Swearing as a response to pain

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Although a common pain response, whether swearing alters individuals' experience of pain has not been investigated. This study investigated whether swearing affects cold-pressor pain tolerance (the ability to withstand immersing the hand in icy water), pain perception and heart rate. In a repeated measures design, pain outcomes were assessed in participants asked to repeat a swear word versus a neutral word. In addition, sex differences and the roles of pain catastrophising, fear of pain and trait anxiety were explored. Swearing increased pain tolerance, increased heart rate and decreased perceived pain compared with not swearing. However, swearing did not increase pain tolerance in males with a tendency to catastrophise. The observed pain-lessening (hypoalgesic) effect may occur because swearing induces a fight-or-flight response and nullifies the link between fear of pain and pain perception. ***NeuroReport*** **00:000–000**

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Introduction

Swearing, the use of offensive or obscene language [1], occurs in most human cultures [2]. People swear to let off steam, to shock or insult, or out of habit [3]. Cathartic swearing [4] may occur in painful situations, for example giving birth or hitting one's thumb with a hammer. Swearing is also one symptom of the disinhibition in frontal lobe syndrome. For example, the famous frontal lobe patient Phineas P. Gage is said to have become 'fitful, irreverent, indulging at times in the grossest profanity' [5]. Anecdotally (we found no supporting evidence in the literature), some pain theorists view swearing as a sign of 'pain-related catastrophising', which may be defined as a maladaptive response in which negative and unhelpful thoughts and ideas are brought to bear when pain is experienced [6]. We wondered why swearing, a supposedly maladaptive response to pain, is such a common pain response.

Given that pain sensation can be affected by a variety of factors, such as attention state, emotional context, suggestions, attitudes, expectations and sensory information [7] we carried out an experiment to test the as yet unvalidated hypothesis that swearing, being a maladaptive response to pain, would decrease pain tolerance and increase pain perception compared with not swearing. Participants were asked for 'five words you might use after hitting yourself on the thumb with a hammer' and used the first swear word on the list. As a control they were asked for 'five words to describe a table' and used the word whose position corresponded with the swear word. The 'cold pressor' paradigm was employed. This laboratory procedure requires participants to submerge one hand in ice-cold water until discomfort necessitates removal. Submersion latency is recorded as an index of pain tolerance [8]. After each trial we measured heart rate to assess autonomic arousal [9] and pain perception to provide an additional pain outcome variable [10].

A repeated measures design was applied owing to its superior statistical power [11] and to control group differences with regard to several pertinent factors. These were pain-related catastrophising defined above [6], fear of pain – the tendency to be afraid of pain and physical harm [12] and trait anxiety – the long-term tendency to feel uneasy, afraid or worried [13]. These factors, which are correlated with pain outcomes, were incorporated as covariates in some of the statistical analyses employed.

Methods

Participants

The participants were 67 undergraduates (see Table 1). The Keele University School of Psychology Research Ethics Committee approved the study.

Design

Repeated measures; cold-pressor latency, perceived pain and change in heart rate were compared across swearing and control conditions. Condition order was randomized across participants. Participants were asked to maintain a similar pace and volume of word recital across conditions.

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Table 1 **Means (SDs) of cold-pressor latency, heart rate, change in heart rate, and perceived pain score by study condition and sex, and covariate scores by sex; *P* values are for male versus female comparisons using unpaired *t*-tests**

	Males	Females	
Variable	*n*=38	*n*=29	*P* value
Age	20.79	21.10	0.258
	0.99	1.26	
Cold-pressor latency (s)			
Swearing condition	190.63	120.29	0.001
	82.81	80.52	
Nonswearing condition	146.71	83.28	0.002
	91.46	61.42	
Heart rate (bpm)			
Resting	78.50	83.03	0.093
	11.40	9.89	
Swearing condition	90.05	100.28	0.006
	15.92	12.61	
Nonswearing condition	85.26	91.07	0.081
	14.43	11.55	
Change in heart rate (bpm)			
Swearing condition	11.55	17.24	0.007
	8.99	7.07	
Nonswearing condition	6.76	8.03	0.414
	6.43	6.06	
Perceived pain score			
Swearing condition	3.89	3.79	0.780
	1.45	1.50	
Nonswearing condition	4.87	5.62	0.071
	1.63	1.70	
Covariates			
Catastrophising score	14.39	23.66	<0.001
	7.58	9.40	
Fear of pain score	73.37	88.69	<0.001
	14.24	18.52	
State anxiety score	34.61	35.28	0.671
	6.83	5.70	

bpm, beats per minute.

