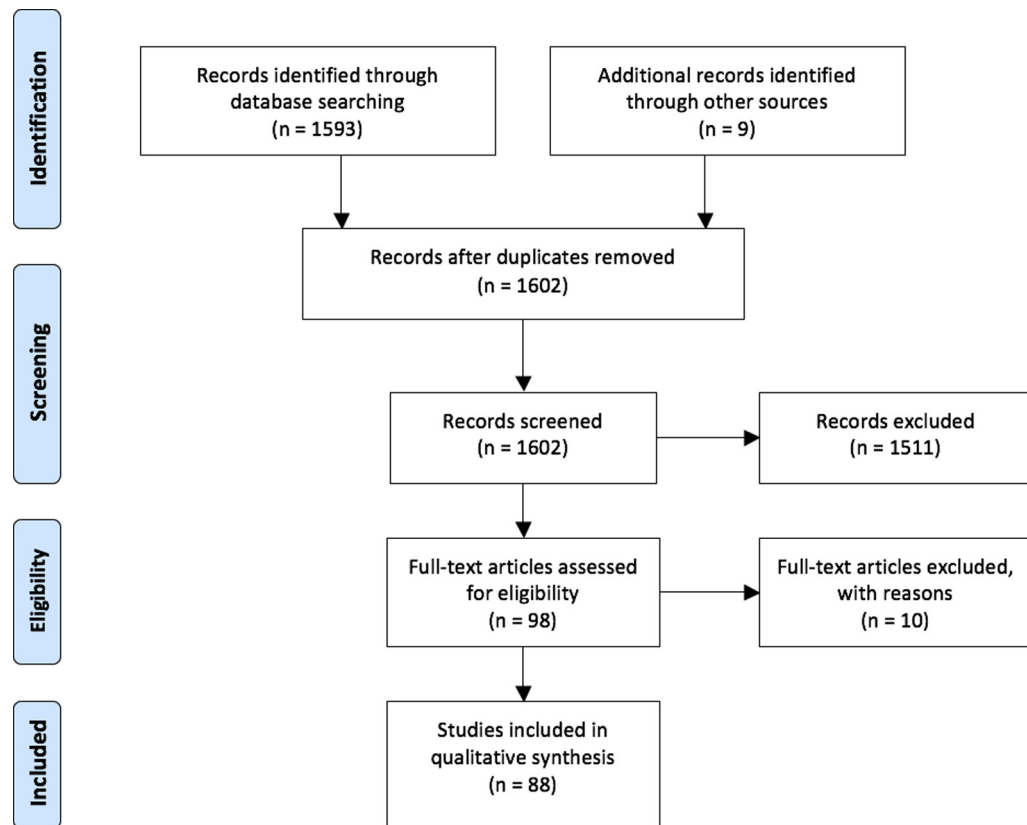
The Pubmed database search initially generated 1,593 records. Cross-referencing further led to inclusion of 9 additional articles and book chapters. Preliminary screening of titles and abstracts resulted in 98 remaining articles to be read in full. 10 articles were found irrelevant for the current review (studies including forensic patients, opinion articles, articles related to non-BDSM sexuality), resulting in a final selection of 87 articles to be included.

## RESULTS

### Prevalence Rates of BDSM

Studies reporting on the prevalence rates of BDSM interests and practices have yielded somewhat divergent results ([Table 1](#)). An Australian study<sup>18</sup> found that 2.2% of men and 1.3% of women between ages 16–59 years had engaged in BDSM activity during the previous year. On the other end of the spectrum, Holvoet et al<sup>3</sup> reported a BDSM interest in as much as 46.8% of the general population (n = 1,027), who have engaged in BDSM-themed activities at least once, although the same study indicated that only 7.6% of the general population self-identified as a BDSM practitioner. Studies reporting on individuals having BDSM fantasies reveal higher prevalence rates. Holvoet et al,<sup>3</sup> for example, found that 69% of the general population had fantasies about BDSM-related activities. In line with these prevalence rates, another study in Canadian university students showed that 72% of the men and 59% of the women had had fantasies of being tied up, and 65% of the men and 58% of the women had fantasies of tying up a partner.<sup>16</sup> In the same group, 60% of the men and 31% of the women indicated positive thoughts of whipping or spanking someone. Similarly, Jozifkova and Flegel<sup>21</sup> demonstrated that about half of the general population preferred unequal power dynamics in their sexual relationship.

This divergence might be explained by several factors. First, studies that surveyed participants on their interests using an overarching term such as “SM” or “BDSM” without specifying a definition<sup>18,19,24,25</sup> systematically yielded lower prevalence rates, compared with studies gauging interest or practices of specific activities and dynamics (eg, “tying up,” “blindfolding,”



**Figure 1.** Preferred reporting items for systematic review and meta-analysis protocols flowchart. PRISMA = preferred reporting items for systematic review and meta-analysis protocols.

“whipping”).<sup>3,16,21,22</sup> This may indicate that, in general, the subjective interpretation of the definition of (BD)SM practice has a stricter connotation than when defining the practice through specific, individual acts, leading to lower prevalence rates when overarching terminology is used. This is illustrated by the fact that about half of the sample from Holvoet and colleagues<sup>3</sup> indicated having engaged in BDSM activities, whereas, in the same sample, only 7.6% actually self-identified as a BDSM practitioner. It should be noted that no consensus exists on which activities are BDSM practices and which are not.<sup>3</sup>

A second source of divergence might stem from investigating different intensity levels of BDSM interest. As such, some studies assessed interest in or fantasies about BDSM, whereas others queried actual performance of such activities. As can be expected, the first type of studies demonstrated higher prevalence rates than the latter.

Third, the applied methodology could further account for some of the variance, because the surveys yielding higher prevalence rates<sup>3,22,23</sup> were held via internet channels, whereas Richter et al<sup>18,19</sup> interviewed participants through less-anonymous telephone calls. A final explanation might come from the time span covered by the different questionnaires, because the prevalence of activities in the preceding month<sup>1,3,22</sup> was found to be much lower than lifetime experience (1.3–8.1% vs  $\leq 32\%$ ).<sup>22</sup>

## The BDSM Spectrum

Although BDSM practitioners are often considered as a homogeneous subculture of the general population, in the current review, we applied a dimensional approach toward interest in and practices of BDSM. On one end of the spectrum, BDSM-related interests translate into unexplored fantasies and, on the other, an intensive, continuous implementation of these interests in all aspects of daily life. It has been suggested that a majority of the general population has BDSM-themed fantasies, and about half has engaged in BDSM-related activities at least once.<sup>3</sup> Joyal and Carpentier<sup>23</sup> found interest in voyeurism, fetishism, and masochism in half of their population sample and at least 1 experience with such an activity in one-third. Additionally, engaging in at least 1 BDSM-related activity on a regular basis is reported by 12.5% of the general population.<sup>3</sup> The latter study also demonstrated that 1% of the general community explores these interests outdoors and visits dedicated BDSM-related clubs or events. Finally, an even smaller subgroup implements BDSM in their lives on a 24/7 basis, although specific prevalence rates of these practices are not known.<sup>26</sup> Accordingly, BDSM is seen by some as a form of leisure,<sup>27</sup> whereas others define it as a lifestyle, an identity, or even their “orientation(s).”<sup>23</sup> Santilla and colleagues<sup>28</sup> showed that these interests also seem to evolve over time, from initial milder interactions toward more extreme forms later on. For example, a practitioner may start pain play interests

**Table 1.** Prevalence rates of BDSM interests in the general population

Study	Sample size (M/F)	Population	Age range	Method of assessment	Results	Remarks
Renaud & Byers <sup>16,17</sup>	n = 292 (148/144)	Undergraduate students (Canada)	17–45	Self-developed rating scale, 56 items	More than 90% of the group reported both positive and negative cognitions of sexual submission. Women had more frequent positive cognitions of sexual submission than men. 72% of the men and 59% of the women had fantasies of being tied up, and 65% of the men and 58% of the women had fantasies of tying up a partner; 60% of the men and 31% of the women indicated positive thoughts of whipping or spanking someone, whereas 44% of the men and 35% of the women indicated positive thoughts of being whipped.	The authors used a self-developed rating scale asking for sexual cognitions, including cognitions on sexual submission, whipping, spanking, and hurting partner. It did not ask for actual experiences with BDSM-themed practices. Only included heterosexual students (mean age = 19.8 y).
Richters et al <sup>18,19</sup>	n = 19.307 (9.729/9.578)	General population Australia	16–59	Computer-assisted telephone interviews	2.0% of the men and 1.4% of the women indicated to have engaged in BDSM in the last 12 months. Prevalence was higher in gay/lesbian (4.4%) and bisexual (14.2%) individuals	A single question was asked in the interview: "In the last 12 months have you been involved in B&D or S&M? That's bondage and discipline, sadomasochism, or dominance and submission"
Långström & Seto <sup>20</sup>	n = 2,450 (1,279/1,171)	General population Sweden	18–60	Self-administered questionnaire as part of larger survey	Sadomasochistic behavior in 2.2% of the total sample	The survey asked about sadomasochistic behavior, and, as such, did not include bondage, discipline, dominance, and submission. Focus of analysis was on other aspects of sexuality
Jozifkova & Flegr <sup>21</sup>	n= 864 (398/466)	General population with access to Czech largest internet portal	/	Internet trap method	Unequal sexual partnership was chosen by 51% of the men and 42% of the women. Men chose submissive-woman depictions approximately 2.6 times more frequently than dominant-woman. Women chose either submissive- or dominant-man depictions with equal frequency.	A banner was offered attached to the e-mail account of members of general population. After clicking on the banner, the participant had to choose an icon displaying different hierarchical positions between partners. Presumably, 0.41% of the men and 0.27% of the women participated, thus accounting for an immense participation bias. No age limits were defined for participation.

