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Relationship between Emotion Regulation Strategies, Affect and Perceived Stress among Individuals with Coronary Heart Disease: A Moderated Mediation Model

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Abstract

BACKGROUND

Increases in the incidence of cardiovascular diseases (CVDs), particularly coronary heart disease (CHD), can be observed globally. Therefore, this research aimed to better understand the mental health of people with heart disease by elucidating the factors that may contribute to their feelings of perceived stress. In addition, the present study aimed to explore the complicated interaction between emotion regulation strategies, affect, and perceived stress in reference to Coronary Heart Disease (CHD).

PARTICIPANTS AND PROCEDURE

The participants of this study were 120 individuals with Coronary Heart Disease selected through a random cluster sampling approach from various hospitals in Nagpur, Maharashtra. Positive-Negative Affect Scale, Perceived Stress Scale, and Emotion Regulation Scale were used to collect data. In addition, the valid data was subjected to Moderated Mediation Analysis using the PROCESS macro.

RESULTS

The gender ($t = 4.34$, $p = 0.000$) significantly influenced the perceived stress among the patients with CHD, and birth order, socioeconomic position, residence, and family types were insignificant in influencing the perceived

stress. The association between negative affect and perceived stress was partly mediated by cognitive appraisal. Positive emotions moderated the mediated impact of cognitive reappraisal.

CONCLUSIONS

The perceived stress was affected by the negative affect, cognitive reappraisal, expressive suppression, and positive affect. Expressive suppression failed to mediate the relationship of negative affect with perceived stress. The mediational effect of cognitive reappraisal for the relationship of negative affect with perceived stress was moderated by positive affect.

Keywords*:* coronary heart disease, emotion regulation strategies, affect, perceived stress

Rises in the occurrence of cardiovascular diseases (CVDs) and, in particular, CHD, have been reported worldwide. The mortality rate due to CHD declined in industrialized countries and increased significantly in developing countries (Fuster et al., 2012). In 2012, CVD was alone because of 17.5 million deaths worldwide; 75% of deaths were reported in developing countries, and there will possibly be an escalation throughout the global number of deaths from the approximate 17.5 million in 2012 to 22.2 million in 2030, the high mortality due to CHD is attributed to comorbid conditions such as diabetes, hypertension, and lipid abnormalities cost by physical inactivity and obesity (World Health Organization, 2015, p. 14, 95). In 2021, the World Health Organization classifies a variety of cardiovascular diseases (CVDs) as major causes of death worldwide. These include heart attacks, strokes, aneurysms, occlusions, arrhythmias, pulmonary emboli, and rheumatic and congenital heart conditions. Estimates show that in 2019, cardiovascular diseases caused the deaths of 17.9 million individuals worldwide, or 31% of all deaths. The majority of the deaths (85%) were caused by cardiovascular causes. 75% of these deaths also took place in nations with low or moderate incomes. One of the most common reasons for death in these situations was hypertension (cardiovascular diseases (CVDs), 2021).

In India, the prevalence of CHD and mortality due to CVD have increased drastically in the last two decades; communicable diseases are declining in India, whereas the prevalence of non-communicable diseases is increasing. Location matters when it comes to coronary heart disease, and in India, cities have a greater rate of the disease than rural areas, 63% of deaths were reported due to non-communicable diseases, with CVDs accounting for 27% of those in 2016, meaning CVDs were responsible for 45% of deaths in the 40–69 age groups, People are at risk of cardiovascular disease if they are overweight or obese, have hypertension, high sugar levels, high serum lipids, or all three. Evidence from studies by Gupta et al. (2002), Kamili et al. (2007), and Mohan et al. (2021) suggests that lives could be saved by promptly addressing those with high levels of risk for cardiovascular diseases. In India, the death rate from cardiovascular disease is 349 per 100,000 males and 265 per 100,000 women, according to data from the World Health Organization. Women's mortality in the US stands at 108 per 100,000, while men's mortality in the US is 170 per 100,000. These rates are more than twice as high in India. Increased vulnerability to cardiovascular disease is associated with prolonged exposure to pressures that can't be alleviated (Rozanski et al., 1999). People who experience more chronic stress are less likely to practice risk-reducing behaviors like maintaining a healthy weight, getting regular exercise, avoiding meals high in saturated fat and trans fat, and quitting smoking and drinking (DeSteno et al., 2013).