Materials

Two water containers with water at 5°C (cold) and 25°C (room temperature) were employed. Temperatures were checked and adjusted as necessary before each trial. Heart rate was assessed using a Polar FS1 monitor (Polar Electro UK Ltd., Hartlepool, Teeside, UK). The Pain Catastrophising Questionnaire [14], the Spielberger State-Trait Anxiety Index [15], the Fear of Pain Questionnaire Version 3 [16], and the Perceived Pain Scale (PPS) [10] were employed to assess pain-related catastrophising, trait anxiety, fear of pain and perceived pain, respectively.

Procedure

Participants individually attended a research laboratory. At the outset they were informed that the study was concerned with quantifying the degree of stress that various forms of language elicit during tense situations. Participants submerged their nondominant hand in the room temperature water for 3 min before each cold-pressor trial to create a standardized starting point. Then the participants immersed the same hand in the cold water with the instruction that they should submerge their unclenched hand for as long as they could, while repeating their chosen word. Timing began when the hand was fully immersed and stopped when the hand was fully removed from the water. A 5-min time limit was imposed; 10 participants reached this limit in one or both trials. One participant was excluded because none of their suggested words were swear words. Participants immersed the hand in the room temperature bath before the second and final trial. Heart rate was recorded after the initial hand submersion in the room temperature bath (resting heart rate) and at the end of each cold-pressor submersion. The Pain Catastrophising Questionnaire, the Spielberger State-Trait Anxiety Index and the Fear of Pain Questionnaire Version 3 were administered at the start of the test session; the Perceived Pain Scale was administered immediately after each cold-pressor submersion.

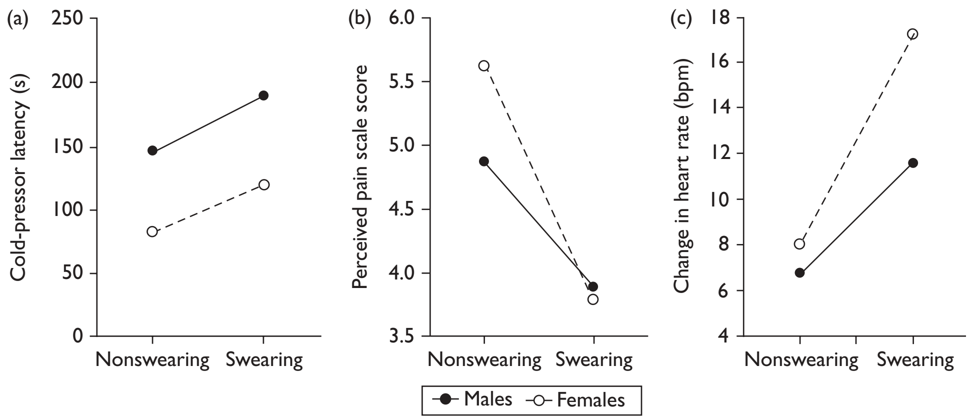
Results

All variables followed a normal distribution although tending towards platykurtotis in some cases. However, where appropriate transforms could be identified, analyses yielded identical results and so only nontransformed analyses are reported. Descriptive data are shown in Table 1.

A series of 2×2 mixed analysis of variances were used to investigate the effect of swearing and sex on cold-pressor latency, perceived pain scale score and change in heart rate. For cold-pressor latency there were main effects of swearing [$F(1.65) = 89.749$, $P < 0.001$] and sex [$F(1.65) = 11.789$, $P = 0.001$], but no interaction. Latencies were longer in the swearing condition relative to the nonswearing condition, and in males relative to females (Fig. 1a). For perceived pain, the swearing by sex interaction was significant [$F(1.65) = 9.159$, $P = 0.004$] and there was a main effect of swearing [$F(1.65) = 98.569$, $P < 0.001$]. Although both sexes experienced a reduction in perceived pain in the swearing condition, females did so to a greater extent (Fig. 1b). For heart rate, the swearing by sex interaction was significant [$F(1.65) = 15.019$, $P < 0.001$] as were the main effects of swearing [$F(1.65) = 150.774$, $P < 0.001$] and sex [$F(1.65) = 4.142$, $P = 0.046$]. Swearing increased heart rate in both the sexes, but more so for females compared with males (Fig. 1c).