(continued)

Table 1. Continued

Study	Sample size (M/F)	Population	Age range	Method of assessment	Results	Remarks
Holvoet et al <sup>3</sup>	n = 1,027 (459/565) (n= 3 indicated other sex)	General population Belgium	18–65	Internet survey including 54 BDSM-related activity items	47% had performed at least 1 BDSM-related activity, and additional 22% had fantasies about it. 12.5% indicated performing at least 1 BDSM related activity on a regular basis. 7.6% self-identified as BDSM practitioner. When asked for activities at least experienced once, movement restriction and use of blindfold elicited highest interest (20–24%). Submissive kneeling, whipping, hitting a partner in sexual context (6–11%)	The authors used a self-developed questionnaire to assess interest in a wide range of BDSM-related activities, which included items that on their own may not define a BDSM activity as such (eg, blindfolding, movement restriction, use of ice cubes, etc)
Herbenick et al <sup>22</sup>	n = 2,021 (975/1,046)	General population USA	18–91	Internet survey including some BDSM related questions	Playful whipping (6% in past year; 15% lifetime); spanking (17.2% in past year; 31.9% lifetime); tying up/being tied up (4.5% in last year; 21.1% lifetime); gone to BDSM party (1.1% past year; 3.4% lifetime). 29.3% found tying up partner or being tied up (very or somewhat) appealing. Experiencing pain as part of sex was very or somewhat appealing to 11.4%. Use of blindfolds (very to somewhat) appealing in 34.9%.	This large-scale survey focused on a broad range of sexual behavior but included some BDSM-themed questions.
Joyal & Carpentier <sup>23</sup>	n = 1,040 (475/565)	General population Canada	18–64	2 survey methods: online survey (n = 543) vs telephone interview (n = 500)	A desire for masochism was indicated by 23.8% (19.2% in men, 27.8% in women), whereas, for sadism, this was present in 7.1% (9.5% in men, 5.1% in women). Actual experience (once in lifetime) was confirmed by 19.2% for masochism (men: 13.9% vs women: 23.7%), whereas this was the case in 5.5% for sadism (men: 7.4%; women: 3.9%). Levels indicated for masochism were significantly higher when assessed by internet survey compared to telephone interview.	Masochism was questioned by “Have you ever been sexually aroused while suffering, being dominated, or being humiliated?”; sadism was assessed by the question “Have you ever been sexually aroused by making someone suffer or by dominating or psychologically or physically humiliating another person?”

B&D = bondage and discipline; BDSM = bondage and discipline, dominance and submission, and sadism and masochism; M/F = male/female; S&M = sadism and masochism; / = information not available.



by experimenting with mild spanking and evolve toward more intense stimuli, such as electrical stimulation or needle play.

Literature indicates that BDSM is an umbrella term that covers an array of interactions that can be present independently or in different clusterings. A dimensional angle of approach is therefore also applicable on the nature of the interaction and the acts implemented. Generally, a shift in power dynamics is at the core of BDSM play.<sup>1,29</sup> As such, in a more stereotypical setting, there is a dominant partner (D) in charge of the scene, and a submissive partner (s), who consents to being submitted to the actions of the dominant. The roles may switch, more parties may be involved, but, at each point, power exchange is at its essence. This power shift will translate in a wide range of role play possibilities, including specific rituals (kneeling, use of title to address partner), humiliation, movement restriction, or sensory deprivation. When looking at the specific nature of the activities, “softer” BDSM elements such as movement restriction or blindfolding are much more frequently implemented, compared with “harder” BDSM activities (eg, whipping).<sup>3</sup> Based on the associations between specific BDSM activities, Alison and colleagues<sup>2</sup> <https://paperpile.com/c/ihzoih/Gpb1+egEC> defined 4 clusters of BDSM-related behaviors: pain play (including spanking, caning, use of clothespins), humiliation (eg, verbal abasement, gagging), physical restriction (use of bondage, handcuffs, or chains), and hypermasculinity (eg, anilingus, use of dildo). This last category, however, presumably reflects the fact that more than half of their sample consisted of gay men and may not be representative for the broader BDSM community. Nevertheless, it demonstrates that different BDSM activities are not necessarily all present in each interaction and that certain clusterings can be established. In this line, Jozifkova et al<sup>30</sup> suggested that D/s dynamics and affinity with bondage are 2 separate play strategies, although both may co-occur. Weierstall and Giebel<sup>31</sup> recently developed a sadomasochism checklist containing a submission scale and a dominant scale, each containing 24 items with 6 different factors: domination, use of toys, soft play, beatings, breath play, and play involving bodily fluids. This, again, indicates that heterogeneous profiles of interest emerge within the BDSM community.

BDSM play is often perceived as a precursor to or part of sexual activities.<sup>1</sup> Chivers et al<sup>32</sup> demonstrated that exposing individuals with masochistic sexual interests to stories with masochistic and submissive themes elicited both subjective and genital sexual arousal responses, indicating the sexual nature of these experiences. In contrast, Newmahr<sup>33</sup> argued that, to many practitioners, SM does not precede or replace sexual activities but is an end in itself. Both may be true, because a recent online survey of BDSM forum members (Fetlife; n = 363) conducted by our research group (unpublished results, 2019) showed that BDSM-related interests are sexual in nature in most, but not all, BDSM community members; 70% indicated they always or regularly combined BDSM play with sex, whereas 7% never combined the 2, and 23% do so only on occasion.

In the layman’s view, BDSM is subject to binary categorization, with participants being either dominant or submissive. More recently, however, more roles have been defined for BDSM community members to identify with: dominant, master/mistress, top, sadist, submissive, bottom, masochist and switch,<sup>34,35</sup> although a clear delineation between these roles does not always exist. In Martinez’s survey study,<sup>35</sup> most of the participants (n = 185 of 202) identified with 1 BDSM identity, with 41.1% of the participants self-identifying as a submissive, slave, or bottom, 28.2% as dominant, master, or sadist, and 22.3% as switch. More than half of the population (52%) indicated maintaining the same role (dominant or submissive) throughout all interactions, whereas the other half tended to experiment with other roles as well, although men tended to be significantly less fluid in their role (43.4% of the men had at least some level of fluidity, whereas this was the case for 51.5% of the women). Nevertheless, almost all participants clearly preferred 1 role over others, because only 7.4% experienced both roles in equal amounts. In Alison’s study,<sup>2</sup> these ratios were confirmed, with 27.0% of the subjects identifying themselves as mainly sadistic, 22.7% as both sadistic and masochistic, and 50.2% as mainly masochistic. However, it should be noted that the sample used in the latter study is far from representative for the general population, because 88% of the participants (n = 184) were male, and, additionally, more than half (51.6%) reported being homosexual.

To conclude, BDSM interests can be approached from a multidimensional perspective. In the general population, depending on the applied BDSM definition and methodology, 8–70% is BDSM-minded, with a smaller amount of practitioners seeking to take their interests outdoors. Practitioners play with varying degrees of intensity and frequency and are heterogeneous in performing their activities in a sexual context. Roles adopted in the interaction occasionally are strictly dominant or submissive, but they are more flexible in the majority of the players.

## Stigma Surrounding BDSM

There is a distinct stigma surrounding the spectrum of BDSM, resulting, among others, from the fact that it links sexuality to pain, power display, and humiliation, rather than to romance and tenderness, an association more commonly made by the general public. Nevertheless, it has been claimed that previous cultures (eg, ancient Egypt, ancient Rome) accepted the use of physical and mental pain play in a sexual context much more than is the case in our current western societies,<sup>1,36,37</sup> but insufficient data exist to verify this hypothesis. International differences in BDSM practices have been suggested,<sup>38</sup> but large-scale studies investigating this notion have yet to be conducted. Yost<sup>39</sup> identified 4 categories of stigmatizing attitudes: (i) BDSM is socially and morally wrong, (ii) BDSM is associated with non-consensual violence, (iii) a general lack of tolerance toward SM practitioners, and, finally, (iv) the notion that submissive or

dominant traits translate to other domains in everyday life (eg, behavior toward children). Although few studies looked into the characteristics and traits facilitating these stigmatizing attitudes, stigma was found to be higher in women who were less sexually emancipated.<sup>40</sup> In a large sample of SM-identified women, half reported they had experienced some form of physical assault or discrimination because of their SM practices, and another 30% were refused or ejected from social, recreational, political, educational, and spiritual groups.<sup>41</sup> On the other hand, Graham and colleagues<sup>42</sup> showed that participation in accepting environments where BDSM is stimulated and celebrated has a positive impact toward stigma management. This may partly explain why some practitioners explore their sexual interests in public BDSM communities, rather than keeping it in the privacy of their homes.