The ability to control one's emotions is crucial for counteracting the harmful effects of stress on one's health. It involves monitoring, analyzing, and adjusting once own emotional experiences meet the demands of the situation (Rottenberg & Gross, 2007). It includes the conscious and subconscious actions taken to increase, maintain, or decrease the affective, behavioral, and cognitive aspects of an emotional reaction (Gross, 2002). The better emotion regulation skills reduced the psycho-physiological stress response. Effective emotion regulation skills facilitate healthy behavior. People can be trained to improve their emotion regulation skills.

Negative affect such as anger and anxiety are the risk factors for CVDs, whereas positive affect such as cheerfulness and joy reduce the risk of CVDs (Roest et al., 2010). Low positive effects resulting from unmanaged stress due to poor emotion regulation skills can lead to poor CVD outcomes lie death (Heo et al., 2009). If left unmanaged, feelings like worth, hatred, and jealousy can increase heart complications (Low et al., 1998). Positive and negative affect are the two independent states that differ at emotional and behavioral levels

and neuro clinical levels. Dopamine is linked with positive emotions whereas serotonin is linked with negative emotions (Ostir et al., 2001). The following hypotheses were formulated based on the aforementioned examination of the relevant literature.

H1: The association between negative affect and perceived stress among people with coronary heart disease would be mediated by the use of emotion regulation strategies.

H2: The relationship between negative affect and perceived stress would be mediated by emotion regulation strategies, while positive affect would moderate this effect.

Emotional regulation strategies may mediate the association between negative affect and perceived stress, and positive affect may moderate this effect, which provides a viable explanation for the observed correlation between perceived stress and negative affect. The purpose of this research was to better understand the mental health of people with coronary heart disease by elucidating the probable pathways behind negative affect and perceived stress. Figure 1 depicts the proposed moderated mediation model in the current study. The effects of negative affect can be mediate by the use of emotion regulation strategies like cognitive reappraisal and expressive suppression. The strategies used to deal with emotions are modified even further by a positive affect.

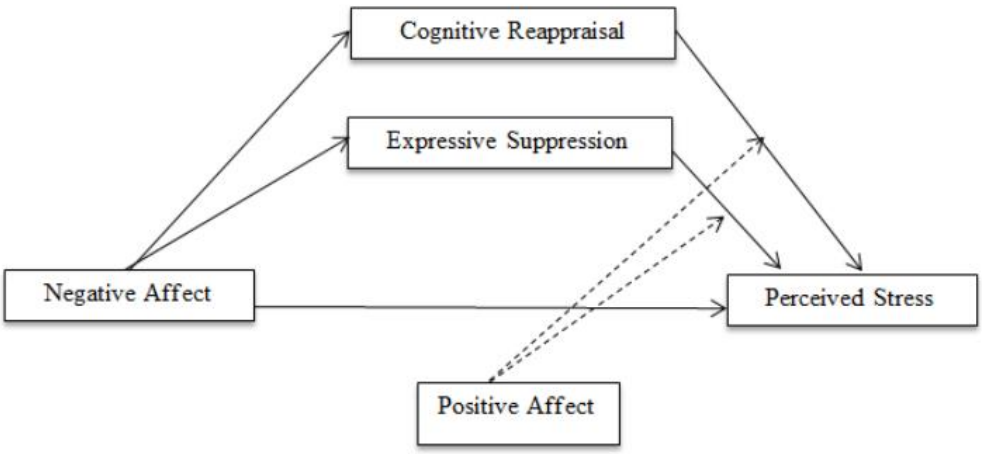

Fig. 1

In this study, the Moderated Mediation Model was used.

The effect of negative affect on perceived stress is mediated by Cognitive reappraisal and Expressive suppression. The positive affect further modify the emotion regulation strategies.

METHOD

PARTICIPANTS AND PROCEDURE

For this cross-sectional study, one hundred twenty (120) individuals with coronary heart disease were selected as participants through the cluster sampling method from the Nagpur city of Maharashtra, India. They were aged from 35 to 76 years (M=58.26, SD=9.83). After permission from the participants scales were distributed. They were also told of the study's broad objectives to avoid bias in their replies. After getting consent to participate in the study, the scales and questionnaire were distributed, and participants were given instructions on how to fill them out. The scales and questions took 40 minutes to complete.

