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Beyond pain : a study on the variance of pain thresholds within BDSM interactions in dominants and submissives

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Beyond pain: a study on the variance of pain thresholds within BDSM interactions in dominants and submissives

Abstract:

Background

BDSM is an acronym describing bondage & discipline, dominance & submission and sadism & masochism. Afflicting or receiving pain is usually an important part of the BDSM interaction.

Aim

This research will focus on better understanding the aspect of pain within a BDSM interaction.

Methods

Submissive and dominant counterparts of 35 couples were recruited to participate in a BDSM interaction, of which 34 dominants and 33 submissives were included in analyses. A non-BDSM interested control group (n=27) was included to control for social interaction, of which 24 were included in analyses.

Outcomes

This research investigates the differences in 1) baseline pain thresholds, 2) the impact of a BDSM interaction on those thresholds and 3) threshold moderating factors like pain cognition between submissive and dominant BDSM participants and control individuals.

Results

BDSM practitioners have a higher pain threshold overall and a BDSM interaction will result in a temporary elevation of pain thresholds for submissives. Additionally, pain thresholds in dominants will be dependent upon their fear of pain and tendency to catastrophize pain and submissives will experience less fear of pain than the control group.

Clinical Implications

By further enhancing our understanding of the mechanisms behind a BDSM interaction in this way, we aspire to relieve the stigma these practitioners still endure.

Strengths & Limitations

This is one of the first studies of its kind with a large sample size compared to similar research, which makes it a significant contribution to the field. It must be mentioned that there is a possible selection bias because recruitment was only done through the Flemish BDSM

community and specifically those who visit clubs. Additionally, pain threshold remains a subjective measurement, which must be taken into account.

Conclusion

This study helps shed further light on the biological processes behind a BDSM interaction through pain threshold measurements.

Keywords:

BDSM; biological assessment; pain threshold; sexuality; submissive; pain cognition

Introduction:

BDSM is an acronym describing bondage & discipline, dominance & submission and sadism & masochism. It encompasses the physical and psychological roleplay between two or more consenting partners, often involving a power exchange (1) between a dominant party (i.e. “the dominant”) and a submissive party, (i.e. “the submissive”). Pain is often an important part of the BDSM interaction, as the dominant will usually inflict some sort of painful stimulation upon the submissive (2). It should be noted that not all BDSM play involves pain, but for the purpose of this study we will focus on BDSM play involving the use of pain and stress stimuli.

The International Association for the Study of Pain (IASP) defines pain as “an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage” (3). Acute pain serves to detect, localize and limit tissue damage. It is typically associated with a systemic neuroendocrine stress response that is proportional to the pain’s intensity. It usually motivates or drives the organism to activity aimed at preventing further bodily harm as quickly as possible (4, 5). These mechanisms rely on pain being an unpleasant sensation that should be avoided. However, in the context of BDSM, pain is often not experienced as unwanted by the submissive but rather as a desired part of the play. Qualitative research shows that most BDSM-oriented individuals also consider pain to be disagreeable in daily life (i.e. pain stemming from medical procedures, accidents, etc.) (6), though a recent study found that 46% of its practitioners enjoyed pain for itself as well (7). It has been hypothesized that pain within a BDSM interaction is processed by the brain in a different manner than everyday pain (8). Kamping et al. corroborate this theory as they showed masochists to report lower pain intensity while receiving similar painful stimuli when looking at masochistic images but not at neutral images (9).

A commonly investigated aspect of pain is the pain threshold, which can be defined as “the amount of stimulus which will just barely produce a painful sensation under given conditions” (10). This stimulus usually involves either pressure, temperature or exposure to erosive chemical substances, and is often gradually up titrated (11). Individual pain thresholds depend on many different factors. For instance, older age seems to be proportional with a lowered pain threshold (12). Some studies demonstrated men to have higher pain thresholds than women (12, 13), though this has been contradicted by other research (14, 15). When it comes to personality traits, it has been suggested that people who score high on extraversion (16) and low on neuroticism (17) report higher pain thresholds. Insecure attachment style on the other

hand, has been linked to lower pain thresholds (18). Finally, pain cognitions, i.e. assumptions and beliefs about pain, affect pain thresholds in a great extent. Specifically, a tendency to catastrophize pain (19), heightened fear of pain (20) and high levels of anxiety (21, 22) have all been associated with lower pain thresholds.

