



## Episode 8: K is for Kinky Hormones

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## The Article



### Between Pleasure and Pain: A Pilot Study on the Biological Mechanisms Associated With BDSM Interactions in Dominants and Submissives

- January 2020
- Journal of Sexual Medicine
- Wuyts et al.
  - Elise Wuyts, Nele De Neef, Violette Coppens, Erik Fransen; Eline Schellens, M. Van, Der Pol, M. Prof, Manuel Morrens
  - University of Antwerp



# The Article

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## **Between Pleasure and Pain: A Pilot Study on the Biological Mechanisms Associated With BDSM Interactions in Dominants and Submissives**

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# Wuytz et al.

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## **Aim**

- “To shed light upon the rewarding biological mechanisms associated with BDSM interactions.”

## **What did they do? (between groups study)**

- Compared stress and reward hormone levels in
  - 35 BDSM couples before a scene, immediately after an active BDSM interaction (a scene), and 20 minutes after (to account for aftercare)
- with stress and reward hormone levels in
  - a control group (folks from a sports bar)





# Introduction

## Aim

- “To shed light upon the rewarding biological mechanisms associated with BDSM interactions.”

## What did they do? (between groups study)

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## BDSM: Definitions



### Bondage & Discipline (Wiseman, 1996)

- Physical restraint
- “Training” of submissive

### Dominance & Submission (Moser & Kleinplatz, 2006)

- Psychological power exchange
- Appearance of one partner’s rule over the other

### Sadism & Masochism (Wiseman, 1996)

- Sadism: Sexual arousal/pleasure from inflicting pain on consenting partner
- Masochism: Sexual arousal/pleasure from receiving pain





# BDSM: Definitions



## Five components (Weinberg, T.S., Williams, & Moser, 1984)

1. Power exchange
2. Role playing
3. Consent/Voluntary agreement
4. Mutual Definition
5. (Typically) Sexual Context
  1. BDSM is not always sexual (Moser & Kleinplatz, 2006)
  2. Fetishism sometimes (Nichols, 2006)

Approximately 31-60% of people practice BDSM in some fashion (i.e., BDSM related activities)

"Although pain is an evolutionary protection mechanism to prevent individuals from further exposing themselves to damage, afflicting or receiving pain is a core element of BDSM play."

(Wuyts et al., 2020; abstract)

# BDSM: Definitions



## Operational Definitions (Wuyts et al., 2020)

1. Power Play – the inclusion of power imbalances within the BDSM interaction
2. Pain Play – the inclusion of painful stimulation within the BDSM interaction





# Sub Space vs. Dom Space

## Define Sub Space vs Dom Space

- Duality of pleasure and pain
  - Runners high
  - Arousal is arousal is arousal
- Studying Sub and Dom Space
  - Past studies have focused mostly on qualitative reports and experiential data
  - New focus: Phenomenological, Physiological, Biological study of interplay between pain/power play and pleasure/reward

### Phenomenology

is the study of structures of consciousness as experienced from the first-person point of view. The central structure of an experience is its intentionality, its being directed toward something, as it is an experience of or about some object.

(Stanford Encyclopedia of Philosophy)

# Physiology



## Hormonal biomarkers of pleasure or reward

- Endorphins (beta-endorphins)
  - Heavily studied in pleasure/reward contexts
  - Don't pass blood brain barrier (BBB) so role in brain functioning uncertain; not ideal for measuring brain induced chemical changes
- Endocannabinoids
  - Lipid-based (do pass BBB)
  - 2-arachidonoylglycerol (2-AG)
  - Anandamine (AEA)

## Hormonal biomarkers of stress

- Cortisol

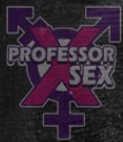
### Biology

is the study of all living things

### Physiology

A branch of biology that deals with the functions and activities of life – more specifically, the physical and chemical processes involved





# Endocannabinoids and the VTA

Endocannabinoids bind on the CBI receptor

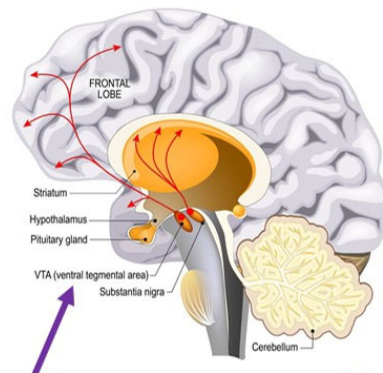
• Most CB1s are in the brain and many of those are in the Ventral Tegmental Area (VTA)

The VTA projects "dopaminergic pathways stimulating the nucleus accumbens"

• This is a core aspect of neurological reward systems

AEA and 2-AG have a regulating role in dopaminergic transmission

## DOPAMINE PATHWAY



Reward pathway starts in the VTA

## Previous Research



### Sexual contexts for endocannabinoids

- Experiencing sexual pleasure
- Sexual motivation

Masturbation has been shown to increase plasma levels of 2-AG for men & women

### Sexual contexts for cortisol

- Increased cortisol in submissives during BDSM play

# Hypothesis



**BDSM interactions are biologically mirrored by an increase in stress and reward hormones.**

# Method



## Blood draw and vitals

- Before play
- Immediately after
  - 30 – 90 min scenes
- 15-20 min after that (after care)