This stigmatization translates into feelings of anxiety in most to disclose their BDSM interests<sup>43</sup> and may be in line with the elevated rates of suicidal ideation seen among BDSM practitioners, even after adjusting for depressive symptoms,<sup>44,45</sup> with 37% of them reporting non-zero levels of suicidal ideation.<sup>45</sup> Similarly, Brown et al<sup>46</sup> found that 12% of their large sample of BDSM practitioners (n = 576) reported  $\geq 1$  previous suicide attempts, with significantly more women (19%) indicating an attempt, whereas this was only the case for 8% of the men. This is in contrast with the general adult population, in which lower rates of suicide attempt have been reported (1.3–4.2%).<sup>47,48</sup> It may also have important consequences in the context of jurisdiction, because it is still unclear how law makers position themselves toward consensual sadomasochism.<sup>49</sup> It is often argued that sexual behaviors should be protected under a right to privacy, and parallels have been drawn with sports in which bodily harm also incurs on a consensual base (eg, boxing). In light of the still-ongoing equivocality, Green<sup>49</sup> argues for a similar legal treatment of sexual and sportive activities when consensual harm is involved.

Some scientific literature contributes further to stigma sustenance, for example, by focusing on fatal cases of autoerotic asphyxia, while looking into associations with masochism, bondage, or transvestism.<sup>50–52</sup> Despite these incidental cases, safety and consensual practices are core elements in BDSM interactions, and there is a lack of evidence that asphyxiophilia (ie, restriction of breathing) specifically and sexual masochism in general is actually harmful.<sup>53</sup> Also, from a clinical perspective, it was demonstrated that most psychotherapists do not tend to see BDSM as a benign variation in sexual behavior, and almost half of these therapists were unsure whether most of the BDSM practitioners were “psychologically healthy.”<sup>54</sup> Worryingly, some therapists were unable to differentiate between BDSM and abuse and, as a result, required clients to give up BDSM as a condition of treatment. Unsurprisingly, then, Waldura et al<sup>55</sup> found that only 38% of their sample was able to disclose their kink orientation to their clinician. Women especially were concerned about being judged by their medical care givers for their sexual

practices. Therapists experienced in working with BDSM clients, however, accentuated the importance of a non-judgmental attitude and knowledge of BDSM practices and values.<sup>56,57</sup> Moser and Levitt<sup>58</sup> found that only 6% of BDSM participants indicated they preferred not having these interests, and a survey of sex therapists demonstrated that BDSM interests presented rarely a manifesting problem in their BDSM-practicing clients.<sup>59</sup>

## Pathologizing BDSM

The inclusion of sexual sadism and sexual masochism in the Diagnostic and Statistical Manual of Mental Disorders has its roots in earlier descriptions by Freud<sup>6</sup> and Krafft-Ebing,<sup>5</sup> who pathologized these interests. According to Weinberg,<sup>60</sup> they presumably had biased views on the matter because they based their ideas on literature describing extremes (eg, the works of the Marquis de Sade) that did not necessarily represent actual BDSM, as well as on conservative views on sexuality that were generally prevailing in their time, thereby further inflating aversiveness toward all kinds of sex-related activities. It should be noted that, in the latest 2 editions of the DSM (DSM-IV and DSM-5), a clear distinction is made between non-pathologic atypical sexual interest (or paraphilia) and actual paraphilic disorders that, by definition, have to cause distress or impairment to the practitioner or cause personal (risk of) harm to others.<sup>7,61</sup> As such, the DSM distinguishes between normal BDSM behavior and pathology and thereby recognizes that many people are quite comfortable with their potentially non-mainstream sexual interests expressed through consensual practices. Therefore, some argue for keeping diagnoses such as sexual masochism and sexual sadism in the DSM classification system.<sup>62</sup> Similarly, sadomasochism is included in the ICD-10 as a disorder of sexual preferences, and Reed and colleagues<sup>13</sup> have recommended that this diagnosis be deleted in the next edition (ICD-11). They stress the importance of the consensual nature of these interactions and propose 2 new diagnoses based on this principle of consent: (i) If consensual behavior is involved, sadomasochism can be added as Other paraphilic disorder, “if accompanied by marked stress that is not entirely attributable to rejection or feared rejection of the arousal pattern by others, or by significant risk of injury or death”; (ii) A new diagnosis, “Coercive sexual sadism disorder,” is proposed when “arousal pattern focuses on the infliction of suffering on non-consenting individuals.”<sup>10</sup>

Nevertheless, several authors have criticized the presence of sexual sadism and sexual masochism in the DSM and suggested that public opinion, rather than scientific argumentation, was the main reason for paraphilias to be part of the DSM.<sup>10,62,63</sup> This is in line with Connolly,<sup>64</sup> who failed to show significant psychopathology in BDSM practitioners and showed levels of psychological sadism and masochism that were comparable to control subjects. Others believe that these diagnoses deserve a place in the classification system, because they are highly prevalent in forensic populations of sexual murderers, but that it is crucial to differentiate between safe, sane, and consensual BDSM practices

on one hand and pathologic, non-consensual forms of sexual sadism and masochism on the other.<sup>64,65</sup> Indeed, when practiced in a non-consensual way and when harming others or self, these interests need to be categorized as pathologic.

Additionally, Klement et al<sup>66</sup> demonstrated significantly lower levels of sexism and rape myth acceptance in BDSM practitioners; contrasting insinuations that erotica involving sexually submissive women negatively impacts attitudes toward women and increases rape myth acceptance in men.<sup>67,68</sup> Nevertheless, 2 negative implications of incorporating BDSM as paraphilia in the DSM remain. First, the fact that sexual sadism and masochism are part of a psychiatric classification system may still fuel stigmatizing presumptions (eg, in a context of jurisdiction). Second, the fact that BDSM-related activities are classified as paraphilias implies that they are unusual or atypical; however, this stands in stark contrast with data showing that more than half of the general population has BDSM-themed fantasies.<sup>3,16</sup> An internet survey<sup>69</sup> conducted on 1,516 adults showed that only 9 of 55 sexual fantasies were deemed to be “unusual” (operationalized as being reported by <15.9%), including urine play, transgender dressing, or sexual abuse. Fantasies about sex with animals or children (age <12 years) were rare (as reported by <2.3%). Typical BDSM-related fantasies, such as being dominated, bondage, or spanking, were found to be more common (up to 34.5%), and could, thus, not be identified as unusual. Notably, some authors parallel BDSM classification to the inclusion of homosexuality in previous DSM editions.<sup>56,70</sup>

### Psychosocial Aspects of BDSM Interests

Some preliminary literature suggests an influence of several psychological factors and social influences driving an affinity with BDSM.

#### Personality and Personality Disorder

A single study scrutinized associations between personality traits and BDSM preferences.<sup>71</sup> Compared with non-BDSM control subjects (n = 434), BDSM practitioners (n = 902) were less neurotic, more extroverted, more open to new experiences, more conscientious, and less agreeable. Moreover, BDSM practitioners differed in their attachment styles because they were less sensitive to rejection, more confident in their relationships, had lower need for approval, and were less anxiously attached compared with the non-BDSM participants. Most of these effects were driven by the female subsample of the BDSM practitioners. Frías et al<sup>72</sup> suggested a higher prevalence of sexual masochism in subjects with borderline personality disorder (6 of 60; compared with 0 of 60 control subjects without borderline personality disorder), but, because of very limited sample size, these findings should be replicated. In this line, Connolly<sup>64</sup> demonstrated higher levels of narcissism among practitioners (n = 32) compared with control subjects. These preliminary findings, thus, may suggest an association between cluster B

personality traits and BDSM interests, but this notion should be explored in future studies.

#### Impact of Adverse Childhood Experiences on BDSM Interests

A study performed by Nordling et al<sup>73</sup> showed that the prevalence of self-reported sexual childhood abuse was higher among BDSM practitioners (8% men, 23% women), as compared with the general population (3% men and 8% women). It should be noted that the sample of women in Nordling's sample was small (n = 22) and thus not representative for female BDSM practitioners. Moreover, a recent meta-analysis on the prevalence of child sexual abuse in community and student samples showed that 7.9% of men and 19.7% of women had suffered some form of sexual abuse in childhood,<sup>74</sup> which is more in line with Nordling's findings among BDSM practitioners. It should be noted that earlier research has shown that women who were sexually abused in childhood were more likely to report submission fantasies than those who were not.<sup>16,75,76</sup> Nonetheless, although some preliminary findings suggest an association between sexual trauma and BDSM-related interests, current literature does not prove a causal relationship. Future large-scale, preferably cross-nation research should further elucidate whether an association between childhood abuse and BDSM interests is actually present. It can also be hypothesized that a report bias may exist, driving these preliminary associations, because it is possible that BDSM practitioners may communicate more openly about sexual boundaries and sexuality in general. The latter notion has not been investigated yet, so comparing the communication style between BDSM practitioners and non-BDSM control subjects may be of interest. Moreover, because BDSM practitioners frequently emphasize consent, safety, and personal boundaries within BDSM play,<sup>65</sup> they may label certain behaviors more quickly as being sexually transgressive than non-practitioners from the general population. Further research should clarify the nature of this relationship.