As they are mediated by state-dependent biological and psychological factors, pain thresholds are dynamic. Biologically, endogenous opioids and endocannabinoids are known to temporarily blunt painful sensations (23, 24). Interestingly, research suggests the skin's mechanical nociceptors to be particularly effective in stimulating endocannabinoid release (25), which translates into higher pain thresholds (26). Indeed, in the current participants, increased peripheral endocannabinoid levels were demonstrated after BDSM-oriented pain play in submissives but not dominants (27).

Psychological wellbeing and emotions play an important role in the way pain is experienced (28, 29). For instance, fear and anxiety increase pain thresholds (21, 22). Social bonding (30) as well as sexual arousal and behavior (31) have been linked to momentary analgesic effects and therefore higher pain thresholds (32) through opioid mediation (33). These findings thus suggest that pain appraisal and pain thresholds are affected by contextual and emotional conditioning.

Because pain threshold can be easily measured within a research context, it is a valuable tool to investigate pain within the BDSM experience. Previous research investigating pain thresholds in masochists found the presence of higher pressure pain thresholds in masochistic individuals compared to controls (34, 35). Interestingly, Pollok et al. also found that their masochistic group consistently rated painful sensations as more pleasant than the control group, indicating a different approach to pain even outside the BDSM context (35).

In the current project, we will investigate the differences in 1) baseline pain thresholds, 2) the impact of a BDSM interaction on those thresholds and 3) threshold moderating factors like pain cognition between submissive and dominant BDSM participants and control individuals not engaged in BDSM activities.

We hypothesize pain thresholds to be higher in BDSM participants than in individuals void of such interests, and that BDSM interaction increases pain thresholds even further. Differential assumptions about pain (i.e. pain cognitions), might moderate these differences. Specifically, we hypothesize pain thresholds to be lower in people with a tendency to catastrophize pain or with a high fear of pain.

Materials and methods:

Participants

Between February 2018 and November 2018, 35 dominant-submissive BDSM couples were recruited through a BDSM-themed internet forum (Fetlife) and within the Belgian BDSM community by word-of-mouth. The term “dominant” is used to describe all D-type identities (i.e. dominant, top, sadist, etc.). Similarly, the term “submissive” describes all s-type identities (i.e. submissive, bottom, masochist, etc.). Switches (i.e. individuals who alternate between a submissive and a dominant role) were allowed to participate, as long as they maintained one role throughout the study period.

BDSM participants were tested during evening play events in VZW 78/Fetish Club 78, a Belgium-based BDSM club.

Non-BDSM interested controls (n=27) were recruited by word-of-mouth and at the bar of a local sports club, in order to control for effects of late-night social interaction. Exclusion criteria for all groups were: 1) Participants taking pain medication 2) participants suffering from neurological conditions affecting pain perception and 3) the presence of active depressive symptomatology as defined by a Beck Depression Inventory (BDI) score of 14 or higher. In all groups, participants were asked to limit their alcohol consumption to a maximum of 2 units while partaking in the study. A single alcohol unit was defined as 10ml of alcohol and could be interpreted as 1 glass of wine or beer.

Of the recruited subjects, a total of 34 dominants, 33 submissives and 24 controls were eventually included in the statistical analyses. Six participants (1 Dominant, 2 submissives, 3 controls) were excluded from analyses due to missing values and/or methodological issues with blood analyses. Blood-based concentrations of cortisol, beta-endorphin and endocannabinoids were equally assessed in the same participant group, and are reported elsewhere (27).

The Committee for Medical Ethics of the University Hospital Antwerp and the Antwerp University approved the study and all participants provided written informed consent. The study met the terms of the Declaration of Helsinki.

Study design

At baseline (T1), all participants completed a questionnaire assessing demographic variables and BDSM interests as well as the BDI and two questionnaires to assess pain cognitions: Fear of Pain Questionnaire (FPQ) (36) and Pain Catastrophizing Scale (PCS) (37). The FPQ

generates three subscores: fear for minor pain, severe pain and medical pain. In addition, vital parameters (heart rate, blood pressure and Body Mass Index; BMI) and baseline pain thresholds were assessed.