MEASURES

1. The Positive and Negative Affect Scale (PANAS-GEN) by Watson, Clark, and Tellegen (1988). Ten items assessing both positive and negative emotions are included. Items are rated from "Very slightly or not at all" (1) to "extremely" (5).
2. Two sets of scores, one measuring positive and one measuring negative affect, are derived by adding th e scores given on each set of 10 items. A higher score indicates a higher affect The internal consistency reliability of the subscales varied from.86 to.90 for positive affect and.84 to.87 for negative affect. Positive affect has a test-retest reliability of.79, whereas negative affect has a reliability of.81.
3. The Cohen, Kamarck, and Mermelstein's Perceived Stress Scale (PSS) (1983). This is a ten item, five point Likert scale, with responses ranging from '1' (Never) to '5' (very often). Item numbers 4, 5, 7, and 8 are scored in reverse. The final score is calculated by adding the scores from all 10 elements. Across diverse populations, the scale demonstrates acceptable internal consistency and test-retest reliability (Lee, 2012).
4. Gross and John's Emotion Regulation Questionnaire (ERQ) (2003). The questionnaire contains ten questions designed to assess respondents' tendency to regulate their emotions using cognitive reappraisal and expressive suppression strategies. The higher the score, the more frequently emotion regulation strategies are used. Each question is rated on a 7-point scale, with 1 indicating 'strongly disagree' and 7 indicating' strongly agree.' 'Cognitive reappraisal' comprises six questions, whereas 'expressive suppression' has four. The internal consistency of this questionnaire is 0.83. (Zhang & Bian, 2020).

RESULTS

IBM SPPS version 23.0 was used for the preliminary analysis. A one-way ANOVA and independent t-test were used to investigate the influence of gender, birth order, socioeconomic status, inhabitants, and family types on perceived stress in people with CHD. The results in table 1 revealed that gender was the only significant factor that influenced the perceived stress (t = 4.34, p = *.000*).

Table 1
Demographical characteristics and the distribution of participants on perceived stress level

Variables	Groups	N (%)	Perceived Stress M (SD)	F/*t*	*p*
Gender	Male	80 (66.7%)	14.99 (6.99)	4.34	.000
	Female	40 (33.3%)	20.68 (6.28)		
Birth Order	First Born	40 (33.3%)	16.56 (5.70)	0.97	.901
	Middle Born	67 (55.8%)	16.96 (7.93)		
	Last Born	13 (10.8%)	17.54 (8.28)		
SES	Middle SES	102 (85.0%)	16.51 (7.21)	1.35	.180
	Low SES	18 (15.0%)	19.00 (7.35)		
Inhabitant	Urban	51 (42.5%)	17.24 (7.59)	0.46	.650
	Rural	69 (57.5%)	16.62 (7.03)		
Type of Family	Nuclear Family	31 (25.8%)	14.97 (6.95)	1.72	.088
	Joint Family	89 (74.2%)	17.55 (7.25)		

The findings also showed that negative affect and expressive suppression were positively correlated with perceived stress, whereas positive affect and cognitive reappraisal were inversely correlated with perceived stress.

Table 2: Correlation between perceived stress, negative affect, positive affect, cognitive reappraisal, and expressive suppression (N=120).

Variables	1	2	3	4	5
Perceived stress	1				
Negative affect	.485**	1			
Cognitive reappraisal	-.526**	-.213*	1		
Expressive suppression	.310**	-.054	-.065	1	
Positive affect	-.351**	-.438**	.173	-.239**	1
Mean	16.88	17.33	30.31	19.90	27.41
SD	7.25	5.74	8.47	6.63	6.57

Note: **p ≤ .01, *p ≤ .05

The PROCESS Macro for SPSS was used to investigate the nature of the moderated indirect effect after testing the criteria for moderated mediation. Perceived stress as a dependent variable, negative affect as the independent variable, cognitive reappraisal and expressive suppression as mediators, and positive affect as a moderator. We determined the mediating effect using a bootstrap sample of 5000 with a 95% confidence interval. We tested whether the slope of the regression equations for high and low interaction values differed from zero by using the Aiken et al. (1991) procedure, which involves comparing the conditional indirect effect at 1 SD above the mean, at the mean, and at 1 SD below the mean for the moderator, i.e. positive affect.

