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Swearing as a Response to Pain—Effect of Daily Swearing Frequency

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Abstract: Previously we showed that swearing produces a pain lessening (hypoalgesic) effect for many people.[20] This paper assesses whether habituation to swearing occurs such that people who swear more frequently in daily life show a lesser pain tolerance effect of swearing, compared with people who swear less frequently. Pain outcomes were assessed in participants asked to repeat a swear word versus a nonswear word. Additionally, sex differences and the roles of pain catastrophizing, fear of pain, and daily swearing frequency were explored. Swearing increased pain tolerance and heart rate compared with not swearing. Moreover, the higher the daily swearing frequency, the less was the benefit for pain tolerance when swearing, compared with when not swearing. This paper shows apparent habituation related to daily swearing frequency, consistent with our theory that the underlying mechanism by which swearing increases pain tolerance is the provocation of an emotional response.

Perspective:* *This article presents further evidence that, for many people, swearing (cursing) provides readily available and effective relief from pain. However, overuse of swearing in everyday situations lessens its effectiveness as a short-term intervention to reduce pain.

Key words: *Swearing, pain, hypoalgesia, cold pressor, daily swearing frequency, habituation.*

Swearing is the use of offensive or obscene language,[19] and is a linguistic feature in most human cultures.[23] Work in our laboratory has demonstrated that, for the majority of people, swearing in response to pain produces a pain lessening, or hypoalgesic effect.[20] We found that when participants repeated a swear word, they were able to hold their hand in ice-cold water for, on average, some 40 seconds longer compared with when they repeated a nonswear word. In addition, participants reported reduced perceived pain in the swearing condition. In light of other studies linking emotional response to pain amelioration,[13,14] we suggested that swearing may provoke an emotional response in the speaker—possibly aggression—mobilizing classic fight or flight mechanisms[3] leading to increased pain tolerance. This would be in keeping with the well-known stress-induced analgesia.[24]

However, swearing did not help all individuals to withstand pain. Nine of the 67 individuals in our original sample showed no benefit from swearing. A question that has occurred repeatedly since the original publication has been whether daily swearing frequency affects the hypoalgesic effect of swearing in response to pain.[18] In this paper, we repeated our original experiment with an additional variable, daily swearing frequency, assessed using the questionnaire item: "How many times per day do you swear?" It follows that if the mechanism by which swearing reduces pain relies on emotional response, then people who swear more frequently in daily life, compared with people who swear less frequently, should show a lesser emotional response to swearing, predicting lesser pain tolerance, pain perception, and change in heart rate effects of swearing in such individuals. These effects are predicted based on the psychological phenomenon known as habituation, which may be defined as the tendency for the gradient of response to a repeated stimulus to decline.[11,21]

In addition, Pinker[10] suggests that sexual swearing, a popular form of swearing in Western culture, may be more advantageous to males than to females. Taken together with estimates that men swear more often than

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women in public,[8] gender differences in the effects of swearing as a response to pain were also assessed.

Methods

Participants

These were 71 undergraduates (Table 1). The Keele University School of Psychology Research Ethics Committee approved the study. Volunteers reporting taking analgesic medications within 12 hours, chronic pain conditions, heart conditions or Reynaud's syndrome were excluded.

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.

Materials

Two water containers with water at 5°C (cold) and 25°C (room temperature) were employed. Temperatures were checked and adjusted as necessary prior to each trial. Heart rate was assessed using a Polar RS400 monitor (Polar Electro Oy, HQ Professorintie 5 FIN-90440, Kempele, Finland). The Pain Catastrophizing Questionnaire,[22] the Fear of Pain Questionnaire Version 3,[9] and the Perceived Pain Scale[1] were employed to assess, respectively, pain-related catastrophizing, fear of pain, and perceived pain. Daily swearing frequency was assessed using a single questionnaire item.

