Original Research

Experimentally Manipulated Somatic Information and Somatization Tendencies and their Impact on Physical Symptom Reporting and Performance in a Physically Strenuous Task

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ABSTRACT

Int J Exerc Sci 5(1) : 60-71, 2012. This study attempts to determine whether the presentation of an experimentally manipulated somatic experience during a physically strenuous task can influence physical performance and symptom reporting. The study also compares the relative influence of experimentally manipulated somatic information (state somatization) with stable individual differences in the tendency to amplify physical symptoms (trait somatization) on performance and symptom reporting. 194 participants completed standardized measures of somatization tendencies, state anxiety, neuroticism and conscientiousness. Participants where then given a mock physical exam, with individuals randomly assigned to receive either favorable or unfavorable somatic information. All participants then had their body mass index assessed and completed a rigorous exercise task, with quantification of performance. Physiological measures of blood pressure and pulse were also assessed before and after the exercise task. The experimentally manipulated presentation of somatic information predicted both performance and physical symptoms, even after controlling for BMI, neuroticism, conscientiousness, and state anxiety. Moreover, expected performance uniquely and significantly predicted performance above and beyond condition, anxiety, BMI, neuroticism, and conscientiousness. Somatosensory amplification tendencies also predicted symptom endorsement, but not performance. Findings suggest that both state and trait expectations with respect to somatic experiences influence symptom reporting and to a lesser extent performance, even after controlling for variables known to strongly influence each of these outcomes. Results are consistent with the cognitive-perceptual and the cognitive-appraisal models of somatic interpretation.

KEY WORDS: Somatosensory amplification, somatization, physical performance, self-verification

INTRODUCTION

Research indicates that the perception and interpretation of somatic information is highly subjective and under the influence of one's cognitive state (16,17). Pennebaker and Skelton were among the first to note that the experience of physical symptoms is largely the result of selective monitoring that confirms symptom related hypotheses (19). Furthermore, Cioffi suggested that this influence, when matched with negative cognitions, creates somatic distress where both self-directed attention and an increase in the salience of somatic information occur (7). Studies have also linked selective monitoring and attentional strategies to self-reports of physical symptoms in exercise settings (19,5). Moreover, the associated thoughts hypothesis suggests that attention is guided by task intensity, such that it is increasingly task focused (e.g., bodily sensations and performance outcomes) as exercise intensity increases (10).

In an extensive review of the literature, Cioffi describes how attention to somatic information reduces distress when physical sensations are interpreted solely based on the concrete (objective) characteristics of these sensations (7). Such neutral interpretations, void of emotional biases, are known as sensory monitoring and allow one to focus on the sensation itself (4). An example of how positive overarching goals can override the often detrimental components of sensory monitoring was demonstrated in a study in which childbirth was reported as less painful and accompanied by positive moods when sensory monitoring occurred (16). In contrast, when one cannot separate sensory information from immediate emotional responses, as seen in the catastrophizing of hypochondriacs, physical sensations are associated with feelings of distress (6).

Theories of control and self-verification are useful in explaining the need to maintain self-perceptions by actively seeking confirmatory information (24). Firmly held self-perceptions, even if negative, persist because they are stable, controllable, predictable, and comforting (25). It can be assumed, then, that self-verification strivings also influence physical performance, such that a person may seek outcomes that match closely with perceived levels of fitness rather than actual fitness. What is less clear is whether the self-regulating process impacts physiological responses. Importantly, the self-regulating process can be driven by states and traits, and we here discussed one state/trait that may be especially relevant when engaging in physical exercise.