MEDIATION ANALYSIS

The first step was a mediation analysis, which was used to look at the relationship between negative affect and perceived stress, and how cognitive reappraisal and expressive suppression may contribute. Hierarchical regression analysis was then used to examine the moderated mediation effect. To avoid multi-collinearity, each component of emotional regulation and positive affect was created by centering the mean, and a composite variable was created for each interaction. According to the findings, negative affect have a negative correlation with cognitive reappraisal but no significant correlation with expressive suppression. Cognitive reappraisal had a negative influence on perceived stress which was not significant, and expressive suppression had a positive influence on perceived stress which was significant at a 0.01 confidence level. There was no statistically significant relationship between negative affect and perceived stress in either model (all p values > 0.01 [see table 3]). These results showed that the relationship between negative affect and perceived stress was mediated by cognitive reappraisal and expressive suppression. Table 4 also shows the bootstrapped 95 percent confidence interval (CI), which confirmed the significance of the indirect effects of cognitive reappraisal and expressive suppression in the relationship between negative affect and perceived stress.

Table 3
Mediation analysis (N = 120).

Variables	B	SE	t	P
Negative affect→ Cognitive reappraisal	-.201	.112	-1.797	.075
Negative affect →Expressive suppression	-.118	.109	-1.083	.281
Cognitive reappraisal →perceived stress	-.356	0.067	-5.322	.000
Expressive suppression → perceived stress	.264	.067	3.941	.000
Negative affect → perceived stress	.486	.082	5.903	.000

Table 4
Bootstrap results for indirect effect (N = 120).

	Bootstrap results for an indirect effect			
Variables	**Effect**	**SE**	**LL 95% CI**	**UL 95% CI**
Cognitive Reappraisal	.089	.039	.013	.168
Expressive Suppression	-.017	.034	-.091	.039

MODERATED MEDIATION ANALYSES

Table 5 shows the findings of a moderated mediation analysis in which positive affect served as a moderator and cognitive reappraisal served as the mediator in the relationship between negative affect and perceived stress. The influence of negative affect on perceived stress as mediated by cognitive reappraisal was found to be statistically significant using the moderated mediation analysis. Cognitive reappraisal and emotional regulation were identified as important mediators Table 6 shows the findings of a moderated mediation analysis in which the relationship between negative affect and perceived stress was mediated by expressive suppression and moderated by positive affect. According to the method used by Aiken et al., (1991) the interaction between cognitive reappraisal and positive affect was evaluated. The findings of the simple slop analysis showed that perceived stress in people with CHD was significantly positively predicted by cognitive reappraisal. However, it loses predictive power as people's positive affectivity declines.

Table 5
Moderated mediation analysis when treating cognitive reappraisal as a mediator (N = 120).

	Outcome variable: perceived stress			
Variables	**B**	**SE**	**T**	**P**
Negative affect (NA)	.464	.086	5.372	.000
Cognitive reappraisal (CS)	-.360	.071	-5.084	.000
NA X PA	.228	.085	2.668	.009
CR X PA	.217	.061	3.571	.001
R^2	.499			.000

Table 6
Moderated mediation analysis when treating expressive suppression as a mediator (N = 120).

	Outcome variable: perceived stress			
Variables	**B**	**SE**	**T**	**P**
Negative affect (NA)	.538	.094	5.721	.000
Expressive suppression (ES)	.302	.079	3.841	.000
NA X PA	.092	.088	1.050	.296
ES X PA	-.127	.071	-1.794	.075
R^2	.374			.000

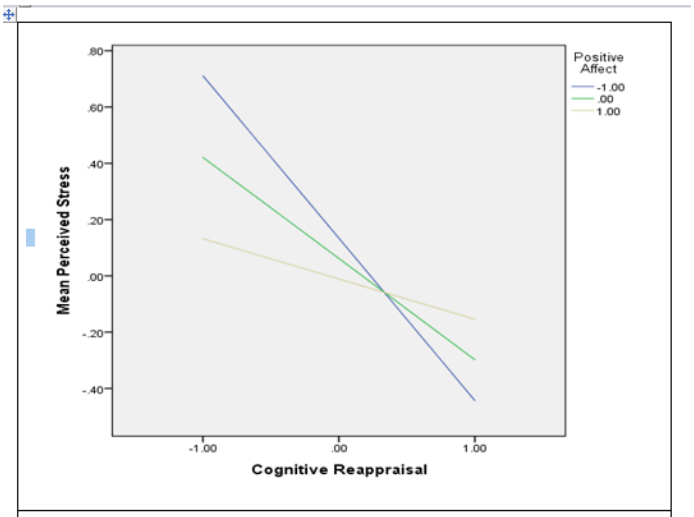

Fig 2
Moderating effect
Positive affect moderates the relationship between cognitive reappraisal and perceived stress among Coronary Heart Disease Patients.