Assessment of pain thresholds

Two different dolorimeters were utilized to determine pain thresholds: 1) an algometer exercising increasing pressure upon the nailbed of the finger (pressure pain threshold) and 2) an NTE-2A device administering a heat stimulus on the inside of the wrist (heat pain threshold). The Algometer type II by SBMEDIC Electronics has a range of 0-2000 kPa with the used probe of 1cm² and an accuracy of 2% of reading +2. The NTE-2A Thermal Sensitivity Tester by Physitemp has an ambient operating range of 15-45°C with a resolution of 0.1°C.

The pain threshold measurements were executed by the same researcher at the three time points following standardized instructions, to avoid variability in results. The participants were instructed to give a verbal indication of when the increased pressure or pain stimulus became painful, upon which point the corresponding pressure or temperature level was noted. Subsequently, couples were instructed to play for a minimum of 30 and maximum of 90 minutes. Post-interaction pain thresholds (T2) were determined directly after the end of the play. After play, participants were allowed to engage in “aftercare”, i.e. a period of reflection and intimate contact such as cuddling or sitting together. A third pain threshold evaluation (T3) was performed 15-20 minutes after T2. At each time point, a single assessment of pressure pain threshold and a single assessment of heat pain threshold was collected.

The control group was recruited and tested at the bar of a sports club and were equally tested three times with similar time intervals, while taking part in their usual evening social interactions between assessment points.

Statistical analyses

One-way ANOVA was used to examine baseline differences in the demographic variables between the three groups, followed by a posthoc Tukey HSD test for continuous variables and by the Pearson Contingency Analyses for non-parametric variables.

The longitudinal data were examined by use of Linear Mixed Model (LMM) analyses with the pain thresholds as outcome variables. Based on the Loglikelihood (-2LL) value, a model was fitted that systematically included subject ID as a random intercept. Group, time and group*time interaction were systematically included in the model as fixed factors for each

marker. Additionally, to control for the effects of the demographics, the variables age, BMI and BDI were added as additional fixed factor in the adjusted models. Only the fixed factors that significantly contributed to the model were retained. Outputs from mixed model analyses are reported as 'F-ratio (DF); p-value'. Initial LMM analyses include all groups. In the case of a significant group*time interaction, a follow-up LMM analysis explored the group*time interaction in dominants compared to controls on one hand and submissives versus controls on the other to investigate which group differences contributed significantly to the interaction in the initial model. Finally, upon finding significant time or group*time effects in this latter analysis, a post-hoc analysis was carried out with Tukey HSD correction for multiple testing to compare the outcome between time points within the three separate groups.

The normality of outcome variables was assessed. To check the assumptions for the linear model analyses, the normality of the residuals and homoscedasticity of variance were tested for each of the markers. If necessary, markers were log-transformed to obtain normal distribution. The homogeneity of variances was assessed using a Levene's test.

Pearson's *r* correlations were conducted to assess correlational associations between continuous variables.

Results:

Subjects

Table 1 represents demographic information. There were significant age and gender effects present, as well as an overall BMI group effect. The post-hoc Tukey-Kramer HSD analyses showed a significant age difference between the dominants and controls, with dominants being older. Submissives did not differ significantly from either group. Following up on the BMI difference, Tukey HSD follow-up analyses did not reveal a significant difference between the groups. Any gender differences were attributable to most dominant participants being male (68%) and submissives tending to be female (73%). The mean duration of the play was 53.5 minutes (+/- 14.6 minutes).

--INSERT TABLE 1 ABOUT HERE --

Pain thresholds in dominants, submissives and controls

A linear mixed model (LMM) was used to investigate the effect of BDSM orientation ("group") and BDSM play ("time") on pain thresholds as measured by a heat stimulus and a pressure stimulus.

Primary LMM analyses showed an overall group effect in heat pain threshold measurements ($F=6.31$; $p=0.003$; see figure 1a) but not a significant group*time effect. Further analyses revealed that both dominants ($F=6.76$; $p=0.012$) and submissives ($F=14.31$; $p<0.001$) had higher pain thresholds compared to controls. Neither age, BMI, gender nor BDI-scores could account for any of these effects or contributed to the model.

Post-hoc LMM analyses comparing submissives and controls revealed a marginally significant group*time interaction between T2 (right after play) and T3 (20min after play) ($F=3.96$; $p=0.053$) and a near significant interaction between T1 and T2 ($F=3.12$; $p=0.086$).