## Observer ratings

- Length and type of play
  - Pain play, power play, observed sexual interactions
- Binary score
  - Yes/No was pain/power/sex present

In some cases there were 2 observers, which helped minimize **interrater variability**



## Method



### BDSM Group

- Measured before scene (T1)
- Immediately after (T2)
- 15-20 min later (T3)

### Control Group

- Measured once (T1)
- 30-90 min later (T2)
- 15-20 min after that (T3)

## Statistical Analyses



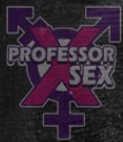
### ANOVA (Analysis of Variance)

- Demographics

### Linear Mixed Model (LMM)

- Biomarkers
  - Group; Time; Group\*Time
- 3 groups
  - Dominants, submissives, Controls
- Controlled for demographics
  - Included age, BMI, BDI in the model





# Results

## Subjects

- Age
  - Doms slightly older
- Gender
  - Most Doms were male (68%)
  - Most subs were female (73%)
- Mean duration of play was 53.5 min
  - ( $\pm$  14.6 min)

Table 1: Demographic and clinical variables

	Dominants (n=34)	Submissives (n=33)	Controls (n=24)	Test p value
Age (y)	44.5 $\pm$ 11.3	38.2 $\pm$ 11.3	34.3 $\pm$ 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;%)	1 (3%) 15 (44%) 2 18 (53%) 3	1 (3%) 15 (45%) 17 (52%)	0 (0%) 5 (21%) 19 (79%)	.238*
BDI (Mean, range)	3.1 (0-11)	3.9 (0-12)	5.2 (0-12)	.101*
BMI	28.0 $\pm$ 5.3	27.7 $\pm$ 7.3	24.4 $\pm$ 4.0	.0467*

Education level: 1= high school unfinished; 2 = high school finished; 3: higher education (college/university)

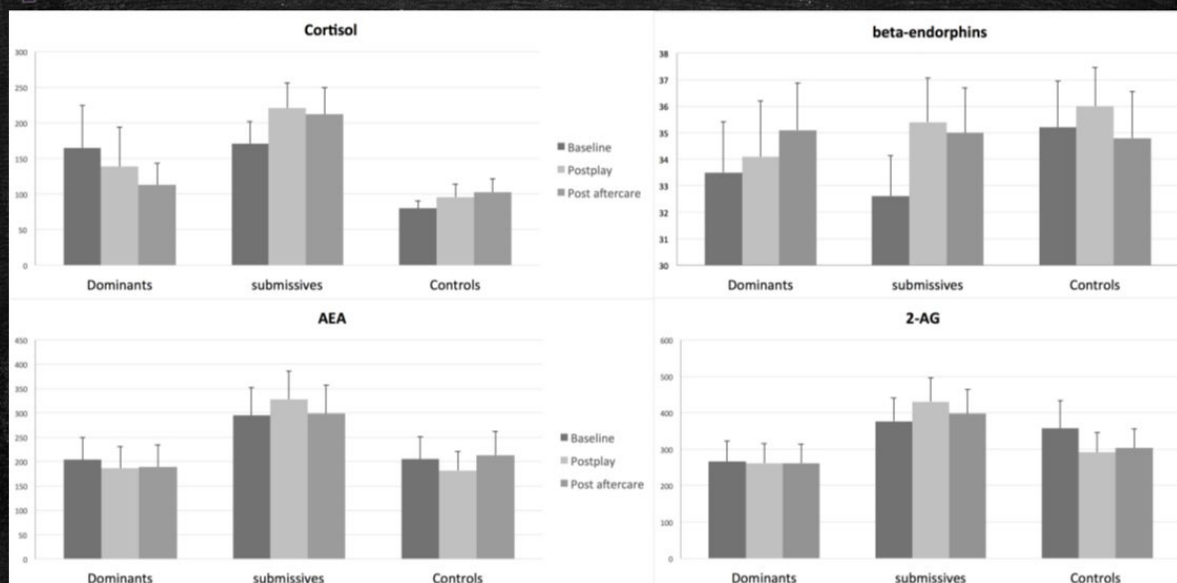
\* Oneway Anova analysis

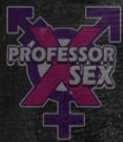
+ Contingency analyses (Pearson)



# Results

Biomarker levels on 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: Cortisol levels (ng/ml); Figure 1b: beta-endorphins (pg/ml); figure 1c: Anandamide (AEA; ng/ml); figure 1d: 2-arachidonoylglycerol (2-AG; ng/ml)





## Results

### Biomarkers

- 4 biomarkers over 3 time points
- **Compared to baseline, cortisol levels significantly increased in submissives** ( $p=.0011$ )
  - The time\*group interaction was the only predictor for cortisol levels in the LMM ( $F=5.40$  (4,111);  $p=.0005$ ).
- **AEA levels significantly increased in submissives from T1 to T3** ( $p=.0218$ )
  - AEA concentrations were predicted by a significant time\*group effect ( $F=2.48$ ;  $p=.0486$ ) and of cortisol concentrations ( $F=100.14$ ;  $p<.0001$ )
- **Submissives showed a borderline significant difference in 2-AG between T1 and T3** ( $p=.0570$ )
  - Concentrations of Endocannabinoid 2-AG were predicted by cortisol levels ( $F=81.77$ ;  $p<.0001$ ) and marginally significantly by group ( $F=2.57$ ;  $p=.0829$ ).