One area of research focusing on the influence of cognitive states/traits on perceived physiological functioning is the work on somatosensory amplification (2). According to Barsky, trait somatosensory amplification is the general and enduring tendency to perceptually amplify somatic (bodily) sensations (2) and this is a central component to the experience of somatization. Importantly, somatization can also occur as a transient state in which symptom endorsement (i.e., self-reporting the experience of a symptom) and symptom intensity is influenced by factors including goals, cognition, context, attention, and mood (2,14,15). Past research has been unable to demonstrate a connection between physiological functioning and somatic amplification (18). One possible reason for the absence of this relation may be the less demanding nature of the physical tasks typically used in the literature. The assumption that an effect would emerge under more strenuous conditions is derived in part from a cognitive appraisal model in which the presence of a perceived threat (a physically exhausting task) is necessary for the interpretation/appraisal of a stressful event to occur (13). Additionally, studies involving outcome expectancy have shown that the task at hand must be sufficiently challenging for the possibility of failure to exist (7,26,11).

Hypotheses

The present research will manipulate the interpretation of somatic experience in a physically strenuous task. Participants in one condition will be told that they have excellent fitness and elevated heart rate will be labeled "healthy cardiovascular functioning." Conversely, participants in a second condition will be told that they have poor fitness and elevated heart rate will be labeled "imminent exhaustion."

It is predicted that those given unfavorable somatic information will verify their beliefs by selectively self-monitoring and amplifying physical symptoms. This increased awareness of symptoms during exercise should create anxiety/self-doubt that will lead to poorer performance. It is also predicted that stable somatization tendencies will predict the report of symptoms attributed to the exercise. Thus, this study will examine the influence of experimentally manipulated somatic information (state somatization) and stable individual differences in the tendency to focus on physical symptoms (trait somatization) on three outcomes: 1) physical performance, 2) symptom endorsement, and 3) physiological changes. Importantly, these variables will be examined in an experimental paradigm that includes a physically demanding/strenuous task. Moreover, several variables that have a demonstrated relation with exercise performance, attentional processes, and/or somatization (state anxiety, Body Mass Index, conscientiousness, and neuroticism) will be statistically controlled.

METHODS

Participants

194 college students (65% female) undergraduates were given class credit for participating. Average age was 19.6 years (*SD* = 3.55). Ninety-nine participants (67% female) were randomly assigned to the favorable somatic condition, and 95 (64% female) were assigned to the unfavorable somatic condition. Twenty-six participants (11.7%) were excluded due to equipment failure (bike pedal strap breaking) or for not following directions (wearing attire non-conducive to exercise). Three participants (1.3%) were excluded for being too sick to exercise.

Somatosensory Amplification Scale (SSAS)

The SSAS is a self-report, 10-item questionnaire asking respondents to rate whether each statement is "characteristic of you in general" from 1 ("not true at all") to 5 ("extremely true") (4). The SSAS assesses the tendency to amplify normal bodily sensations, is correlated with measures of hypochondriasis (4), and somatosensory amplification (as indicated by scores on the SSAS) is more prevalent in hypochondriacal relative to nonhypochondriacal subjects (3).

NEO-FFI (Five Factor Inventory)

The NEO-FFI is a widely used 60-item inventory measuring personality across five factors; Neuroticism, Conscientiousness, Agreeableness, Openness, and Extraversion, with Cronbach's alphas ranging from .63 to .83 (8,28).

SEQ (State Anxiety Scale)
The SEQ is a 20-item state version of the State-Trait Anxiety Inventory (22). Items are rated from 1 ("almost never") to 4 ("almost always") and respondents answer based on how they feel "right now." The generalized state-trait version has excellent internal consistency (> .89), while the state version exhibits lower temporal stability (test-retest r = .70).

Physical Symptom Questionnaire (PSQ)
The 11 item PSQ contains items from the Physical Symptom Checklist (PSC) derived from the DSM-III somatoform disorder criteria. These items, used to quantify "symptom endorsement" in the current experiment, were those that could be plausibly related to short periods of physical exercise. Participants are asked to rate the experience of a symptom and its intensity on a 5-point Likert scale, 1 = "Barely noticeable" and 5 = "Very Intense." The original PSC demonstrates high internal consistency, with a Cronbach's alpha of .88 (21).

