THE JOURNAL OF
SEXUAL MEDICINE

PSYCHOLOGY

The Influence of Emotion Upregulation on the Expectation of Sexual Reward

Mirte Brom, MSc,[1] Ellen Laan, PhD,[2] Walter Everaerd, PhD,[3] Philip Spinhoven, PhD,[4] Baptist Trimbos, PhD,[5] and Stephanie Both, PhD[6]

ABSTRACT

Introduction: Emotion regulation research has shown successful altering of unwanted aversive emotional reactions. Cognitive strategies can also downregulate expectations of reward arising from conditioned stimuli, including sexual stimuli. However, little is known about whether such strategies can also efficiently upregulate expectations of sexual reward arising from conditioned stimuli, and possible gender differences therein.

Aim: The present study examined whether a cognitive upregulatory strategy could successfully upregulate sexual arousal elicited by sexual reward-conditioned cues in men and women.

Methods: Men (n = 40) and women (n = 53) participated in a study using a differential conditioning paradigm, with genital vibrostimulation as unconditioned stimulus (US) and sexually relevant pictures as conditional stimuli.

Main Outcome Measures: Penile circumference and vaginal pulse amplitude were assessed and ratings of US expectancy, affective value, and sexual arousal value were obtained. Also a stimulus response compatibility task was included to assess automatic approach and avoidance tendencies.

Results: Evidence was found for emotion upregulation to increase genital arousal response in the acquisition phase in both sexes, and to enhance resistance to extinction of conditioned genital responding in women. In men, the emotion upregulatory strategy resulted in increased conditioned positive affect.

Conclusion: The findings support that top-down modulation may indeed influence conditioned sexual responses. This knowledge may have implications for treating disturbances in sexual appetitive responses, such as low sexual arousal and desire.

Key Words: Positive Emotion Regulation; Sexual Conditioning; Sexual Response; Sexual Reward Learning; Sexual Arousal

Received April 21, 2015. Accepted November 11, 2015.

[1]Leiden University, Institute of Psychology, Clinical Psychology Unit, Leiden University Medical Centre, Department of Psychosomatic Gynaecology & Sexology, Leiden, The Netherlands;

[2]Academic Medical Centre, University of Amsterdam, Department of Sexology and Psychosomatic Obstetrics and Gynaecology, Amsterdam, The Netherlands;

[3]University of Amsterdam, Department Clinical Psychology, Amsterdam, The Netherlands;

[4]Leiden University, Institute of Psychology, Clinical Psychology Unit. Leiden University Medical Centre, Department of Psychiatry, Leiden, The Netherlands;

[5]Leiden University Medical Centre, Department of Gynaecology, Leiden, The Netherlands;

[6]Leiden University Medical Centre, Department of Psychosomatic Gynaecology & Sexology, Leiden, The Netherlands

http://dx.doi.org/10.1016/j.jsxm.2015.11.003

INTRODUCTION

According to incentive motivation models, etiology and maintenance of low sexual arousal and desire, such as in Female Sexual Interest/Arousal Disorder (*Diagnostic and Statistical Manual of Mental Disorders,* DSM-5), can be explained from a classical conditioning perspective.[1] Learning about sexual cues may encompass learning of positive expectations of pleasure and sexual reward, but may also include the learning of negative expectations.[2] External stimuli that can elicit sexual motivational responses are called sexual incentive stimuli.[1] The motivational valence of incentive stimuli can be unconditioned (primary) or conditioned (secondary) as a result of associative learning.[3] In associative learning processes such as classical conditioning, a neutral stimulus (NS) is repeatedly paired with an unconditioned stimulus (US),[3] and eventually the NS is able to elicit the same reaction as the US. The NS is now called the conditioned stimulus (CS) and the reaction to the CS is called the

conditioned response (CR). It is suggested that the contingent pairing of negative emotional experiences (eg, sexual assault or repeated experiences with painful coitus) with stimuli that used to have sexual incentive value may result in less attraction or even aversion to these incentives.[4,5] This lack of a positive sexual learning history, or even a more negative learning history, may result in a limited number and/or in limited strength of potential sexual incentives that can activate the sexual response system, and subsequently in reduced or lacking feelings of sexual desire and arousal (often in the absence of disturbed genital response).[6,7]