No significant group, time or group*time interactions were found for any of the pressure pain thresholds (see figure 1b).

--INSERT FIGURE 1 ABOUT HERE--

Relationship between pain cognitions and the pain threshold

A linear mixed model (LMM) was used to investigate the effect of BDSM orientation ("group") at baseline on the subjective evaluation of pain as measured by the pain catastrophizing scale (PCS) and the fear of pain questionnaire (FPQ).

First, LMM analyses considered overall group effects with the PCS scores ($F=3.64$; $p=0.030$). Post-hoc, a significant group effect was found when comparing submissives and controls ($F=8.78$; $p=0.005$) but not in dominants vs. controls ($F=1.78$; $p=0.187$).

No overall group effect was found when looking at the FPQ scores ($F=0.79$; $p=0.456$).

Second, exploratory Pearson's r correlations were conducted to see if pain cognitions could be correlated to pain thresholds in any groups at baseline. PCS scores had a (near) significant correlation with both heat ($r=-.31$; $p=.086$) and pressure thresholds ($r=-.47$; $p=.006$) in the dominant group but not in the submissive or control group. Similarly, FPQ-minor scores were significantly correlated with both heat ($r=-.37$; $p=.0383$) and pressure thresholds ($r=-.47$; $p=.006$) in the dominant group, though again not in the submissive or control group.

--INSERT FIGURE 2 ABOUT HERE--

Discussion

Main findings

This research endeavored to study the interrelation between BDSM interactions and pain thresholds as well as the moderating influence of pain cognitions upon these pain thresholds.

The main findings were that both the dominant and submissive group have an overall higher pain threshold than the control group, indicating that they are more tolerant towards pain. This effect could not be explained by age, gender, BMI or depressive symptoms. In addition, submissives showed a trend towards a temporary additional increase in their pain threshold after a BDSM interaction. Moreover, submissives had lower scores on the pain catastrophizing scale, indicating they are less likely to catastrophise either medical pain, severe injuries or minor ones. Last, both a low fear of pain and a lower tendency to catastrophize pain were associated with higher pain thresholds in dominants.

As discussed in the introduction, pain thresholds depend on many different factors. We will first explore the biological aspects relevant to the BDSM context, before discussing the more psychological and cognitive importance of BDSM regarding the pain threshold.

Given the nature of BDSM interactions, submissives are generally more exposed to painful stimuli compared to dominants or controls, which will have a biological impact. As a long-term effect, receiving repetitive painful stimulation will generally lead to a process of habituation (38), which has been shown to cause a lasting increase in pain thresholds (39, 40). This may be reflected in the results of our study sample, showing a higher pain threshold in submissives compared to controls.

Repetitive painful stimulation can also lead to short-term hyperalgesia (38), causing a temporary decrease of pain thresholds. We found the opposite of this in our research, with a near significant increase of pain thresholds in submissives during the BDSM interaction compared to controls. Since this hyperalgesia will be observable only in regions where the repetitive stimulation was applied, whereas in this study, pain thresholds were assessed elsewhere (i.e. hand region), this may explain the contradictory result. It does suggest that the BDSM interaction itself also influences these dynamic pain thresholds. A similar connection has been made by Kamping and colleagues, who suggest the specific BDSM context is necessary for a different pain perception in masochists compared to controls (9).

It should also be noted that in the current study sample increased endocannabinoid levels have also been demonstrated in the submissive subgroup following the interaction (27), which could be partly responsible for the found increases in pain thresholds, since endocannabinoids have been linked to higher pain thresholds (26). Finally, sexual arousal, which also plays an important part in (most) BDSM interactions (8, 41), has also been known to have an analgesic effect and elevate pain thresholds (32).

On a more psychological level, social bonding and trust, both considered integral parts of the BDSM experience (42, 43), are known to increase pain thresholds (30). This suggests that the social closeness experienced during a BDSM interaction might contribute to higher pain tolerance in submissives. Interestingly, the voluntary and negotiated nature of pain within the sadomasochistic context, which is an integral part of any BDSM interaction (6) will also influence the pain thresholds of the submissive. Suggestive of this is the finding that pain thresholds are higher if an individual is in control of the painful stimulus (15).