Procedure

Participants individually attended a sound-attenuated research laboratory. Informed consent was obtained from participants, although they were not explicitly told until debrief, after testing, of the aim of assessing the effects of swearing on pain tolerance. At the outset, participants were informed only that they were taking part in a study on stress. Participants were asked for the swear word they might use in response to banging their head accidentally, and for a word they would use to describe a table. All procedures were carried out in the presence of the (female) experimenter (the author C.U.). The Pain Catastrophizing Questionnaire and the Fear of Pain Questionnaire were administered at the start of the test session; the Perceived Pain Scale was administered immediately after each cold pressor submersion. Heart rate was recorded continuously and automatically throughout the procedure at 1-second intervals. Participants submerged their nondominant hand in the room temperature water for 3 minutes prior to each cold pressor trial to create a standardized starting point and to allow heart rate to normalize. Then, 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-minute limit was imposed; 9 participants reached this limit in 1 or both trials. Upon completing the perceived pain scale with respect to the first trial, participants immersed the hand in the room temperature bath prior to the second and final cold pressor trial.

Table 1. Means (SDs) of Age, Cold Pressor Latency, Perceived Pain Scale Score, Resting Heart Rate, Change in Heart Rate, and Covariate Scores by Sex

Variables	Males N = 22	Females N = 49
Age	22.86	21.76
	4.70	5.99
Cold pressor latency (s)		
Swearing condition	130.27	78.53
	117.35	75.45
Nonswearing condition	82.95	54.53
	83.40	49.69
Perceived Pain Scale score		
Swearing condition	4.55	4.84
	2.06	2.22
Nonswearing condition	4.89	5.09
	2.00	1.95
Heart rate (BPM)		
Resting pre-swearing condition	87.97	100.22
	12.03	13.89
Resting pre-nonswearing condition	88.91	99.23
	12.14	15.25
Change from resting swearing condition	5.40	5.33
	6.09	7.33
Change from resting nonswearing condition	3.38	4.23
	4.22	6.90
Covariates		
Catastrophizing score	21.59	26.96
	10.32	9.33
Fear of pain score	83.95	89.02
	18.56	15.47
Daily swearing frequency (words per day)	18.80	11.51
	18.47	12.71

Results

All variables followed a normal distribution although tending towards platykurtosis in some cases. However, where appropriate transforms could be identified (eg, a logarithmic transform normalized cold pressor latency), analyses yielded identical results. Therefore, only nontransformed analyses are reported. Descriptive data are shown in Table 1. A challenge for researchers lies in minimizing Type I error inflation due to multiple hypothesis testing while retaining reasonable power for individual hypotheses tests.[17] This paper deals with Type I error inflation following methods applied in previous comparable pain research. Following George and Hirsh,[6] corrections were not necessary in analyses testing specific hypotheses already demonstrated in our previous research on swearing and pain. For all other analyses, Type I error was controlled using a Bonferroni correction, as used by Hsieh et al.[7]

With respect to cold pressor latency, 52 participants (73% of the sample) kept their hand in the ice cold water for longer in the swearing condition. This is a greater proportion than would be expected by chance, chi-square = 15.338, df = 1, $P < .001$, w = .46.

A series of 2 $\times$ 2 mixed analyses of variance (ANOVAs) were used to investigate the effect of swearing and sex on cold pressor latency, perceived pain, and change in heart rate. For cold pressor latency there were main effects of swearing, $F(1,69) = 26.942$, $P < .001$, omega squared = .268, and sex, $F(1,69) = 4.623$, $P = .035$, omega squared = .049, but no interaction, $F(1,69) = 2.880$, $P = .094$, omega squared = .026. Latencies were longer in the swearing condition relative to the nonswearing condition, and in males relative to females (Fig 1A). For perceived pain, neither swearing nor sex nor the swearing by sex interaction was significant, $F(1,69) \leq 2.074$, $P \geq .154$, omega squared $\leq .015$. For change in heart rate there was a main effect of swearing, $F(1,69) = 4.255$, $P = .043$, omega squared = .044, but no main effect of sex, $F(1,69) < 1$, and no significant swearing by sex interaction, $F(1,69) < 1$. The increase in heart rate during cold pressor immersion was greater in the swearing condition compared with nonswearing (Fig 1B).

To check that the length of time participants immersed their hand in the ice cold water did not confound the heart rate data, the relationship between change from resting heart rate and cold pressor latency was examined. However, these variables were not correlated in the nonswearing condition, $r = -.192$, $P = .109$, and neither were they correlated in the swearing condition of the experiment, $r = -.199$, $P = .096$.