Body Mass Index (BMI)
The National Institutes of Health (NIH) use BMI as a standardized measure of body fat (Formula: weight (lb) / (height (in))^2 x 703). According to NIH, a score of 18.5-24.9 is normal, below 18.5 is underweight, above 24.9 is overweight, and above 30 is obese. BMI scores for participants in this study ranged from 16.9-38.7 (M = 22.4, SD = 3.2).

Procedure
Participants were met individually by an experimenter and led to small laboratory room (with ambient temperature between 74-76 °F) where they first completed the SSAS. This was followed by two brief exercise sessions, after which blood pressure (BP) and heart rate (HR) were recorded. There was no measurement of BP and HR at baseline as the change in BP and HR from the first exercise session to the second was the focus of our analysis. Participants were told that their effort on the bike would be tied to remuneration (i.e., a failure to receive full credit if they engaged only minimally in the task) in order to maximize effort. Prior to initiating the exercise, participants stretched and adjusted the stationary bike seat. The first ride was used to establish their maximum speed, indicated by a digital display, and to hold it for ten seconds. BP and HR were measured using an automated blood pressure machine. The experimenter then used a laminated chart specific to each condition to provide feedback regarding their fitness. Participants received either favorable somatic information ("Your blood pressure and pulse readings were very good, much better than average, and this indicates a high level of fitness typical to that seen in athletes. Elevation of heart rate during intense physical activity is a sign of good blood flow and cardiac health…") or unfavorable somatic information ("Your blood pressure and pulse readings were actually below average and reflect a low level of fitness. Elevation of heart rate during intense physical activity is a sign of imminent exhaustion….”). Participants were then asked return to the stationary bike and instructed to hold their maximum speed established in the first ride for as long as possible. However, prior to beginning the second exercise session, participants were asked to predict how long they would hold maximum speed

(manipulation check). The time participants held maximum speed for the second ride was recorded (speed held for the majority of the time was also recorded in the event that it was below their maximum speed from the first ride). When the participant dropped 3 or more mph below maximum speed for 5 seconds, the timer was stopped. Participants that continued to hold their maximum speed were stopped at 3 minutes for ethical concerns of prolonged exercise at maximum intensity (this only applied to 4 participants or 2% of the sample). Three minutes was used as the cap because it was the longest time sustained in pilot data collected prior to conducting the current experiment. BP and HR were then reassessed, followed by the completion of the physical symptom checklist, SEQ, and NEO-FFI.

RESULTS

Performance Measure

The experimental condition was effect coded (1 = favorable somatic information, -1 = unfavorable somatic information), and SSAS scores were converted to z-scores. An interaction term was also computed by multiplying the standardized SSAS scores by the effect coded condition. Table 1 includes the basic descriptives for these and the outcome variables.

The time each participant held maximum speed in the second ride ranged from 14-180 seconds. Due to ethical standards, participants were capped at three minutes of vigorous exercise, though only four were at ceiling. Of the 194 participants, 25 (12.9%) did not reach their maximum speed during the second ride, though this was unrelated to condition (13 in the favorable and 12 in the unfavorable condition).

Table 1. Descriptive statistics for predictor and outcome variables.

Variable	n	Range Min	Range Max	*M*	*SD*
Performance	194	14.00	191.25	69.86	38.26
Symptom endorse.	194	2.00	32.00	10.90	4.75
BMI	194	16.95	38.75	22.42	3.17
Anxiety	190	20.00	72.00	36.88	8.31
Neuroticism	193	0.00	37.00	18.29	7.53
Conscientiousness	193	12.00	47.00	32.24	6.49
Somatosens. amp.	194	12.00	48.00	30.63	5.29
Interaction term	194	-3.52	3.28	0.01	1.00
Manipulation check	193	15.00	180.00	88.02	43.07

Note: N = 194 (final sample) with n = valid values per variable.