There are some group effects to consider as well, however. The overall higher pain thresholds in dominants and submissives compared to controls indicate a difference between BDSM-interested individuals and non-BDSM-interested individuals beyond general demographic factors. BDSM participants are arguably more familiar with certain types of pain since they often introduce pain play in a sexual and/or intimate context, which may result in differential affective conditioning of pain stimuli. Alternatively, personality traits such as higher rates of extraversion and lower rates of neuroticism are associated with lower pain threshold (16) and have also been linked to BDSM interests (44). As a side note, a single study has found higher pain thresholds among lesbian and bisexual women compared to heterosexual women (45) which may be reflected in the higher LGBTQA+ representation generally found in BDSM participants (1).

The submissive group in particular has been found less likely to catastrophize pain compared to controls. Pain cognitions are an important determining factor in pain thresholds (21). More specifically, a tendency to catastrophize or fear pain leads to lower pain thresholds (19, 20). Attributions and assumptions about pain have been found to be relevant in BDSM research as well: Defrin and colleagues show that masochists have higher pain thresholds and are less likely to catastrophize pain compared to the general population (34). Hypothetically, these group differences could arise from a familiarity with pain in the sadomasochistic context and a desire to seek out certain types of pain in a BDSM interaction, which makes it less likely for submissive individuals to catastrophize pain compared to the general population who are more used to associating pain with negative experiences. Another possibility is that people who are less predisposed to catastrophize pain, will gravitate more easily towards pain play experimentation.

We further found that the dominant group has a particular interplay between pain cognitions and pain thresholds. Specifically, dominants that catastrophize less or have less fear of pain, have higher pain thresholds, an association that is not seen in the control group. Since this effect is also not observed in the submissive group, it can be hypothesized that the state-

dependent variables of the BDSM interaction, as referenced above, will interfere more strongly in submissives – who are on the receiving end of pain play – than in dominants, thus weakening the link between pain cognition and pain thresholds. Why pain thresholds are influenced by pain cognitions specifically in the dominant group but not in the control group is unclear. It can be argued that dominants have more experience with pain in the context of BDSM, since many dominants will have experimented with submission as well in their lives (6) so for a dominant to have a tendency to catastrophize or fear pain could be more significant than a high score in the control group and will subsequently affect the pain threshold more strongly.

Exploring this link between pain threshold and pain cognitions in a BDSM context further might help explain the unexpected differences between the dominant group and control group in this research. Understanding these mechanisms more fully could not only help our comprehension of BDSM, but also of the importance and influence of pain cognitions in general.

Limitations

Several limitations must be mentioned. First, although the sample size is significantly higher than in similar previous research, this study has but a moderate amount of participants. This implies a limited statistical power which should be addressed in future research. Second, pain threshold remains a subjective measurement based on the partaker's interpretation. Among participants, especially for submissives who receive aversive stimuli on a regular basis, it could be presumed honorable to show high pain endurance, which could result in reporting bias. Third, participants were recruited through the same BDSM club where data collection was done as well as through the Flemish community on Fetlife (i.e. the largest social website for BDSM communities), which might have introduced a selection bias. We know from previous research (46) that 85% of BDSM-interested people only play at home, which means that results may not be generalizable towards the broader population of BDSM practitioners. Moreover, although this notion still needs further scrutiny, there may exist cultural differences between different clubs and nationalities in regard to the kind of interactions performed (1, 47), further affecting generalizability. However, studying experienced participants fully engaged in the BDSM scene, does have the advantage that the interactions are built on trust and are completed in a safe, sane and consensual way.

We feel confident that these limitations will be addressed in future research.

Clinical implications

Research in this specific topic strives to shed some light on something that is widely practiced yet poorly understood. This study endeavors to explain how pain may be processed in a different way in the context of a BDSM interaction through biological and psychological processes. By further enhancing our understanding of the mechanisms behind a BDSM interaction in this way, we aspire to relieve the stigma these practitioners still endure.

As a result of the historical pathologization of BDSM practice, it is still included in the Diagnostic and Statistical Manual of Mental Disorders 5th edition (DSM-5) under the heading of “sexual sadism” and “sexual masochism” (48). As a consequence, BDSM practitioners will find it difficult to seek mental health support, for fear of being discriminated against because of their proclivities. Promisingly, the International Classification of Diseases 11th edition (ICD-11), which was published in 2019, has officially eliminated the diagnoses of fetishism, fetishistic transvestism and sadomasochism (INSERT Moser). We strongly encourage mental health professionals to see beyond this particular point of view and help lessen the taboo atmosphere surrounding BDSM, so that anyone, regardless of their lifestyle, may receive equal treatment (49).