Separate and simultaneous general linear model (GLM) analyses were applied to each of the dependent variables: cold pressor latency, Perceived Pain Scale score, and heart rate. Each analysis included the qualitative predictors—swearing and sex—as well as 1 of the following centered[5] quantitative predictors: catastrophizing; fear of pain; or daily swearing frequency. In each analysis, to check regression homogeneity, first the 3-way interaction was examined in a GLM additionally containing all of the 2-way interactions and the main effects. If the 3-way interaction was not significant, then a GLM including only the 2-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,[15] was applied. Prior to conducting the GLM analyses, the correlations between the 3 covariates were calculated. As the remaining analyses extend previous research, Type I error was controlled using a Bonferroni correction by setting alpha at .017 (.05 divided by 3 dependent variables; cold pressor latency, perceived pain, and change from resting heart rate).

Catastrophizing was correlated with fear of pain, $r = .564$, $P < .001$, but not with daily swearing frequency, $r = .061$, $P = .614$. Daily swearing frequency and fear of pain were not correlated, $r = .171$, $P = .155$.

The 2-way interaction of swearing and daily swearing frequency was a significant predictor of cold pressor latency, $F(1, 68) = 6.582$, $P = .013$, omega squared = .073. This interaction indicates significantly different slopes of the best-fit regression lines for the relationship between daily swearing frequency and cold pressor latency in the swearing ($B = -.406$, $P = .587$) and nonswearing ($B = .676$, $P = .185$) conditions of the study, although the P values accompanying the regression coefficients indicate that neither slope differed significantly from zero in its own right. Fig 2A shows that participants reporting lower daily swearing frequency tended to keep their hands in the ice water for longer in the swearing condition (solid line) compared with the nonswearing condition (dashed line). However, the difference in mean cold pressor latency across the swearing and nonswearing conditions diminished as daily swearing frequency increased. Fear of pain did not predict cold pressor latency, $F(1, 68) = 1.641$, $P = .205$, omega squared = .009, and neither did pain catastrophizing, $F(1, 68) < 1$.

Perceived pain was not predicted by daily swearing frequency, $F(1, 68) = 1.083$, $P = .302$, omega squared = .001, fear of pain, $F(1, 68) < 1$, or pain catastrophizing, $F(1, 68) = 3.912$, $P = .052$, omega squared = .039. Change in heart rate was not predicted by daily swearing frequency, $F(1, 68) < 1$, or by pain catastrophizing, F

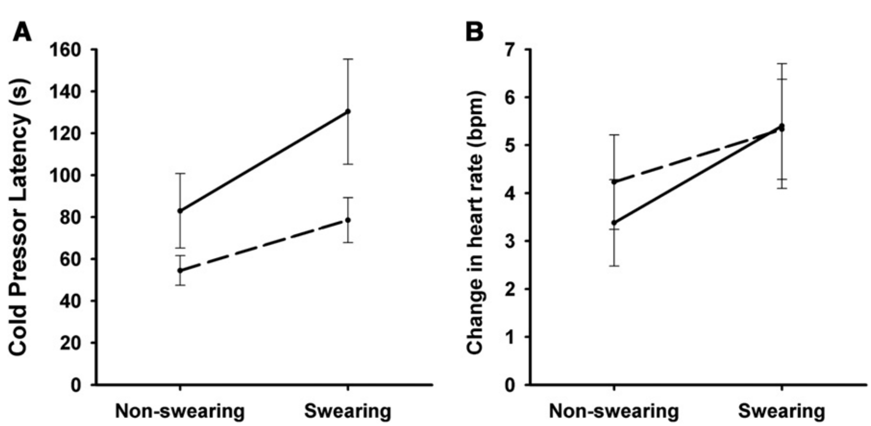

Figure 1. Cold pressor latency **(A)** and change from resting heart rate **(B)** in the swearing and the nonswearing conditions of the experiment, by sex (males, solid line; females, dashed line).