Participants not reaching their maximum speed were given a zero for time on the second ride. However, these participants were still effortful (less than 3 mph under their maximum speed) in the second ride. Thus, a new performance variable was calculated. Participants that received a zero for the second ride had 30 seconds subtracted from the time for their first ride and the remainder of time was used as the new time variable. (Note: 30 seconds was selected because it was less time than the time for the first ride of every participant that reached their maximum speed in the second ride. Therefore, none of the participants who failed to reach their maximum speed established in ride 1, were given performance values that exceeded the participants who did reach their maximum speed.) To calculate the new performance variable, the maximum speed held in the second ride was divided by the established maximum speed held in the first ride and multiplied by the amount of time the maximum speed was held on the second ride (the new time variable for the 25 participants not achieving their maximum speed is Equation 2). Thus, both speed and time were considered when determining how participants performed.

$$performance = \frac{maxspeed\,(ride\ 2)}{maxspeed\,(ride1)} \times time\ (ride2) \tag{1}$$

$$performance = \frac{maxspeed\,(ride\ 2)}{maxspeed\,(ride1)} \times [time\ (ride1) - 30(\text{seconds})] \tag{2}$$

This performance variable and time for the second ride are highly correlated ($r = 0.80$, $N = 194$, $p < .001$), and the findings are virtually identical regardless as to the outcome variable used.

The manipulation check demonstrates that participants in the favorable somatic information condition estimated they would hold maximum speed longer ($M = 92.9$ seconds, $SD = 41.0$) than participants in the unfavorable information condition ($M = 83.0$, $SD = 44.6$), with this effect being modest, but in the predicted direction ($t = 1.60$, $df = 191$, $p = .056$).

Predicting Performance

An analysis of group differences in performance showed that participants in the favorable somatic information condition ($M = 75.18$, $SD = 42.36$) scored higher than the unfavorable information condition ($M = 64.32$, $SD = 32.76$); $t = 2.00$, $df = 184$, $p = .047$. This indicates that condition is a significant predictor of performance. After centering the variables (1), a multiple regression indicates that after accounting for the covariates of BMI, anxiety, neuroticism, and conscientiousness, condition uniquely accounts for variance in performance ($R^2 = .02$, $b = 5.34$, $t = 1.90$, $p = .029$). Moreover, the squared semi-partial correlations (see Table 2) indicate that condition explains more variance in performance than any other variables individually or combined. This indicates that the presented information on physical/somatic experience (condition) has an influence on physical performance independent of potentially confounding variables such as personality traits, state anxiety, and general fitness.

Table 2. Summary of regression analysis, including semi-partials and squared semi-partials for variables predicting performance.

Variable	*B*	*SE B*	*β*	*sr*	sr^2
Anxiety	-.537	.551	-.117	-.071	.005
BMI	-.169	.887	-.014	-.014	<.001
Neuroticism	.008	.586	.002	.001	<.001
Conscientiousness	-.655	.490	-.109	-.097	.009
Condition	5.34	2.80	.140	.138	.019

Note: Listwise $n = 194$. Predicted variable = performance on exercise task. *sr* = semi-partial correlation. sr^2 = squared semi-partial correlation. **p* < .05.

The above-described multiple regression was repeated with the addition of the manipulation check variable; estimated time (seconds) that participants thought they would hold maximum speed. Expected performance uniquely and significantly predicted performance above and beyond condition, anxiety, BMI, neuroticism, and conscientiousness ($R^2 = .07$, $b = .252$, $t = 3.80$, $p < .001$).

Additionally, the SSAS was used to examine the effect of somatosensory amplification on performance. A regression analysis indicated that it was not an independent predictor of performance after controlling for the variance explained by condition (R^2_{change}< .001, F_{change}= .016, b = .019, t = .258, p = .797). This indicates that general body awareness does not affect performance, nor was there an interaction between condition and somatosensory amplification.