#### Age of Awareness and Education Levels

Many BDSM-oriented individuals became aware of their kink-themed interests at a relatively young age, that is, before the age of 15.<sup>43,77</sup> Moser and Levitt<sup>58</sup> surveyed 178 BDSM-oriented men who, on average, participated in SM at the age of 23, whereas 26% reported having a first SM experience by age 16. Similarly, Holvoet and colleagues<sup>3</sup> found that 61.4% of the general population with a BDSM interest became aware of it before age 25. In Breslow's sample of men,<sup>77</sup> half recognized their SM interests by age 14. In a Finnish sample of mostly gay men, 9.3% claimed awareness of their sadomasochistic inclinations before the age of 10.<sup>78</sup>

Because these interests apparently are already present early in life, social contexts during childhood and adolescence (eg,



parenting style) presumably largely influence affinity for BDSM practices. Future research should dig deeper in the potential moderating role of parenting style and power disparity in the parental couple.

Ample literature shows that BDSM practitioners are typically highly educated. Sandnabba and colleagues<sup>78</sup> found that more than one-third had a university degree, with an additional 21% having a college degree. Wismeijer & Van Assen<sup>71</sup> similarly found that 70% had a higher education (ie, bachelor's or master's degree), as compared with 34% in the general population. Martinez<sup>35</sup> again showed that about half of their BDSM sample had a college degree, with another 33% having taken up to 1 year of college. In this line, they also had higher income levels than the general population.<sup>2</sup> Interestingly, higher education levels were seen in participants visiting public BDSM-themed events, but not in practitioners who preferred to explore their interests at home with a less high level of intensity (Coppens et al.<sup>79</sup>;  $n = 1,289$ ). These findings suggest that there is a positive correlation between the intensity with which one practices BDSM and their education level. It could be suggested that individuals with higher education levels are attracted to the psychological dynamics of BDSM play and see it as an enrichment of their relationship or sexuality, but this should be clarified by future research. It may also be that a participation bias exists, because more-educated BDSM practitioners may be more prone to participate in research or because they may have easier access to research projects through internet forums. Nonetheless, it should be noted that these findings are merely associations found between education level and BDSM interest and, thus, did not reflect causality. Future BDSM research could explore whether higher education levels may be linked to more liberal attitudes and beliefs or a more unrestricted sociosexual orientation.

### Relationship Between Sexual Orientation and the BDSM Interest

Earlier research mostly included male participants and members of the lesbian, gay, bisexual, and transgender (LGBT) community,<sup>2,78</sup> whereas recent research reports on more balanced samples, although men still tend to be slightly over-represented in BDSM samples recruited online (eg, reference 44, Coppens et al.<sup>79</sup>). This parallels the evolution in the social profile of the (public) BDSM community, because in the 1980s and 1990s, initial clubs were typically part of the gay leather scene.<sup>1</sup> More recently, BDSM-themed clubs seem to attract broader groups of BDSM aficionados.<sup>70</sup> Moreover, the generation of online BDSM-related forums facilitates interactions with and within the community. This also has significant advantages for research in the field, because it results in a vast increase in the accessibility of the population for research purposes and thereby strongly reduces study population selection bias.

Whereas, in the general population, about 90% declare themselves to be heterosexual,<sup>3</sup> this is the case for only about

two-thirds in the BDSM community, with more members self-identifying as being bisexual (23%) or otherwise (17%).<sup>46</sup> Cross and Matheson<sup>80</sup> found almost half of online recruited masochists to be bisexually or homosexually oriented. More specifically, the survey by Tomassilli et al<sup>81</sup> showed that bisexual women were more likely to have engaged in BDSM-related activities than lesbian women.

BDSM-oriented members of the LGBT community also have a significantly higher play frequency than do heterosexuals.<sup>44,60,78</sup> Moreover, gay men tended to have a higher ratio of university degrees and primarily held white-collar occupations, whereas the straight respondents held more blue-collar positions (eg, industry and service). Surprisingly, LGBT respondents began their BDSM related activities at a later age compared with their heterosexual peers.<sup>82</sup> Differences were also found in the type of activities they engaged in, because gay men preferred hypermasculine-related activities (use of dildos, anal play) and tended to be more sadistically oriented, whereas heterosexuals rather preferred humiliation-related activities.<sup>2,28,80,82</sup>

### BDSM as Leisure or Sexual Activity

Several studies scrutinized the sexual nature of BDSM and surveyed the role of BDSM in sexual activity of participants. A recent interview-based study<sup>83</sup> showed that a small sample ( $n = 32$ ) of practitioners indicated that their sexual BDSM experiences were primarily emotional and psychological in nature and that these were preferred over mainstream ("vanilla") sexual interactions. In contrast, Pascoal's small-scale survey study ( $n = 68$ )<sup>84</sup> revealed that BDSM and non-BDSM sexual activities were experienced as equally satisfying and that most practitioners did not exclusively engage in BDSM-oriented sexual practices. Nevertheless, they accentuate how BDSM-themed sexual interactions deepen the interpersonal connection more than non-BDSM sexuality. Moreover, within the community, BDSM play is more associated with long-term relationships, and some even indicate them as being unnecessary or inappropriate in short-term sexual encounters,<sup>85</sup> again pointing toward the bidirectional association between an emotional connection and BDSM play. Some practitioners even describe their BDSM preference as an addiction<sup>86</sup>; in this exploratory, qualitative study in which 9 individuals underwent a semistructured interview focusing on the experience of sexually masochistic acts, some subjects mentioned a rush or "high" during BDSM-oriented interactions, which could explain a state of dependency and a craving for future similar experiences. This interesting notion should be explored in future research.

Cross and Matheson<sup>80</sup> indicate that it is power that is at the core of BDSM interactions, rather than pain, bondage, and humiliation, which are merely tools or methods to achieve the mutual creation of a hierarchical status. As such, the exchange of power in an erotic context is the driving mechanism underlying sexual pleasure. This was based on the analyses of SM

interactions in progress in online SM chat rooms, followed by post-scene interviews ( $n = 13$ ). An important limitation of this approach is that it was a virtual interaction, not necessarily reflecting all processes involved in a real-life interaction. This notion mirrors the fact that women having sexual fantasies of forced sex often imagine minimal physical discomfort in those fantasies,<sup>87–89</sup> suggesting that it is the power dynamics rather than a masochistic mechanism driving these fantasies.

### BDSM as Identity

Although, for some, BDSM is a form of leisure or a means to spice things up in the bedroom,<sup>33,65</sup> other practitioners will argue that BDSM is their sexual identity or orientation. Some even go as far as to perpetually maintain their BDSM dynamics in their everyday lives.<sup>26</sup> Parallels have been drawn with being part of the LGBT community. For example, a person identifying as gay will indicate that sexual orientation stands for who he or she essentially is.<sup>43,90</sup> A small-scale qualitative research study<sup>43</sup> demonstrated that the level of identification can vary, with some framing their BDSM interests as a sexual orientation reflecting interests that started early on in life, whereas others became attracted to BDSM more gradually at a later age after dating someone with these preferences or after reading about it, without seeing these interests as fundamental part of their personality or sexuality.

### The Biological Aspects of BDSM

Up to now, very few studies focused on the biologic underpinnings of BDSM practice, but some indeed have investigated effects of gender, brain activity patterns, or associations with hormonal changes.

### Sex and Age Effects on BDSM Interests

Several studies looked into the association between the sex of the participant and BDSM role. In the BDSM community, men tend to be more dominant, whereas up to 75% of the women identify themselves as submissive.<sup>27,71</sup> A minority of both men and women identify as switch. Non-heterosexual participants mainly self-identified as switches (37%), with a slightly less but equal ratio of dominants and submissives (22% and 27%). As was shown by Herbenick et al<sup>22</sup> in a large sample of the general population ( $n = 2,021$ ), more women (14.2%) than men (8.5%) find experiencing pain as part of sex (very or somewhat) appealing. Women also demonstrate significantly higher interest in submissive sexual fantasies<sup>16</sup> and express a preference for a dominant man.<sup>40</sup> In addition to these differential affinities for BDSM roles between men and women, men apparently become aware of these interests on average 5 years earlier than women.<sup>60,77</sup>

From an evolutionary point of view, male assertiveness is a characteristic valued by women in their male (potential) partners, because it may have led to increased survival chances for women and children.<sup>67</sup> In this line, Jozifkova and Kolackova<sup>91</sup> aimed to

investigate the origin of dominance and submissiveness as sexual preferences. To do so, they investigated the hypothesis that sexual arousal induced by hierarchical imbalance between a person and his or her partner reflects a mating strategy. This was done by comparing the number of children and self-reported attractiveness of dominant men and submissive women with control subjects within the general population ( $n = 673$ ). They showed that, compared with control subjects, sexually dominant men and sexually submissive women perceived themselves as being more attractive and had more biological children. This led the authors to conclude BDSM to be a successful mating strategy.<sup>91</sup>