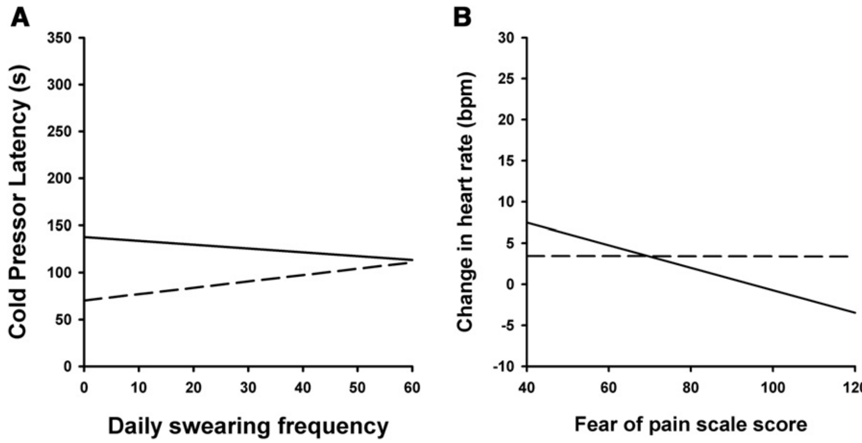

Figure 2. Prediction of cold pressor latency by daily swearing frequency **(A)** and prediction of change in heart rate by fear of pain **(B)** in the swearing (solid line) and nonswearing (dashed line) conditions of the experiment.

(1, 68) = 1.872, *P* = .176, omega squared = .012. However, change in heart rate was predicted by the swearing by fear of pain interaction, F (1, 68) = 8.078, *P* = .006, omega squared = .091. This interaction indicates significantly different slopes of the best-fit regression lines for the relationship between fear of pain and change in heart rate in the swearing (B = −.118, *P* = .020) and nonswearing (B = −.001, *P* = .977) conditions of the study. Fig 2B shows that the increased heart rate during cold pressor immersion in the swearing condition (solid line), compared with not swearing (dashed line), was not universally experienced, but was more pronounced for participants with lower fear of pain scores.

Condition order interaction effects were examined via a series of 2 × 2 mixed ANOVAs for the dependent variables cold pressor latency, perceived pain, and change in heart rate. Each ANOVA included the between-subjects factor condition order (swearing first versus nonswearing first) the within subjects factor swearing (swearing versus nonswearing), and the swearing × condition order interaction. Table 2 summarizes the means and standard deviations examined in these analyses.

For cold pressor latency there was no swearing × condition order interaction, F(1,69) < 1, and no main effect of condition order, F(1, 69) < 1. For perceived pain, there was a swearing × condition order interaction, F(1,69) = 10.965, *P* = .001, omega squared = .123 (see Fig 3A). The interaction was such that perceived pain in the nonswearing condition was about the same regardless of whether it was the first or second condition encountered. However, perceived pain in the swearing condition differed according to condition order. Participants encountering swearing first rated perceived pain in the swearing condition as much lower than participants encountering swearing as the second condition. For change in heart rate, there was a significant swearing × condition order interaction, F(1,69) = 8.045, *P* = .006, omega squared = .090 (see Fig 3B). This interaction was such that heart rate in the swearing condition was about the same regardless of whether it was encountered as the first or second experimental condition. However, heart rate in the nonswearing condition was increased for participants encountering nonswearing as the first experimental condition compared with those encountering swearing first. An additional check for condition order effects was carried out with respect to resting heart rate. However, this analysis found no swearing × condition order interaction, F(1,69) < 1, and no main effect of condition order, F(1,69) < 1.

Discussion

Replicating Earlier Findings

This experiment replicated the pain lessening effect of swearing and the accompanying changes in heart rate associated with swearing in response to a painful or uncomfortable stimulus that were first demonstrated in

Table 2. Means (SDs) of Cold Pressor Latency, Perceived Pain Scale Score, Resting Heart Rate, and Change from Resting Heart Rate by Condition Order

Variables	Swearing First N = 36	Nonswearing First N = 35
Cold pressor latency (s)		
Swearing condition	87.53	101.80
	88.44	97.87
Nonswearing condition	55.97	70.91
	55.61	69.58
Perceived Pain Scale score		
Swearing condition	3.89	5.63
	1.73	2.23
Nonswearing condition	4.75	5.31
	2.01	1.89
Heart rate (BPM)		
Resting pre-swearing condition	95.61	97.26
	15.98	12.83
Resting pre-nonswearing condition	95.35	96.73
	15.64	14.64
Change from resting swearing condition	6.16	4.52
	7.58	6.18
Change from resting nonswearing condition	2.92	5.05
	4.58	7.38