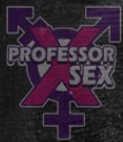


## Results

### Impact of sexual experience of the interaction

- Participants rated their experience of sexual tension
  - 15 of 34 Doms and 17 of 33 subs rated the experience to have at least some sexual tension
- **In the Dom group, sexual tension scores** ( $M=3.1$ ;  $SD=1.5$ ; range 1-6) **correlated to AEA and 2-AG**
- **6 of 33 subs reported experiencing an orgasm during the scene - this was not correlated to any of the biomarkers**





## Results

### Impact of type of BDSM interaction in Doms and subs

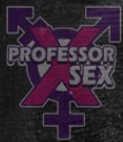
- Dichotomous variables
- Pain play
  - Yes (n=25) or No (n=8)
- **Subs who experienced pain play had elevated 2-AG** ( $t=2.26$  (35);  $p=0.030$ )
- Power play
  - Yes (n=12) or No (n=19)
- **Doms who engaged in power play had higher AEA** ( $F=5.178$ ;  $p=.0302$ ) **and higher 2-AG** ( $F=4.51$  (30);  $p=0.0421$ ) **levels versus those who did not.**



## Discussion

- Cortisol levels were elevated \*at\* baseline for subs compared to Doms
- Subs experienced increased cortisol as a result of the play
- No significant effect on beta-endorphins
- AEA and 2-AG were impacted in subs (this was influenced by cortisol)
- **These findings are consistent with previous research and confirm the hypothesis**





## Endocannabinoids and the VTA

Endocannabinoids bind on the CBI receptor

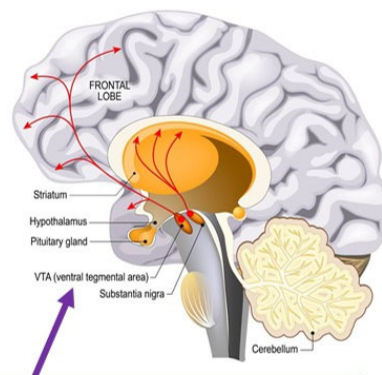
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The VTA projects "dopaminergic pathways stimulating the nucleus accumbens"

• This is a core aspect of neurological reward systems

AEA and 2-AG have a regulating role in dopaminergic transmission

### DOPAMINE PATHWAY



Reward pathway starts in the VTA



## Discussion

- **Submissives engaging in BDSM play derive pleasure from these interactions**
  - Changes in biomarkers were related to pain play, not power play
  - Pleasure-inducing impact of the stress experienced by the BDSM scene
    - But not correlated with reported sexual tension
  - Reward-related biomarkers were related to pain play, not power play
    - Previous research showed pleasure was strongly (subjectively) related to intensity of pain and number of areas on the body involved (Defrin et al., 2015)
- **Dominants engaging in BDSM play derive pleasure from these interactions**
  - Changes in biomarkers were related to power play and control, not pain play
  - Trigger mechanisms similar to those involved in sexual arousal and sexual enjoyment
    - Previous research showed that BDSM practitioners characterized their BDSM as mostly sexual in nature; bidirectionally associated with emotional connection and long-term sexual interaction (Simula, 2017)





## Limitations

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- Moderate number of participants
- Potential observation bias
- Potential selection bias
- Failure to control for physical activity level of participants



## Clinical Implications

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### Link between "aberrant" behavior and biological pleasure

- Relieve stigma
- Further de-pathologizing, reconsideration of DSM inclusion/DSM language



## AZ Scale

### AZ Scale

<b>Rigor</b>	0 = Significant methodological flaws 4 = No methodological flaws
<b>Sex Positivity</b>	0 = Pathologizes sex or sexuality 4 = Affirms sexuality as diverse
<b>Inclusivity</b>	0 = Perpetuates stigmas or stereotypes 4 = Affirms queer communities and other marginalized communities
<b>Writing</b>	0 = Confusingly written 4 = Well written and clear
<b>Comprehensiveness</b>	0 = So narrow in focus that is unhelpful 4 = Includes all relevant features of topic

$(\text{Angel's Total Score} + \text{Rob's Total Score}) \div 10 = \text{AZ Score}$

To figure out YOUR AZ Score, total them and divide by 5.

**Questions**  
Thank you