Conclusion:

The above-mentioned results suggest that BDSM practitioners have a higher pain threshold overall and that a BDSM interaction will result in a temporary elevation of pain thresholds in submissives. Additionally, pain thresholds in dominants will be dependent upon their pain cognitions and submissives will generally experience less fear of pain than the general population.

This study helps shed light upon the biological processes behind a BDSM interaction through pain threshold measurements. Future research will be required to expand our knowledge on this subject.

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Lastly, a special thanks to all the couples that participated and were so kind to let us observe and analyse these intimate interactions.

Table 1: Clinical and demographic variables

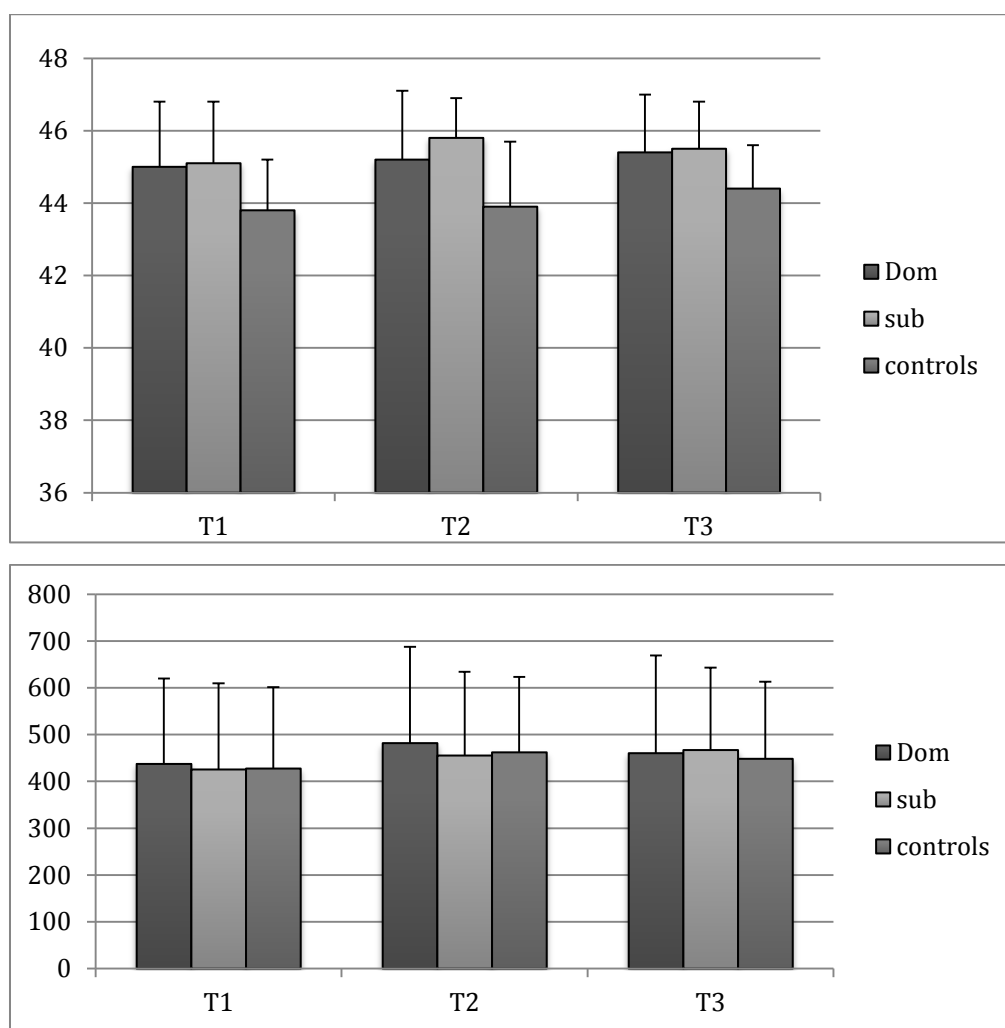
	Dominants (n=34)	Submissives (n=33)	Controls (n=24)	Test p value
Age (y)	44.5 ± 11.3	38.2 ± 11.3	34.3 ± 10.26	.0026*
Gender	M: 23 (68%) F: 9 (25%) other 2 (6%)	M: 8 (24%) F 24 (73%) Other: 1 (3%)	M 13 (54%) F 11 (46%) Other: /	.0035+
Education level (n;%)				.238*
1	1 (3%)	1 (3%)	0 (0%)	
2	15 (44%)	15 (45%)	5 (21%)	
3	18 (53%)	17 (52%)	19 (79%)	
BDI (Mean, range)	3.1 (0-11)	3.9 (0-12)	5.2 (0-12)	.101*
BMI	28.0 ± 5.3	27.7 ± 7.3	24.4 ± 4.0	.0467*