In contemporary society, dominance is still primarily considered a masculine characteristic.<sup>67,92</sup> Gender norms urge women to associate sex with submission and subordination to men, whereas men learn to eroticize male dominant behavior.<sup>18,34,91,93</sup> This is confirmed by a study by Sanchez and colleagues,<sup>94</sup> with a lexical decision test that assessed implicit associations between words of dominance (eg, “power,” “strong”) or submission (eg, “comply,” “concede”) and words associated with sex (eg, “climax,” “oral”). Words referring to sex primed faster responses for submissive words in women, leading the authors to conclude that women implicitly associated sex with submission, an association not found in men. It was also demonstrated that many adolescent girls, but not boys, report assuming a submissive role during their first sexual experiences.<sup>94,95</sup> In this line, being dominated and overpowered by a man is one of the most common sexual fantasies among women.<sup>67,92,96</sup> Jozifkova et al<sup>97</sup> postulated that a submissive/dominant hierarchical disparity within a couple can be an important mechanism, promoting cohesion and cooperation between the partners. Notably, Hawley and Hensley<sup>92</sup> also demonstrated high preference rates for submissive fantasies in some men, regardless of sexual orientation or gender identity. The authors suggest differential between-gender mechanisms for these submissive fantasies. In women, interest in submission is presumably mainly driven by the need for nurturing and security, whereas, in men, this need is possibly more associated with the need to surrender to the will of another.

As noted by Holvoet et al,<sup>3</sup> age also seems to impact role preference; they show dominant self-identification to be associated with older age, whereas younger practitioners displayed a higher interest for the submissive role. The authors note that this might not be a strictly biological phenomenon and could potentially be explained, at least partially, by cultural changes over the years. Possibly, in the BDSM community, acceptance toward more-fluid role positioning may have increased over time, although this notion should be investigated. It may also reflect a level of maturity needed to take on the dominant role and implement the responsibilities needed for the role.

### Brain Activity Associated With Dynamical Pain Thresholds in BDSM Practitioners

2 studies gauging pain thresholds in masochistic subjects<sup>98,99</sup> demonstrated that masochists displayed pain hyposensitivity.

This finding was corroborated by Luo and Zhang,<sup>100</sup> who showed that submissive women have lower differential amplitudes of several event-related potentials, compared with control subjects, when looking at pictures of women with painful and neutral facial expressions. These reduced event-related potentials include the N1, P2, and long-latency potential. The N1 has been associated with the perception of threat,<sup>101</sup> whereas the P2 has been linked to the degree of perceived pain in others.<sup>102</sup> The long-latency potential seems to be an indicator of emotion regulation, thus assessing the emotional appraisal of stimuli by the participant.<sup>100</sup> This, thus, seems to suggest that submissives perceive pain as less threatening and may be associated with lower (negative) emotional appraisal of pain-related stimuli. A link between painful stimulation and the experience of pleasure was investigated by Defrin and colleagues,<sup>99</sup> demonstrating that the number of stimulated body regions—as reported by the respondents on a self-developed questionnaire including 7 body regions (including “upper back,” “lower back,” “buttock,” and “legs”;  $r = 0.781$ ,  $P < .001$ )—as well as the intensity of pain during BDSM play, as scored on a visual analogue scale ( $r = 0.414$ ;  $P < .05$ ), correlated highly with the amount of pleasure experienced by these participants. In contrast, both masochists and non-BDSM control subjects reported equal levels of negative emotions while experiencing pain in everyday life.<sup>98,99</sup>

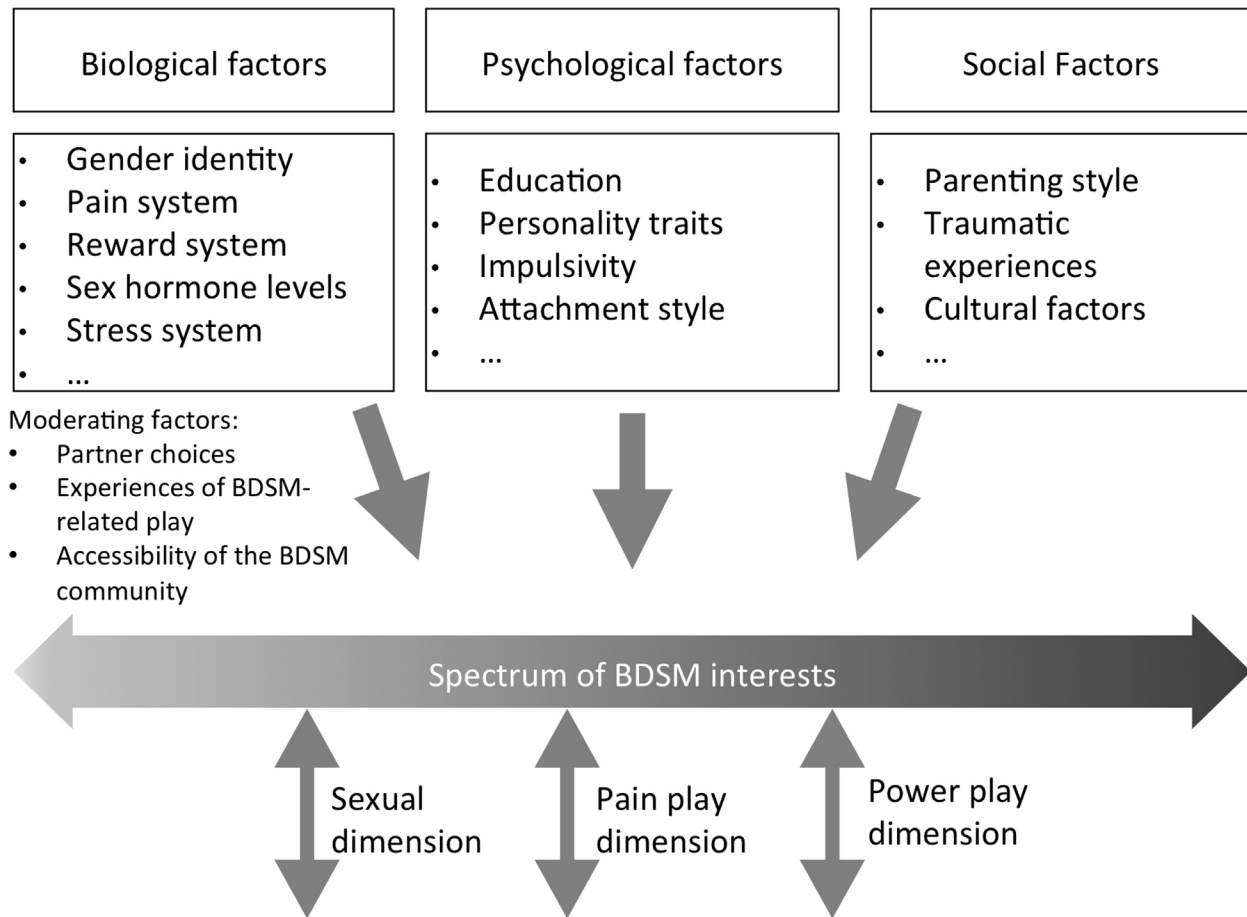
A single functional magnetic resonance imaging study<sup>103</sup> investigated brain activity in masochists during the administration of painful laser stimuli while viewing body-related masochistic stimuli vs other, non-masochistic stimuli. Compared with control subjects, masochistic participants reported reduced pain perception while viewing the masochistic images, which was mirrored by higher levels of positive arousal while watching the images. Interestingly, they had unaltered pain perception in other non-masochistic contexts. Brain imaging revealed that, in masochists, the functional connectivity of the parietal operculum to the left and right insulae, the central operculum, and the supramarginal gyrus is altered. Activity of the insula region specifically has been associated with aversion.<sup>104</sup> Interestingly, all these brain regions are part of the so-called “mirror neuron system,” the brain regions that are associated with the ability to understand the mental state of others, as well as with empathy and, thus, are important in the context of social interaction. These results, thus, suggest that masochists tend to experience painful stimuli when framed in a masochistic social context as being less negative compared with control subjects. These aforementioned regions of the operculum have also been shown to be activated in non-BDSM participants when watching sexual video clips. The level of activation of these brain structures predicted sexual arousal induced by these videos.<sup>105</sup> Because the reduced pain perception was not present when receiving painful stimuli in a non-masochistic context, it, thus, seems that masochists retrieve positive experiences from past memories when shown masochistic pictures during painful stimulation, leading them to imagine themselves in the situation with the associated positive emotions.