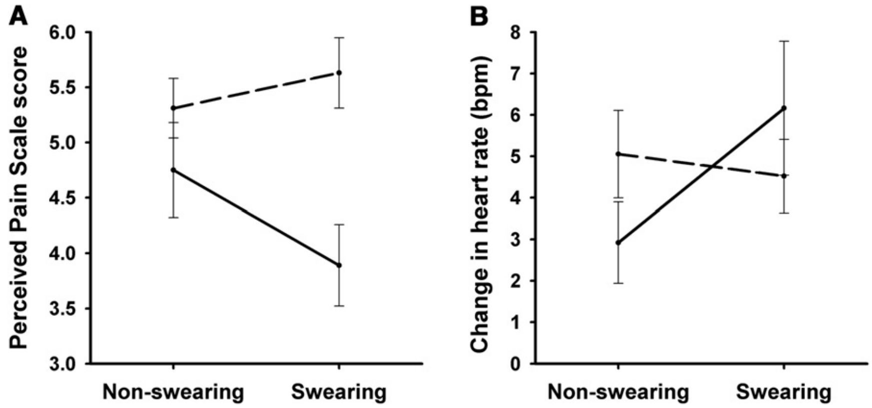

Figure 3. Perceived Pain Scale score **(A)** and change from resting heart rate **(B)** in the swearing and the nonswearing conditions of the experiment, by condition order (swearing condition first, solid line; nonswearing condition first, dashed line).

our laboratory.[20] In the present study, 73% of participants kept their hand in ice-cold water for longer if they repeated a swear word compared with repeating a nonswear word. On average, participants held their hand in the ice-cold water for 31 seconds longer in the swearing condition. Both these effects were statistically significant. Furthermore, as in our previous study, heart rate increased during cold-water hand immersion compared with immersion in room-temperature water, but did so to a greater degree in the swearing condition compared with the nonswearing condition. These consistent heart rate increases are important as they show that swearing produces a somatic effect, in turn indicating a pain-reducing mechanism over and above cognitive distraction. The only observed effect of gender was the finding that cold pressor latency was longer in males compared with females, an effect which replicates observations in our original study.[20]

Daily Swearing Frequency

While replication of previously observed effects was welcome, this was not our primary aim. This experiment was designed to assess whether the pain lessening (hypoalgesic) effect of swearing is moderated by daily swearing frequency. The prediction of cold pressor latency by the interaction of swearing in the experiment and daily swearing frequency indicates such a moderating effect. The more often participants reported swearing in daily life, the less extra time they were able to hold their hand in ice cold water when they repeated a swear word, compared with when they repeated a nonswear word. This effect can be observed in Fig 2A as the reducing distance between the solid and dashed regression lines with increasing daily swearing frequency. Daily swearing frequency did not, however, predict increased pain perception or decreased change in heart rate in response to the cold pressor challenge.

Our explanation of the observed moderating effect of daily swearing frequency on the hypoalgesic effect of swearing is based on the long-established psychological phenomenon of habituation. People who swear more often in daily life experience a lesser emotional response to swearing in the experiment because of habituation to the stimulus of swearing. As a consequence, these people experience a lesser pain tolerance effect from swearing, compared with people that swear less often in daily life. This implies that overuse of swearing in everyday situations lessens its effectiveness as a short-term intervention to reduce pain.

Swearing and Emotion

Based on evidence from positron emission tomography, functional magnetic resonance imaging, and skin conductance response studies, Pinker[10] concluded that swearing aloud may tap into "deep and ancient parts of the emotional brain." There is also good evidence linking several candidate emotions likely to be aroused by swearing—fear, aggression, and anger—with hypoalgesia. Fear induced by small electric shocks was found to increase pain tolerance via amygdala activation of descending pain inhibitory systems[13,14]; boys rated high in trait aggression showed lower finger pressure pain sensitivity compared with non-trait-aggressive boys[16]; and playing an action genre first person shooter video game for 10 minutes was found to increase anger, heart rate, and cold pressor latency.[12] These findings, our repeated observations of raised heart rate accompanying swearing, and the finding in the present study that participants appear to habituate to swearing via everyday use of swear words are consistent with our hypothesis that swearing protects some people from pain via emotionally mediated stress-induced analgesia. Nevertheless, further research could usefully assess the extent to which participants experience emotions such as fear, aggression, and anger while swearing during the cold pressor challenge.