Education level: 1= high school unfinished; 2 = high school finished; 3: higher education (college/university); BDI = Beck's Depression Inventory; BMI = Body Mass Index

* Oneway Anova analysis

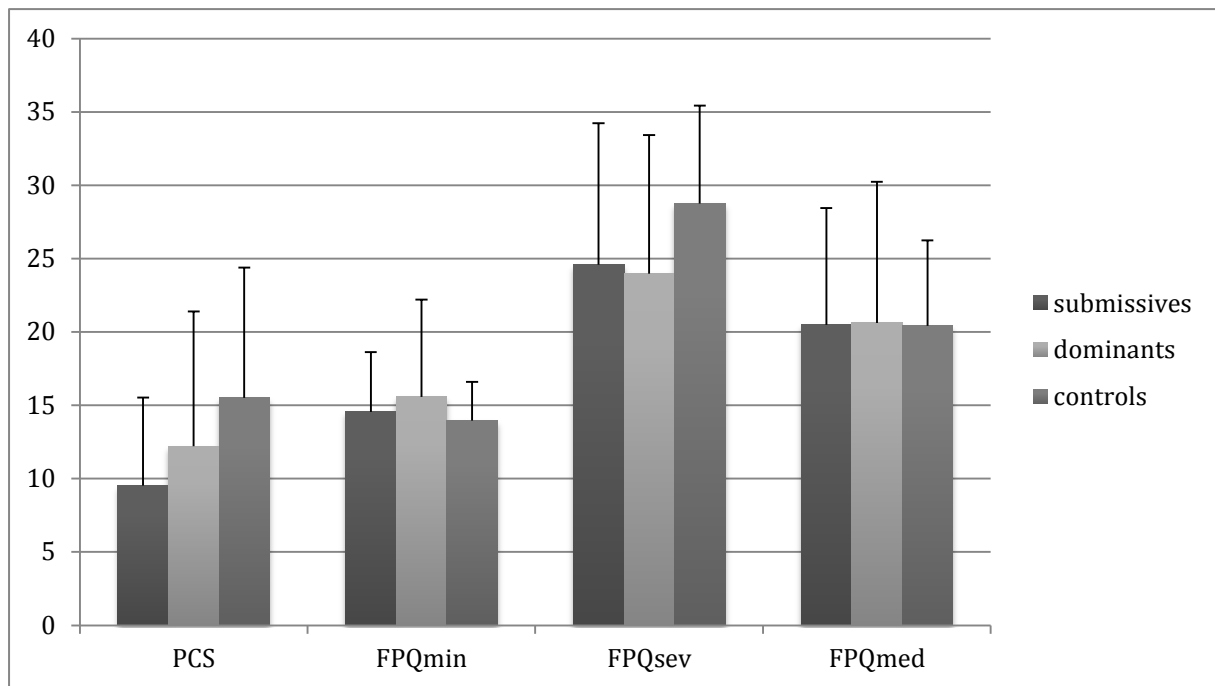
+ Contingency analyses (Pearson)

Figure 1: Pain thresholds in dominants, submissives and controls



Pain thresholds (y-axis) in dominants (n=34), submissives (n=33) and controls (n=24) on T1 (pre play baseline), T2 (post play) and T3 (post aftercare, i.e. 15-20 minutes after T2). Figure 1a: NTE-2A heat threshold. Figure 1b: algometer pressure threshold

Figure 2: Pain cognitions in dominants, submissives and controls



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