Although there is limited empirical support, cognitive behavioral therapy (CBT) based on associative learning principles has emerged as the psychological treatment of choice for disorders in sexual interest and desire.[8–10] Core components of CBT are cognitive techniques such as cognitive restructuring of negative and sexually inhibiting thoughts, and behavioral techniques such as sex therapeutic exercises to (re)create different, more varied, or prolonged sexual stimulation to enhance sexually pleasurable experiences. It is thought that the interaction with pleasurable sexual stimuli and events desensitizes possible negative associations and facilitates sexual response acquisition and maintenance, and that memories of positive sexual experiences result in expectations of sexual reward, which may subsequently enhance sexual interest and arousal.[8,9] It is likely that cognitive and behavioral processes interact during CBT. Experiences during sex therapeutic exercises may change cognitions, and cognitive restructuring, in turn, may facilitate acquisition of pleasurable sexual associations. The term "emotion regulation" (ER) signifies any process that serves to initiate, inhibit, or modulate (eg, cognitively reevaluate) emotional feelings or behavior.[11,12] The ER techniques "reappraisal" (ie, cognitive change, yielding an altered interpretation of an emotional situation) and attentional focus (decreasing or increasing attention to the emotional and physical impact of the stimulus) have been proposed to be effective regulatory strategies because their influence begins at an early stage of emotion generation, before emotional responses have fully unfolded.[13] Insight into the mechanisms of these cognition-emotion interactions can help in the development of effective CBT interventions. The present study investigated whether deployment of an emotion upregulatory strategy can facilitate the acquisition of conditioned sexual responses. The present study created a laboratory analogue of CBT by applying a key feature of cognitive restructuring (ie, cognitive upregulation of sexual arousal response evoked by US/CS by means of reappraisal and attentional focus) to the laboratory analogue of basic sexual reward learning (ie, classical conditioning).

There is growing evidence that cognitive strategies such as attentional deployment can downregulate expectations of reward arising from conditioned stimuli,[14] including sexual conditioned stimuli.[15] However, less is known about the efficacy of upregulatory strategies in sexual arousal. Nevertheless, studies on positive emotion upregulation have demonstrated that reappraisal of positive images (ie, upregulation of positive affect) influenced the early stage of emotional response, and was associated with adaptive hemodynamic profiles both during anticipation and during viewing of affective images, depending on their valence and the regulatory goal.[16] In addition, in another study,[17] before each sexual film, participants were instructed to increase their sexual arousal, decrease their sexual arousal, or respond as usual. They found that on average, participants performed the task as instructed. However, individuals with higher sexual desire for a partner exhibited less change in their sexual arousal to regulation instructions. Moreover, in a neuroimaging study from our lab (in preparation) 40 healthy male participants had to increase ("Up"), decrease ("Down"), or maintain ("Equal") their sexual arousal response evoked by sexual explicit pictures inside an MRI scanner. Downregulation of sexual arousal activated prefrontal regions, whereas upregulation activated reward-related structures such as the nucleus accumbens and amygdala. These studies suggest that men and women can effectively enhance sexual arousal levels making use of upregulatory strategies. However, despite its presumed importance, research on the regulation of reward expectations elicited by sexual conditioned stimuli is lacking in the literature. In addition, it is unclear whether men and women are equally prone to conditioning of sexual response and whether sex differences do exist in the emotion regulation of positive emotions, such as sexual arousal.[2,15] However, regarding possible gender differences in emotion regulation, the general assertion is that women tend to use more emotion-focused strategies, whereas men are thought to use more effective cognitive (rational) cognitive strategies.[18] To be specific, in a review of neuroimaging research, Whittle et al[18] suggests that women may recruit different brain regions compared to men during emotion perception. In general this seems to be associated with greater levels of limbic/subcortical and temporal activation in women compared to men, and greater levels of frontal and parietal activation in men compared to women. Moreover, the authors suggest that men and women use different strategies to downregulate negative emotions, and that these strategies might be mediated by different neural circuitry. Men seem to engage in automatic or unconscious emotion regulation when exposed to emotional stimuli, which may result from greater integration of cognitive and emotional neural circuits. However, most of these results on gender differences in ER relate to the regulation of particularly negative emotions.[18–20]

A recent study demonstrated that women may indeed use less effective cognitive strategies compared to men in the regulation of positive emotions.[15] Making use of a differential sexual conditioning paradigm, evidence was found for the deployment of a cognitive emotion downregulation strategy to effectively enhance extinction of conditioned affective value and subjective sexual arousal in men, whereas this cognitive strategy in women resulted in overall higher ratings of affective value and subjective sexual arousal towards the CS+ and CS− in the extinction phase compared to a control condition.[15] Compared to men, women also reported experiencing more difficulties with the deployment of the cognitive downregulatory strategy. The fact that this study