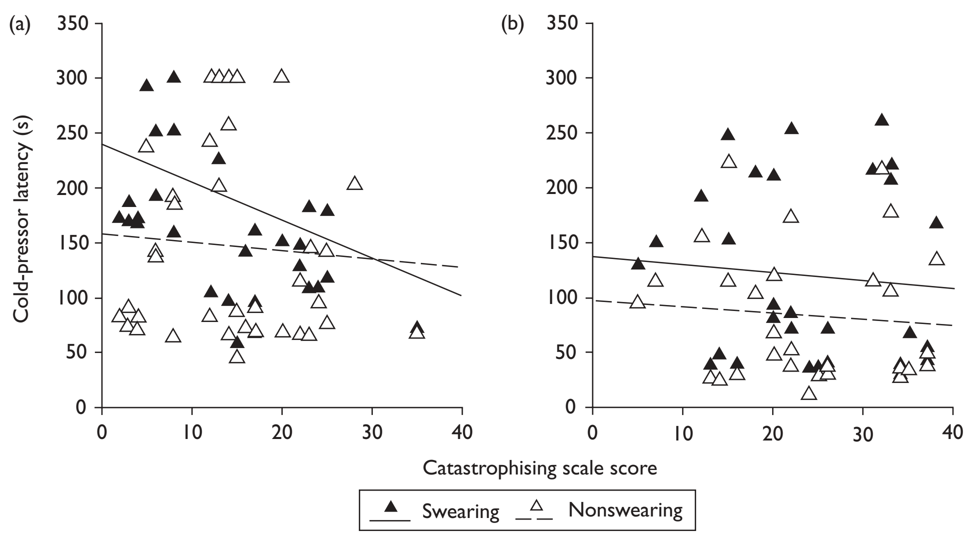
Separate and simultaneous general linear model (GLM) analyses were applied to each of the dependant variables: cold-pressor latency, perceived pain scale score and change in heart rate. Each analysis included the qualitative predictors: swearing and sex, as well as one of the following centred [17] quantitative predictors: catastrophising, fear of pain, or trait anxiety. In each analysis, to check regression homogeneity, first the three-way interaction was examined in a GLM additionally containing all the two-way interactions and the main effects. If the three-way interaction was not significant

Fig. 1



Cold-pressor latency (a), perceived pain scale scores (b) and change from resting heart rate (c) in the swearing and the nonswearing conditions, by sex.

Fig. 2

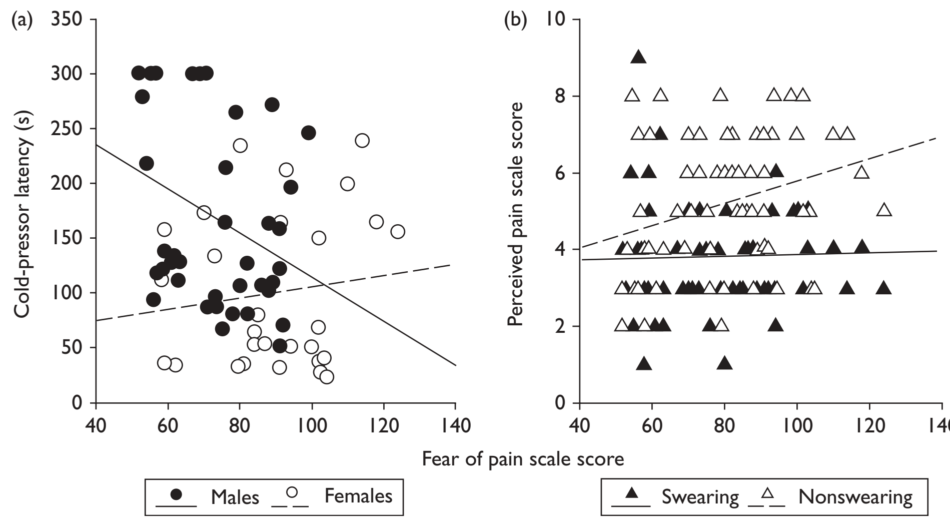


Prediction of cold-pressor latency by the three-way interaction of swearing versus nonswearing, catastrophising scale score, and sex [males (a); females (b)].

then a GLM including only the two-way interactions and the main effects was inspected. Where none of the interactions was significant, a final GLM including only the main effects, equivalent to traditional analysis of covariance [18], was applied. Before conducting the GLM analyses the correlations between the three covariates were calculated. Catastrophising was correlated with fear of pain ($r = 0.691$, $P < 0.001$) and with trait anxiety ($r = 0.292$, $P = 0.016$). Trait anxiety and fear of pain were not correlated ($r = 0.129$, $P = 0.300$).

The three-way interaction of swearing, sex and catastrophising was a significant predictor of cold-pressor latency [$F(1.63) = 7.754$, $P = 0.007$]. Catastrophising predicted decreased latency in swearing males but not in nonswearing males or females (Fig. 2a and b). Catastrophising did not predict perceived pain or change in heart rate. The fear of pain by sex interaction predicted cold-pressor latency [$F(1.63) = 4.570$, $P = 0.036$]. Fear of pain predicted decreased latency in males but not females (Fig. 3a). The fear of pain by swearing interaction predicted perceived pain [$F(1.64) = 5.621$, $P = 0.021$]. Fear of pain predicted perceived pain in the nonswearing condition but not in the swearing condition (Fig. 3b). Fear of pain did not predict change in heart rate. Trait anxiety predicted change in heart rate [$r = 0.334$, $F(1.64) = 6.663$, $P = 0.012$] but not cold-pressor latency or perceived pain.