Predicting symptom endorsement (PSQ scores)
As predicted, participants in the favorable somatic information group (M = 10.30, SD = 5.04) reported less symptom intensity relative to those receiving the unfavorable somatic information (M = 11.52, SD = 4.37); t = -1.79, df = 182, p = .038. Multiple regression was then used to determine if other measured variables including body awareness, anxiety, BMI, neuroticism, and conscientiousness (all of which were centered for the analysis) uniquely explain variance in symptom intensity ratings. As shown in Table 3, condition significantly predicted symptom reporting after controlling for the above-mentioned variables (R^2= .02, b = 4.98, t = 2.08, p = .036). Importantly, the covariates independently predict symptom endorsement and cumulatively account for almost 16% of the variance (R^2= .161, $F_{1, 192}$= 6.17, p <.001), with the bulk of the predictive power coming from BMI (b = -.218, t = -2.06, p = .041) and state anxiety (b = .135, t = 2.09, p = .038). This indicates that a lower body mass index and higher state anxiety scores result in greater symptom endorsement, but the experimentally manipulated variable still predicts symptom endorsement over and above these influential factors.

Table 3. Summary of regression analysis, including semi-partials and squared semi-partials for variables predicting symptom reporting.

Variable	*B*	*SE B*	*β*	*Sr*	*sr²*
Anxiety	.135*	.065	.234	.138	.0234
BMI	-.218*	.106	-.146	-.136	.018
Neuroticism	-.063	.069	-.099	-.066	<.001
Conscientiousness	-.059	.059	-.078	-.061	<.001
Condition	4.98*	2.39	1.04	.137	.019

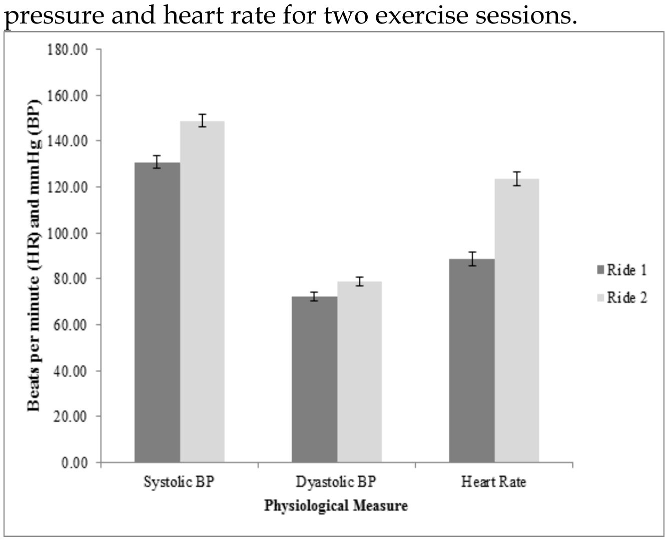
Note: Listwise *n* = 194. Predicted variable = performance on exercise task. *sr* = semi-partial correlation. *sr*² = squared semi-partial correlation. **p* < .05.

Interestingly, the effect of condition on the endorsement of the heart rate symptom item on the PSQ was not significant (R^2= .000, $F_{1, 192}$ = .026, p = .873). However, somatosensory amplification did have a significant impact on the endorsement of the heart rate item (R^2= .045, $F_{1, 192}$= 9.80, b = .209, t = 2.93, p = .004), with higher somatosensory amplification resulting in the tendency to endorse the heart rate symptom even after controlling for condition. Somatosensory amplification (SSAS) was also significantly and positively correlated with the endorsement of three other PSQ symptoms that directly related to physical symptoms experienced during the exercise session, difficulty breathing (r = .21, N = 194, p = .004), heartburn (r = .20, N = 194, p = .005), and leg cramps (r = .23, N = 194, p = .001). In addition, results showed somatosensory scores to predict the sum of all symptoms (PSQsum); R^2= .078, $F_{1, 192}$= 16.3, p < .001. These findings suggest that the validity of the SSAS may extend beyond the general trait of body awareness and also predict the state-level occurrence of symptom reporting.