## Hormonal Changes Associated with BDSM

Male sex hormones, especially testosterone levels, are known to be associated with sexual activity and aggression in general,<sup>105,106</sup> but it should be noted that the association between testosterone and aggressive behavior is a complex one that remains to be elucidated. Nonetheless, this association has been extrapolated to both sexual (non-consensual) sadism<sup>107</sup> and sexual masochism.<sup>108</sup> In a fascinating set of 2 studies,<sup>109</sup> 58 dominant or submissive practitioners underwent salivary testosterone quantification before and after BDSM interaction. Contrasting to previous results, female (but not male) submissives had increased testosterone levels after BDSM play, whereas testosterone levels remained stable in dominants. The authors hypothesized the hormonal increase in female submissives to signify an aggressive response to the SM activities, but they also suggested that testosterone was associated with increases in positive mood, although the latter is less likely, given that increases in testosterone are more associated with depressive mood.<sup>110</sup> It should be noted, however, that a small-scale follow-up study of the same research group did not replicate these findings.<sup>111</sup> Nonetheless, recent research associated increases in testosterone with prosocial behavior, because testosterone tended to stimulate rewarding behavior in men.<sup>112</sup> But, more generally, effects of testosterone in women are less understood and should be further scrutinized.<sup>112</sup>

Similarly, increased levels of the stress hormone cortisol have been associated with both sadistic<sup>107</sup> and masochistic<sup>66,113</sup> behaviors. Surprisingly, Klement and colleagues<sup>66,113</sup> found that increased cortisol levels were inversely correlated with subjective stress levels, as well as negative affect.<sup>114</sup> The authors propose 2 mechanisms for these seemingly contradictory findings. Participants may have high pain tolerance levels and, thus, may not experience BDSM-related pain stimuli as particularly painful subjectively, although the body may have registered pain-related sensations. Another explanation may be that pain play could have a moderating effect on the link between physiological and psychological stress, by reducing negative or inducing positive emotions during these activities.

The induction of both sex and stress-related hormones in response to painful stimuli might provide an explanation for the historic notion that pain induction can be sexually arousing. Weinberg et al<sup>1</sup> postulated that pain can act as a sexual stimulus. In addition, Kinsey et al<sup>115</sup> pointed out that milder forms of physical aggression, such as scratching and biting, are often ingredients implemented in conventional sex and that the physiological response to pain is similar to that of orgasm. Other physical activities that may be accompanied by pain, such as long-distance running or dancing, can equally lead to a euphoric state of mind.<sup>116</sup> Combined, these findings indicate that investigation of the potential role of biomarkers implicated in the brain reward system (eg, the dopaminergic system, cannabinoids) and their interactions with the aforementioned hormones provides a promising future research avenue.



**Figure 2.** A biopsychosocial model for BDSM interests. BDSM = bondage and discipline, dominance and submission, and sadism and masochism.

## DISCUSSION

An interest in BDSM-related intimacy and sexuality can translate into a wide range of different fantasies and activities. Kinks and related interests come in many forms and present themselves very individually. Based on the existing literature, these interests seem to stem from a variety of biological, psychological and social influences throughout one's life. [Figure 2](#) presents a biopsychosocial model of how all these influences may converge into the development of BDSM-oriented behavior. It should be noted that this is a tentative model, because many aspects included need further scrutiny. Biologic factors such as gender identity, as well as the constitution of the central pain and reward systems, may influence BDSM orientation, although it can also be argued that these systems change over time as a result of BDSM activities. These are interesting notions to be explored in future research. Sex hormone levels may contribute to the BDSM role identity (dominant vs submissive) and to what extent it is a sexually related interest. Psychological factors equally impact one's positioning within the BDSM spectrum. Both personality traits, such as higher levels of openness or extraversion, as well as the presence of a personality disorder, may have a mediating effect toward a higher interest in BDSM, although

only limited evidence is available with regard to the amount of impact, as well as its specificity. Sensation-seeking levels and impulsivity may guide one's drive to explore new or more-intense kinks. Attachment styles will determine dynamics within the couple and may influence the willingness to explore limits and limitations in a BDSM context. Education levels can equally steer relational or sexual interest, because a higher percentage of BDSM practitioners have a college degree, which often comes with higher levels of responsibilities. It has been suggested that BDSM offers a framework in which these work-related responsibilities can be let go, resulting in a sense of personal freedom.<sup>26</sup> Finally, it can also be hypothesized that the parenting style experienced in childhood, as well as the modeling of the parents as a couple, may steer one's view on relational dynamics, but this still needs to be investigated. As such, if 1 of the parents is the authoritative figure within the couple, the child is more likely to also develop a hierarchical disparity in their future couple dynamics and sexuality.<sup>77</sup> Also cultural factors such as a liberal environment (eg, urban living region) and potential sexually traumatic experiences contribute to a more pro-BDSM lifestyle. To what extent BDSM interests and tendencies develop over time is moderated by, among others, (sexual)



partner choices and accessibility of the BDSM community (eg, online or the proximity of a club).

Within the BDSM spectrum, these interests develop in several dimensions. As such, they may be an inseparable part of one's sexuality or have no sexual connotation at all. Additionally, the nature of the play elements driving the power exchange may be different, because some focus on role or power play, whereas others are more oriented toward pain play or may implement both aspects.

The limitations of the current review reflect those of the topical scientific literature. Although the number of studies focused on all aspects of BDSM is exponentially growing, most of these are only descriptive, and very few focus on underlying driving processes. The current review only included original research articles and, thus, did not implement any of the multitude of existing opinion pieces, which mostly approach BDSM from a psychodynamic angle. Another confounding factor is the extent of generalizability of data. Generally, literature can be divided into 2 categories: the first focuses on BDSM practitioners recruited from specialized settings (club members and, more recently, the online community), which inherently creates a selection bias, because these members are more actively or intensely pursuing their interests, and may not represent the general BDSM-oriented population. Alternatively, more recent studies are using large-scale survey studies to investigate several aspects of BDSM in the general population, but they tend to be more descriptive in nature.

## CONCLUSION

Future research should focus more on the driving mechanisms—with a specific stress on/need for implicated biologic pathways—of BDSM practice and relationships, all the while addressing limitations of current literature, as described above. Research should not only focus on BDSM-oriented people who practice their interests in BDSM-themed clubs, but also take advantage of the increased accessibility of practitioners and more broadly, BDSM-interested individuals without experience, provided by internet forums. This will allow scrutinizing the wide spectrum of BDSM interest. Informative research venues could be driving psychological mechanisms in these interests (such as personality traits, coping skills, sensation-seeking behavior), parenting style of the parents of these individuals, relationship between BDSM and communication style in and outside intimate relationships, associations between BDSM interests and psychological or psychiatric disorders, evolutions in the perception of BDSM interests in society and associated stigma, and international differences in BDSM practices. Finally, research into biomarkers related to reward, sexuality, intimacy, and experienced stress may further our understanding of these interests.

**Corresponding Author:** Manuel Morrens, MD, PhD, CAPRI, University of Antwerp, Belgium; University Psychiatric Hospital

Antwerp, Campus Duffel, Belgium. Tel: 003215304030; Fax: 003215304010; E-mail: [manuel.morrens@uantwerpen.be](mailto:manuel.morrens@uantwerpen.be)

*Conflict of Interest:* The authors report no conflicts of interest.

*Funding:* None.

## STATEMENT OF AUTHORSHIP

### Category 1

- (a) **Conception and Design**  
Nele De Neef; Manuel Morrens
- (b) **Acquisition of Data**  
Nele De Neef; Manuel Morrens
- (c) **Analysis and Interpretation of Data**  
Nele De Neef; Manuel Morrens

### Category 2

- (a) **Drafting the Article**  
Nele De Neef; Manuel Morrens
- (b) **Revising It for Intellectual Content**  
Violette Coppens; Wim Huys

### Category 3

- (a) **Final Approval of the Completed Article**  
Nele De Neef; Violette Coppens; Wim Huys; Manuel Morrens

## REFERENCES

1. Weinberg MS, Williams CJ, Moser C. The social constituents of sadomasochism. *Soc Probl* 1984;31:379-389.
2. Alison L, Santtila P, Sandnabba NK, et al. Sadomasochistically oriented behavior: Diversity in practice and meaning. *Arch Sex Behav* 2001;30:1-12.
3. Holvoet L, Huys W, Coppens V, et al. Fifty shades of Belgian gray: The prevalence of BDSM-related fantasies and activities in the general population. *J Sex Med* 2017;14:1152-1159.
4. De Block A, Adriaens PR. Pathologizing sexual deviance: A history. *J Sex Res* 2013;50:276-298.
5. Krafft-Ebing R. *Psychopathia sexualis: With especial reference to the antipathic sexual instinct : A Medico-forensic Study*. New York: Arcade Publishing; 1998.
6. Freud S. Three essays on the theory of sexuality (1905). Chapter I: The sexual aberrations. (4). The sexual instinct in neurotics [Internet]. *PsycEXTRA Dataset*. 1971; Available from: <http://doi.org/10.1037/e417472005-174>. Accessed November 7, 2017.
7. Tough SC, Butt JC, Sanders GL. Autoerotic asphyxial deaths: Analysis of nineteen fatalities in Alberta, 1978 to 1989. *Can J Psychiatr* 1994;39:157-160.
8. O'Halloran RL, Warren Lovell F. Autoerotic asphyxial death following television broadcast. *J Forensic Sci* 1988; 33:12595J.
9. Roma P, Pazzelli F, Pompili M, et al. Shibari: Double hanging during consensual sexual asphyxia. *Arch Sex Behav* 2013; 42:895-900.