As well as examining emotional states aroused by swearing, research based on the literature on anger expression styles and pain would further understanding of how swearing-induced hypoalgesia occurs. This literature has found that individuals who habitually tend to express feelings of anger, for example by being verbally aggressive (known as "high trait anger-out"[2]), are more sensitive to acute and chronic pain. The mechanism for this appears to be altered functioning of the endogenous opioid system such that the threshold for opioid release is raised in high trait anger-out individuals.[2] However, an interesting modification to this effect has been observed, such that high trait anger-out individuals show increased pain tolerance when they are allowed to express their anger in the face of a pain challenge—known as the matching hypothesis.[2]

Swearing is often heard as a form of anger expression.[8] Moreover, one might assume that high daily swearing frequency would correlate with a greater tendency towards high trait anger-out. This raises the intriguing possibility that we might have expected a swearing × daily swearing frequency interaction in the opposite direction to that observed. Individuals with higher daily swearing frequency might have shown increased pain tolerance when swearing compared with not swearing because of the opportunity for anger expression afforded by swearing during the cold pressor challenge. The absence of this interaction might be because repeating a single swear word at a steady pace and volume may not provide a sufficient outlet for anger expression. On the other hand, the elevation in heart rate in response to swearing observed in this and our previous study appears to counter this argument. A further possibility is that daily swearing frequency and trait anger-out are not correlated. We are not aware of any data characterizing the relationship between these variables. Assessing anger expression in future research would further understanding of swearing as a response to pain.

Other Variables

The prediction of change in heart rate by the interaction of swearing condition and fear of pain appears consistent with the role of swearing in alleviating pain, assuming that increased heart rate indicates an emotional reaction that is protective against pain. People with lower fear of pain showed a greater increase in heart rate when repeating a swear word over a nonswear word, but this difference diminished with greater fear of pain. This interpretation would be fine were it not for our previous finding that the same interaction predicted perceived pain, such that the difference between swearing and nonswearing occurred at higher levels of fear of pain,[20] whereas in the present study the difference occurred at lower levels of fear of pain. The earlier finding was interesting as it opened up an avenue of theoretical interpretation such that swearing during cold pressor immersion appeared to nullify the link between fear of pain and pain perception. Interestingly, the positive slope of the prediction of perceived pain by fear of pain in the nonswearing condition in our earlier study is consistent with research showing fear of pain to be a robust predictor of increased perception and decreased tolerance of experimentally induced pain.[6] The same cannot be said for the present study where the regression of fear of pain on change in heart rate in the nonswearing condition was almost horizontal (Fig 2B).

In addition to these contradictory effects, the interaction of swearing condition and fear of pain was not a significant predictor of perceived pain in the present study. Indeed, in the present study, none of the analyses employing perceived pain as the predicted (dependent) variable were significant. For instance, although participants reported reduced pain perception in the swearing condition, this was not a significant reduction as observed in the earlier paper.[20] Some limitations in our procedure for assessing perceived pain are discussed below. However, given the contradictory findings across this and our earlier study outlined above, the safest interpretation of these data is that the moderating influence of fear of pain on the effect of swearing in response to pain remains unclear.

Pain catastrophizing predicted decreased cold pressor latency in the first study, but only in males and only in the swearing condition.[20] That this effect was not replicated in the present study may reflect the smaller proportion of males in the study sample, or the higher mean catastrophizing score for males in the present study (mean = 21.59) compared with in our earlier study (mean = 14.39). Our previous finding that fear of pain predicted reduced cold pressor latency in males but not females also was not replicated in the present study. Once again, this may reflect the different gender dominance across the 2 study samples.

Limitations

Analyses of condition order effects were carried out in recognition of possible artefacts arising from carryover effects as a consequence of the repeated measures design applied. However, the absence of condition order effects for cold pressor latency and resting heart rate indicate that neither variable was adversely affected by carryover effects. A condition order × swearing interaction effect for change from resting heart rate arose when lower heart rate in the nonswearing compared with the swearing condition was only observed when nonswearing followed swearing. This interaction is consistent with the known habituation of cardiovascular responsiveness to the cold pressor challenge.[25] It appears that the initial stimulation of the cold pressor challenge elevated heart rate on first exposure irrespective of experimental condition. Subsequently, heart rate either reduced where nonswearing was the second condition, or remained elevated by swearing when swearing came second. The clear reduction in heart rate when nonswearing followed swearing indicates that carryover effects from swearing were absent.