Predicting physiological change

This experiment was designed based on the premise that the main effect for condition on performance and symptom reporting would emerge contingent upon the second ride inducing adequate physical exertion. The means for each physiological measure after both rides are reported in Figure 1. A simple t-test demonstrates that the means were significantly elevated in the second ride for all three measures; systolic BP ($t = -13.3$, $df = 181$, $p < .001$), diastolic BP ($t = -5.8$, $df = 181$, $p < .001$), and particularly for heart rate ($t = -27.8$, $df = 182$, $p < .001$).

Figure 1. Means for systolic and diastolic blood pressure and heart rate for two exercise sessions.



Note: Error bars around the mean indicate 95% confidence intervals.

Analyses indicated that condition had no effect on the physiological changes with and without controlling for performance. This indicates that although condition statistically predicts performance and symptom reporting above and beyond other measured factors, it did not predict actual physiological changes. The tendency to endorse physical symptoms (SSAS) also failed to predict any of the physiological measures, and the null findings persisted even after statistically controlling for BMI scores. Finally, the interaction of condition and SSAS also failed to predict the physiological measures.

DISCUSSION

Results indicated that a favorable presentation of somatic experiences in a physically demanding task produced better physical performance and fewer symptom endorsements relative to those given unfavorable information. This effect emerged after controlling for physical fitness, state anxiety, conscientiousness, and neuroticism, thereby demonstrating the relation between expectancy perceptions and the body's ability to perform. The present study did not, however, find an interaction between measures of general body awareness (the trait-like tendency to amplify physical symptoms) and experimentally manipulated (state) somatization. This suggests that although psychological factors do influence performance, that pathway may not be directly influenced by somatosensory amplification. This also suggests that the selective monitoring and resulting increase in perceived (though not actual) intensity of physical sensations may not influence performance, at least in this more time-limited context. Although these findings do question the power with which symptom amplification affects physical performance, they do not eliminate the possible relation between health outcomes and physical functioning (19,7). Indeed, our findings illustrating the effect of condition on symptom reporting indicate that those with an experimentally manipulated, favorable presentation of somatic experiences reported fewer physical symptoms during the exercise session. In examining this finding more closely, results showed that there was no effect for the item specifically referring to the symptom of accelerated heart rate when examining the results by condition. Thus, the manipulation did not result in a symptom-specific effect, but it did result in a more generalized effect spanning many symptoms.

As would be predicted based on the extant literature, an interesting effect emerged for general body awareness and the tendency to amplify self-reported physical symptoms during exercise. The trait of general body awareness (SSAS), measured prior to the manipulation, was a significant predictor of both general and specific (heart rate acceleration) symptom reporting. This finding is in agreement with theories of attentional strategies and the essential role of self-focused attention in studies involving symptom reporting (6,27).

Along these lines, a very interesting finding emerged regarding expectancy and its influence over performance. An analysis of the manipulation check revealed that performance expectations significantly predicted actual performance above and beyond other measured covariates and condition. Although the manipulation check can be conceived of as the effect of condition, it can also reflect more longstanding efficacy perceptions, especially when its effects are evaluated after controlling for condition. When the manipulation check is looked at in the latter light, it suggests that perhaps more firmly held self-concepts of ability or outcome expectancies are better predictors of performance than transient beliefs based on feedback (condition) in the present study. This interpretation can be understood within the context of the self-verification literature (25). Specifically, it has been shown that if the target is certain of his or her self-concept, then self-verification will prevail over other factors (23). This is demonstrated in the present study as perceived ability uniquely predicted performance over the experimenter’s attempt to sway the participant to engage in behavioral confirmation in either a favorable or unfavorable direction.

One criticism of earlier studies failing to demonstrate the effects of psychological variables on physical performance is that participants were not under adequate physiological stress (18). The present study was designed to overcome this issue by asking participants to exercise at maximum speed to induce physical stress and exertion. The physiological measures showed that HR and BP did increase significantly over the course of the exercise session, though these changes were unrelated to condition.