10. American Psychiatric Association. Diagnostic and statistical manual of mental disorders: 5th Edition: DSM-5. Washington, DC: American Psychiatric Publishing; 2003.
11. Krueger RB, Reed GM, First MB, et al. Proposals for paraphilic disorders in the International Classification of Diseases and Related Health Problems, Eleventh Revision (ICD-11). *Arch Sex Behav* 2017;46:1529-1545.
12. Briken P, Krueger RB. From atypical sexual interests to paraphilic disorders: The planned ICD revisions related to paraphilic disorder. *J Sex Med* 2018;15:807-808.
13. Reed GM, Drescher J, Krueger RB, et al. Disorders related to sexuality and gender identity in the ICD-11: Revising the ICD-10 classification based on current scientific evidence, best clinical practices, and human rights considerations. *World Psychiatr* 2016;15:205-221.
14. Moher D, Shamseer L, Clarke M, et al. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement. *Syst Rev* 2015;4:1.
15. Moher D, Liberati A, Tetzlaff J, et al. Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *J Clin Epidemiol* 2009;62:1006-1012.
16. Renaud CA, Byers E. Exploring the frequency, diversity, and context of university students' positive and negative sexual cognitions. *Can J Hum Sex* 1999;8:17-30.
17. Renaud CA, Byers SE. Positive and negative cognitions of sexual submission: Relationship to sexual violence. *Arch Sex Behav* 2006;35:483-490.
18. Richters J, Grulich AE, de Visser RO, et al. Sex in Australia: Autoerotic, esoteric and other sexual practices engaged in by a representative sample of adults. *Aust N Z J Public Health* 2003;27:180-190.
19. Richters J, De Visser RO, Rissel CE, et al. Demographic and psychosocial features of participants in bondage and discipline, "somasochism" or dominance and submission (BDSM): Data from a national survey. *J Sex Med* 2008; 5:1660-1668.
20. Långström N, Seto MC. Exhibitionistic and voyeuristic behavior in a Swedish national population survey. *Arch Sex Behav* 2006;35:427-435.
21. Jozifkova E, Flegr J. Dominance, submissivity (and homosexuality) in general population: Testing of evolutionary hypothesis of somasochism by Internet-trap-method. *Neuro Endocrinol Lett* 2006;27:711-718.
22. Herbenick D, Bowling J, Fu T-C, et al. Sexual diversity in the United States: Results from a nationally representative probability sample of adult women and men. *PLoS One* 2017; 12:e0181198.
23. Joyal CC, Carpentier J. The prevalence of paraphilic interests and behaviors in the general population: A provincial survey. *J Sex Res* 2017;54:161-171.
24. McCarthy BW, Masters WH, Johnson VE, et al., eds. *Ethical Issues in Sex Therapy Am Research*. Boston: Little, Brown, 1977. *Am J Clin Hypn*; 1983; 25:302.
25. Masters WH, Johnson VE, Kolodny RC. *Human sexuality*. New York: Little, Brown Medical Division; 1982.
26. Dancer PL, Kleinplatz PJ, Moser C. 24/7 SM slavery. *J Homosex* 2006;50:81-101.
27. Williams D, Prior EE, Alvarado T, et al. Is bondage and discipline, dominance and submission, and somasochism recreational leisure? A descriptive exploratory investigation. *J Sex Med* 2016;13:1091-1094.
28. Santtila P, Sandnabba NK, Alison L, et al. Investigating the underlying structure in somasochistically oriented behavior. *Arch Sex Behav* 2002;31:185-196.
29. Califia P. Lesbian sexuality. *J Homosex* 1979;4:255-266.
30. Jozifkova E, Bartos L, Flegr J. Evolutional background of dominance/submissivity in sex and bondage: the two strategies? *Neuro Endocrinol Lett* 2012;33:636-642.
31. Weierstall R, Giebel G. The somasochism checklist: A Tool for the assessment of somasochistic behavior. *Arch Sex Behav* 2017;46:735-745.
32. Chivers ML, Roy C, Grimbos T, et al. Specificity of sexual arousal for sexual activities in men and women with conventional and masochistic sexual interests. *Arch Sex Behav* 2014;43:931-940.
33. Newmahr S. Rethinking kink: Somasochism as serious leisure. *Qual Sociol* 2010;33:313-331.
34. Yost MR, Hunter LE. BDSM practitioners' understandings of their initial attraction to BDSM sexuality: Essentialist and constructionist narratives. *Psychol Sexuality* 2012; 3:244-259.
35. Martinez K. BDSM role fluidity: A mixed-methods approach to investigating switches within dominant/submissive binaries. *J Homosex* 2018;65:1299-1324.
36. Vatsyayana, Upadhyaya SC. *The Kama Sutra: The Hindu art of love*. London: Watkins Publishing; 2004.
37. Ford CS, Beach FA. *Patterns of sexual behavior*. New York: Popular Mechanics Press; 1952.
38. International SM. *J Homosex* 2006;50:263-280.
39. Yost MR. Development and validation of the attitudes about somasochism scale. *J. Sex Res* 2010;47:79-91.
40. Lanciano T, Soleti E, Guglielmi F, et al. Fifty shades of unsaid: Women's explicit and implicit attitudes towards sexual morality. *Eur J Psychol Assess* 2016;12:550-566.
41. J. K. Violence against SM women within the lesbian community: A nationwide survey, 1994 [Internet]; Available from: <https://ncsfreedom.org/component/k2/item/453-violence-against-s/m-women-within-the-lesbian-community-a-nation-wide-survey.html>. Accessed November 28, 2018.
42. Graham BC, Butler SE, McGraw R, et al. Member perspectives on the role of BDSM communities. *J Sex Res* 2016;53:895-909.
43. Bezreh T, Weinberg TS, Edgar T. BDSM disclosure and stigma management: Identifying opportunities for sex education. *Am J Sex Educ* 2012;7:37-61.
44. Spengler A. Manifest somasochism of males: Results of an empirical study. *Arch Sex Behav* 1977;6:441-456.
45. Roush JF, Brown SL, Mitchell SM, et al. Shame, guilt, and suicide ideation among bondage and discipline, dominance