A condition order × swearing interaction effect for perceived pain arose when participants experiencing nonswearing as the second condition reported an increase in pain across trials, whereas reported pain remained at a constant elevated level for participants experiencing swearing as the second condition. This may reflect a time course effect such that swearing does not reduce pain perception after a certain amount of pain stimulation has already occurred. That this effect was absent for cold pressor latency might indicate that swearing may differentially affect pain tolerance and pain perception. However, pain ratings were collected only at the point of hand withdrawal when pain tolerance had been reached, rather than at intervals during ice water immersion, thus limiting the pain perception data. Further research would be required to verify this effect.

It could be argued that the increase in heart rate observed in the swearing condition might be a confound effect arising out of the overall longer time spent with the hand immersed in the cold water in the swearing condition. However, this appears not to have been the case as correlational analyses showed no overall positive relationship between cold pressor latency and rising heart rate in either the swearing or nonswearing conditions.

That we showed habituation to swearing for cold pressor pain tolerance but not perceived pain or change in heart rate most likely reflects the different levels of analytic power arising as a consequence of the different effect sizes for the main effect of swearing on these parameters. The cold pressor effect size (omega squared = .268) was almost double that suggested as being large[4] and, therefore, the cold pressor analyses had demonstrably adequate power approaching 1.000. On the other hand, effect sizes for perceived pain (omega squared = .015) and heart rate (omega squared = .044) were in the small-to-medium range,[4] limiting the analytic power of these analyses to .295 and .530, respectively. Effect sizes, and consequently analytic power, were generally lower in the present study compared with our earlier paper.[20] Previously, the main effect of swearing on the variables cold pressor latency, perceived pain, and heart rate had effect-size omega squared $\geq$ .570 and power > .999. Further research will reveal whether the current or previous data are more typical. Nevertheless, on the basis of data from this study, future research should implement more sensitive measures of perceived pain by assessing this variable throughout pain challenge, and should strive to identify a more sensitive somatic indicator of emotional response to swearing, such as skin conductance.

A final potential limitation applies to the self-report daily swearing frequency data. Based on estimates that people produce around 16,000 words per day on average, and that taboo words constitute around .5 to .7% of the spoken corpus, it has been reckoned that people utter, on average, approximately 80 to 90 swear words per day.[8] This estimate, based on data from American university students, is considerably higher than the average of 14 swear words used per day reported by our sample, and suggests that assessing swearing frequency by self-report produces an underestimation. Indeed, it is most likely that people would naturally underestimate the amount they swear given that swearing is taboo, and so, by definition, looked on unfavorably by society in general.[10] Nevertheless, should participants in the present study have been underestimating the amount that they swear, provided all participants underestimated to a similar degree, the measure of swearing frequency employed would serve to differentiate people of lower and higher swearing frequency. Insomuch as the experimental data confirmed our prediction as to the effect of daily swearing frequency on the effect that swearing has in response to pain, the measure of swearing frequency employed appears to have been successful.

Further Research

The hypothesis that swearing produces a hypoalgesic effect via emotional arousal should be further investigated by assessing the extent to which the emotions fear, aggression and anger accompany swearing in response to a pain challenge, and by taking into account anger expression style. In addition, as our two studies to date have looked only at swearing in response to the cold pressor pain challenge, further research should investigate other pain modalities such as heat challenge or electric shock challenge. Finally, while this study showed evidence of habituation based on daily swearing frequency, no research to date has assessed habituation to swearing (and recovery) over specified timescales, such as across several minutes. Such research would allow predictions of how long the hypoalgesic effect of swearing is likely to last.

Conclusions

This study has replicated the increased pain tolerance and the accompanying increase in heart rate associated with swearing in response to a painful or uncomfortable stimulus that were first demonstrated in our laboratory. The paper also moves research on swearing forward as a response to pain by showing apparent habituation to swearing such that the increased pain tolerance arising from swearing varies as a function of daily swearing frequency. These findings are consistent with our theory that the underlying mechanism by which swearing increases pain tolerance is the provocation of an emotional response, although further research is indicated.

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