Fig. 3



Prediction of cold-pressor latency by fear of pain scale score and sex (a) and prediction of perceived pain by fear of pain scale score and condition (b).

Discussion

This experiment tested the hypothesis that swearing, an assumed maladaptive pain response, would decrease pain tolerance and increase pain perception compared with not swearing. In fact, the opposite occurred – people withstood a moderately to strongly painful stimulus for significantly longer if they repeated a swear word rather than a nonswear word. Swearing also lowered pain perception and was accompanied by increased heart rate. We interpret these data as indicating that swearing, rather than being a maladaptive pain response actually produces a hypoalgesic (pain lessening) effect.

Swearing reduced cold-pressor latency by a similar amount in males and females, but led to a greater reduction in perceived pain in females and a greater increase in heart rate in females. However, the most intriguing sex difference was the observation that a hypoalgesic effect of swearing was present in females irrespective of the tendency to catastrophise, whereas in males the hypoalgesic effect of swearing dissipated as the tendency to catastrophise increased. A diminishment in swearing-related hypoalgesia with increased catastrophising may occur because negative emotions induced by swearing (see below) spill over into catastrophic thinking in individuals more predisposed towards catastrophising. Nevertheless, it is unclear why the sex difference occurred. As previously found [19], male participants generally showed lower levels of catastrophising than females (see Table 1), although the range of catastrophising scores in both the sexes was wide. That men swear more often than women [4] may be pertinent.

Fear of pain predicted perceived pain in the nonswearing condition, consistent with previous research [20]. However, fear of pain did not predict perceived pain in the swearing condition. This interesting finding suggests that a part of the hypoalgesic effect of swearing may be because of the amelioration of that part of increased pain perception that is brought about by fear of pain, although further research would be required to investigate this further.

Next we consider the role of emotion in the hypoalgesic effect of swearing. In considering its neurobiological underpinnings Pinker [4] suggests that swearing aloud may tap into 'deep and ancient parts of the emotional brain', particularly the limbic system and the basal ganglia of the right hemisphere. Certainly, swearing often occurs within a strong negative-emotional context. The influence of negative affect on pain has been well researched although with inconsistent results: negative emotions produce hypoalgesia in some studies, but the opposite effect of hyperalgesia in others [21]. Rhudy and Meagher [21,22] suggest that hypoalgesia occurs only if the negative emotion experienced in the context of a painful stimulus is sufficiently strongly felt to cause fear rather than anxiety. For instance, they observed a stress-induced hypoalgesic response to radiant heat pain after fear-eliciting electric shocks [21,22]. It was suggested that fear, being an immediate alarm reaction to present threat, leads to a fight or flight response including heart rate acceleration, whereas anxiety, being a future-oriented emotion, is characterized by a less-activated state of hypervigilance and somatic tension. Neurobiologically, fear may cause amygdala activation of descending pain inhibitory systems that regulate the flow of incoming nociceptive signals [21,22].

Therefore, perhaps swearing induces a negative emotion that, if not fear, may nevertheless be characterized as an immediate alarm reaction to present threat. The heart rate acceleration after swearing observed in this study is consistent with activation of the fight or flight response. However, the question as to which negative emotion swearing elicits, if not fear, is unclear. One possibility is aggression [23]. Everyday examples of aggressive swearing include the football manager who 'psychs-up' players with expletive-laden team talks, or the drill sergeant barking orders interspersed with profanities. Swearing in these contexts may serve to raise levels of aggression, downplaying feebleness in favour of a more pain-tolerant machismo, most likely mediated by classic fight or flight mechanisms [24]. No studies have investigated the effect of manipulating level of aggression on pain tolerance although the reverse has been examined. Electric shock (< 3 mA) pain tolerance was established in a group of men and the same individuals chose what level of electric shock they would be willing to administer to a fellow participant. The correlation between the highest tolerated and the highest administered shock was $r = 0.32$ ($P < 0.001$), indicating that higher levels of pain tolerance predicted increased aggression [25]. Future research could usefully examine whether invoked aggression induces hypoalgesia.

Conclusion

This study has shown that, under certain conditions, swearing produces a hypoalgesic effect. Swearing may have induced a fight or flight response and we speculate on a role for aggression in this. In addition swearing nullified the link between fear of pain and pain perception.

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