In the present study it was hypothesized that poorer performance resulting from an unfavorable presentation of somatic experiences might be due to an anxiety/stress response resulting from hyper-vigilance of negatively perceived physical symptoms that result in catastrophic thinking (9). It was further hypothesized that this catastrophic thinking would result in physiological arousal that inhibits performance. The results indicate that the unfavorable somatic presentation predicts performance, but does not appear to influence physiological responding. However, it is possible, and has been shown in other studies, that the physiological consequence may have emerged in tasks of a longer duration where there might be more variability in effort (7).

There are two well-defined theoretical models that may be applied to the present findings; the cognitive-perceptual model of somatic presentation and the cognitive-appraisal model. Cioffi explains how the cognitive-perceptual model allows different somatic presentations to occur from the same physical stimulus (7). Initially, physical state (physical exertion) induces selective perceptual attention whereby particular sensations (acceleration in heart rate) are somatically labeled (good/bad) and then attributed to a cause (the manipulated feedback of “good cardiac functioning” or “imminent exhaustion”). Pre-existing biases (somatic tendencies) may then regulate the interpretation toward confirmation of those hypotheses (ostensibly high outcome expectancy/low outcome expectancy). The interpretation of somatic information is further regulated by mediators such as goals, affect, and motivation, prior to the resulting behavior (good/bad performance).

More broadly speaking, the cognitive-appraisal model shows how different emotions or appraisals of physiologically or psychologically stressful events can arise from the same situational circumstance (20). Lazarus and Folkman first proposed this model in the context of a stressful event in which perception is more important/salient than the event itself (13). Furthermore, following the primary appraisal of its effects on well-being, a perceived threat initiates a secondary appraisal where perceived coping ability determined by self-efficacy and outcome expectancy act to influence expectations and behavior (5). Incorporating this view into the present findings, the stressful event (physical exertion) enacts a perceived threat (heart rate acceleration) that is interpreted as either within or outside of one's ability to cope, such that the threat is perceived as adaptive or maladaptive (sign of good or poor cardiac health). The resulting interpretation creates responses that are physiological (autonomic stress-response), cognitive (self-monitoring, selective somatic attention, hypervigilance, rumination), and affective, thus influencing behaviors (performance).

Limitations

There are several methodological concerns that merit attention. The current research relied exclusively on young, relatively fit, and predominantly female college students, limiting generalizability. For example, it is unclear whether somatizing patients or those scoring in the extreme range on somatization would respond similarly to the manipulation. Another limitation is that the physiological data were measured using an automated BP machine after the exercise session. The fact that these measures were taken after instead of during exercise reduced the likelihood that an effect would emerge, as additional factors influence physiological functioning once the recovery phase begins (12). It is also a concern of the present study that self-report of performance expectations may not represent longstanding efficacy beliefs as theorized, but rather encompass a situational belief in one's ability as a result of the setting or experimental conditions. Finally, a longer period of exercise or perhaps a task of greater exercise intensity may allow for greater variability in physiological responses.

Conclusions

Favorable presentations of somatic experiences were shown to improve physical performance and reduce symptom reporting, even after removing the influential effects of physical fitness, state anxiety, personality, and performance expectations. Favorable presentations did not, however, have a significant impact on indices of physiological change. Individual differences in somatization tendencies also influenced symptom reporting, but not performance. These findings suggest that both state (manipulated) and trait (stable) expectations with respect to somatic experiences contribute to symptom endorsements and the body's ability to perform, but not actual physiological functioning. These findings suggest that the interpretation of bodily sensations impacts objective (performance) and subjective (symptoms) outcomes. Additionally, results from this study may have an important influence on the way people view and approach methods of optimizing physical performance and motivation to engage in such activities, with a highlighted focus toward mental preparation in relation to the effect of positive expectations in an exercise setting. Indeed, given that any strenuous exercise will result in some degree of physiological reaction (such as increased heart rate), it appears that one method for maximizing performance would be to attach a favorable interpretation to that physiological reaction. This represents one of many psychological techniques for improving performance.

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