- and submission, and sadomasochism practitioners: Examining the role of the interpersonal theory of suicide. *Suicide Life Threat Behav* 2017;47:129-141.
46. Brown SL, Roush JF, Mitchell SM, et al. Suicide risk among BDSM practitioners: The role of acquired capability for suicide. *J Clin Psychol* 2017;73:1642-1654.
  47. Nock MK, Borges G, Bromet EJ, et al. Cross-national prevalence and risk factors for suicidal ideation, plans and attempts. *Br J Psychiatry* 2008;192:98-105.
  48. Bernal M, Haro JM, Bernert S, et al. Risk factors for suicidality in Europe: Results from the ESEMED study. *J Affect Disord* 2007;101:27-34.
  49. Green R. (Serious) sadomasochism: A protected right of privacy? *Arch Sex Behav* 2001;30:543-550.
  50. Blanchard R, Hucker SJ. Age, transvestism, bondage, and concurrent paraphilic activities in 117 fatal cases of autoerotic asphyxia. *Br J Psychiatr* 1991;159:371-377.
  51. Coluccia A, Gabbriellini M, Gualtieri G, et al. Sexual masochism disorder with asphyxiophilia: A deadly yet underrecognized disease. *Case Rep Psychiatr* 2016;2016:5474862.
  52. Sendler DJ. Lethal asphyxiation due to sadomasochistic sex training—How some sex partners avoid criminal responsibility even though their actions lead to someone's death. *J Forensic Leg Med* 2018;56:59-65.
  53. Krueger RB, Kaplan MS. Paraphilic diagnoses in DSM-5. *Isr J Psychiatr Relat Sci* 2012;49:248-254.
  54. Kelsey K, Stiles BL, Spiller L, et al. Assessment of therapists' attitudes towards BDSM. *Psychol Sexual* 2013;4:255-267.
  55. Waldura JF, Arora I, Randall AM, et al. Fifty shades of stigma: Exploring the health care experiences of kink-oriented patients. *J Sex Med* 2016;13:1918-1929.
  56. Lawrence AA, Love-Crowell J. Psychotherapists' experience with clients who engage in consensual sadomasochism: A qualitative study. *J Sex Marital Ther* 2008;34:67-85.
  57. Dunkley CR, Brotto LA. Clinical considerations in treating BDSM practitioners: A review. *J Sex Marital Ther* 2018;1-12.
  58. Moser C, Levitt EE. An exploratory-descriptive study of a sadomasochistically oriented sample. *J Sex Res* 1987;23:322-337.
  59. Kolmes K, Stock W, Moser C. Investigating bias in psychotherapy with BDSM clients. *J Homosex* 2006;50:301-324.
  60. Weinberg TS. Sadomasochism and the social sciences. *J Homosex* 2006;50:17-40.
  61. Baur E, Forsman M, Santtila P, et al. Paraphilic sexual interests and sexually coercive behavior: A population-based twin study. *Arch Sex Behav* 2016;45:1163-1172.
  62. Krueger RB. The DSM diagnostic criteria for sexual masochism. *Arch Sex Behav* 2010;39:346-356.
  63. Moser C, Kleinplatz PJ. DSM-IV-TR and the paraphilias. *J Psychol Human Sex* 2006;17:91-109.
  64. Connolly PH. Psychological functioning of bondage/domination/sado-masochism (BDSM) practitioners. *J Psychol Human Sex* 2006;18:79-120.
  65. Faccio E, Casini C, Cipolletta S. Forbidden games: The construction of sexuality and sexual pleasure by BDSM "players. *Cult Health Sex* 2014;16:752-764.
  66. Klement KR, Sagarin BJ, Lee EM. Participating in a culture of consent may be associated with lower rape-supportive beliefs. *J Sex Res* 2016;54:130-134.
  67. Harris EA, Thai M, Barlow FK. Fifty shades flipped: Effects of reading erotica depicting a sexually dominant woman compared to a sexually dominant man. *J Sex Res* 2017;54:386-397.
  68. Zurbriggen EL, Yost MR. Power, desire, and pleasure in sexual fantasies. *J Sex Res* 2004;41:288-300.
  69. Joyal CC, Cossette A, Lapierre V. What exactly is an unusual sexual fantasy? *J Sex Med* 2015;12:328-340.
  70. Moser C, Kleinplatz PJ. Introduction: The state of our knowledge on SM. *J Homosex* 2006;50:1-15.
  71. Wismeijer AAJ, van Assen MALM. Psychological characteristics of BDSM practitioners. *J Sex Med* 2013;10:1943-1952.
  72. Frías Á, González L, Palma C, et al. Is there a relationship between borderline personality disorder and sexual masochism in women? *Arch Sex Behav* 2017;46:747-754.
  73. Nordling N, Kenneth Sandnabba N, Santtila P. The prevalence and effects of self-reported childhood sexual abuse among sadomasochistically oriented males and females. *J Child Sex Abus* 2000;9:53-63.
  74. Pereda N, Guilera G, Fornis M, et al. The prevalence of child sexual abuse in community and student samples: A meta-analysis. *Clin Psychol Rev* 2009;29:328-338.
  75. Gold SR, Balzano BF, Stamey R. Two studies of females' sexual force fantasies. *J Sex Educ Ther* 1991;17:15-26.
  76. Briere J, Smiljanich K, Henschel D. Sexual fantasies, gender, and molestation history. *Child Abuse Negl* 1994;18:131-137.
  77. Breslow N, Evans L, Langley J. On the prevalence and roles of females in the sadomasochistic subculture: Report of an empirical study. *Arch Sex Behav* 1985;14:303-317.
  78. Sandnabba NK, Kenneth Sandnabba N, Santtila P, et al. Sexual behavior and social adaptation among sado-masochistically-oriented males. *J Sex Res* 1999;36:273-282.
  79. Coppens V, Ten Brink S, Huys W, et al. A Survey on BDSM-related activities: BDSM experience correlates with age of first exposure, interest profile, and role identity. *J Sex Res* 2019;1-8.
  80. Cross PA, Matheson K. Understanding sadomasochism: An empirical examination of four perspectives. *J Homosex* 2006;50:133-166.
  81. Tomassilli JC, Golub SA, Bimbi DS, et al. Behind closed doors: An exploration of kinky sexual behaviors in urban lesbian and bisexual women. *J Sex Res* 2009;46:438-445.
  82. Nordling N, Sandnabba NK, Santtila P, et al. Differences and similarities between gay and straight individuals involved in the sadomasochistic subculture. *J Homosex* 2006;50:41-57.

83. Simula BL. A “Different economy of bodies and pleasures”? Differentiating and evaluating sex and sexual BDSM experiences. *J Homosex* 2017;1:29.
84. Pascoal PM, Cardoso D, Henriques R. Sexual satisfaction and distress in sexual functioning in a sample of the BDSM community: A comparison study between BDSM and non-BDSM contexts. *J Sex Med* 2015;12:1052-1061.
85. Landgraf S, von Treskow I, Osterheider M. “Sex in a relationship” versus “sex during a one-night stand”: The link between mental representations of consensual sexuality, mating strategies, and sexual experience in heterosexual women and men. *Arch Sex Behav* 2018;47:725-736.
86. Kurt H, Ronel N. Addicted to pain: A preliminary model of sexual masochism as addiction. *Int J Offender Ther Comp Criminol* 2017;61:1760-1774.
87. Kanin EJ. Female rape fantasies: A victimization study. *Victimology Int J* 1982;7:114-121.
88. Bond SB, Mosher DL. Guided imagery of rape: Fantasy, reality, and the willing victim myth. *J Sex Res* 1986;22:162-183.
89. Critelli JW, Bivona JM. Women’s erotic rape fantasies: An evaluation of theory and research. *J Sex Res* 2008;45:57-70.
90. Weinberg TS. On “doing” and “being” gay: Sexual behavior and homosexual male self-identity. *J Homosex* 1978;4:143-156.
91. Jozifkova E, Kolackova M. Sexual arousal by dominance and submission in relation to increased reproductive success in the general population. *Neuro Endocrinol Lett* 2017;38:381-387.
92. Hawley PH, Hensley WA 4th. Social dominance and forceful submission fantasies: Feminine pathology or power? *J Sex Res* 2009;46:568-585.
93. Weinberg TS. On “doing” and “being” gay. *J Homosex* 1979;4:143-168.
94. Sanchez DT, Kiefer AK, Ybarra O. Sexual submissiveness in women: Costs for sexual autonomy and arousal. *Pers Soc Psychol Bull* 2006;32:512-524.
95. Martin SM, Smith F, Quirk SW. Discriminating coercive from sadomasochistic sexuality. *Arch Sex Behav* 2016;45:1173-1183.
96. Leitenberg H, Henning K. Sexual fantasy. *Psychol Bull* 1995;117:469-496.
97. Jozifkova E, Konvicka M, Flegr J. Why do some women prefer submissive men? Hierarchically disparate couples reach higher reproductive success in European urban humans. *Neuro Endocrinol Lett* 2014;35:594-601.
98. Pollok B, Krause V, Legrain V, et al. Differential effects of painful and non-painful stimulation on tactile processing in fibromyalgia syndrome and subjects with masochistic behaviour. *PLoS One* 2010;5:e15804.
99. Defrin R, Arad M, Ben-Sasson MP, et al. Attitudes and emotions towards pain and sensitivity to painful stimuli among people routinely engaging in masochistic behaviour. *Eur J Pain* 2015;19:1321-1330.
100. Luo S, Zhang X. Empathy in female submissive BDSM practitioners. *Neuropsychologia* 2018;116:44-51.
101. Luo W, Feng W, He W, et al. Three stages of facial expression processing: ERP study with rapid serial visual presentation. *Neuroimage* 2010;49:1857-1867.
102. Fan Y, Han S. Temporal dynamic of neural mechanisms involved in empathy for pain: An event-related brain potential study. *Neuropsychologia* 2008;46:160-173.
103. Kamping S, Andoh J, Bomba IC, et al. Contextual modulation of pain in masochists: Involvement of the parietal operculum and insula. *Pain* 2016;157:445-455.
104. Guzman-Ramos K, Bermudez-Rattoni F. Interplay of amygdala and insular cortex during and after associative taste aversion memory formation. *Rev Neurosci* 2012;23:463-471.
105. Mouras H, Stoléru S, Moulrier V, et al. Activation of mirror-neuron system by erotic video clips predicts degree of induced erection: An fMRI study. *Neuroimage* 2008;42:1142-1150.
106. Fedoroff JP. Sadism, sadomasochism, sex, and violence. *Can J Psychiatr* 2008;53:637-646.
107. Langevin R, Bain J, Wortzman G, et al. Sexual sadism: Brain, blood, and behavior. *Ann N Y Acad Sci* 1988;528:163-171.
108. Shiwach RS, Prosser J. Treatment of an unusual case of masochism. *J Sex Marital Ther* 1998;24:303-307.
109. Sagarin BJ, Cutler B, Cutler N, et al. Hormonal changes and couple bonding in consensual sadomasochistic activity. *Arch Sex Behav* 2009;38:186-200.
110. Johnson JM, Nachtigall LB, Stern TA. The effect of testosterone levels on mood in men: a review. *Psychosomatics* 2013;54:509-514.
111. Ambler JK, Lee EM, Klement KR, et al. Consensual BDSM facilitates role-specific altered states of consciousness: A preliminary study. *Psychol Conscious* 2017;4:75-91.
112. Carré JM, Archer J. Testosterone and human behavior: The role of individual and contextual variables. *Curr Opin Psychol* 2018;19:149-153.
113. Klement KR, Lee EM, Ambler JK, et al. Extreme rituals in a BDSM context: The physiological and psychological effects of the “Dance of Souls. *Cult Health Sex* 2016;19:453-469.
114. Sagarin BJ, Lee EM, Klement KR. Sadomasochism without sex? Exploring the parallels between BDSM and extreme rituals. *J Pos Sexual* 2015;1:32-36.
115. Sutter J, Kinsey AC, Pomeroy WB, et al. Sexual behavior in the human female. *Population* 1954;9:765.
116. Dietrich A. Endocannabinoids and exercise. *Br J Sports Med* 2004;38:536-541.