We directly stated the combined interaction effects between the variables in the regression model, although the mediation findings were already mentioned in the preceding paragraph. The findings revealed that variables, cognitive reappraisal and positive affect (CR X PA), had a significant interaction with perceived stress (p=0.001). Positive affect therefore served as a moderator for the effect of cognitive reappraisal on perceived stress, however the interaction between positive affect and expressive suppression was not statistically significant (p=.075).

The simple effects analysis explored the impact of cognitive reappraisal on perceived stress at 1SD above and below the mean of positive affect. The positive affect was not significant at the above and below level (mean +SD) Thus, cognitive reappraisal was associated with perceived stress (β =.167 p <0.000). Although cognitive reappraisal was strongly related to perceived stress (mean-1SD) of the positive affect, the positive affect generated a steeper line when compared. When cognitive reappraisal scores rise, the degree of perceived stress is decreased.

The bootstrap technique was used to investigate the conditional indirect effect of negative affect on perceived stress via cognitive reappraisal as a function of several positive affect fits of rage. The bootstrap

method's 95 percent confidence intervals were employed to examine indirect effects at three levels of positive effects: 1 SD above the mean, at the mean, and 1 SD below the mean. According to Table 7, negative affect via cognitive reappraisal was the cause of the conditional indirect impact on perceived stress. Accordance the range of the positive affect and lowest at 1 SD below the mean of the positive affect, the impact has fluctuated. Present data demonstrate that the more negative affect a CHD patient has, the more vulnerable they are to the rise in perceived stress. Therefore, CHD patients with a greater degree of positive affect who utilize the cognitive reappraisal approach may obtain stronger protective benefits than those with lower levels of positive affect.

Table 7
The conditional indirect effect of the moderator at specific levels when treating cognitive reappraisal as a mediator (N = 120).

Moderator: level of PA	Indirect effect	SE	LL 95% CI	UL 95% CI
1 Std. Deviation above the mean	.078	.075	-.068	.229
Mean	.072	.043	.000	.167
1 Std. Deviation below the mean	.038	.045	-.031	.143

VISUALIZATION

The moderation of the effect of cognitive reappraisal on perceived stress by positive affect can be seen below -

Figure 3 depicts the final moderated mediation model.

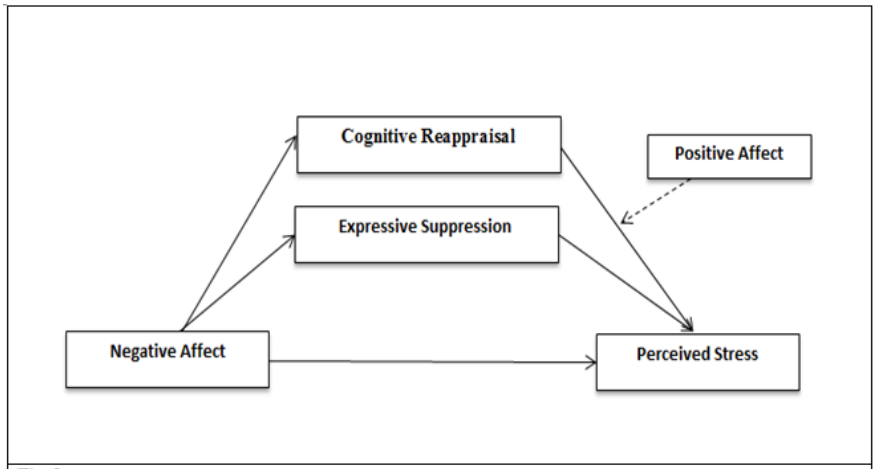

Fig 3
The completed model of moderated mediation.
The association of negative affect and cognitive reappraisal with perceived stress by positive affect.

DISCUSSION

According to the study, women with CHD reported higher levels of perceived stress than their male counterparts. This might be as a result of women being more likely than men to experience negative affect like worry and despair (Steel et al., 2014). According to Kelly et al. (2008), women exhibit increased emotional reactivity to stressful situations and engage in potentially unhealthy behavioural and physiological emotional regulation (Nolen-Hoeksema, 2012; Stevens & Hamann, 2012). Additionally, they are less likely than males to control their negative affet by using cognitive reappraisal strategies. Additionally, the higher perceived stress

associated with CHD symptoms may be caused by biological variations in how they present. Women experience more 'atypical symptoms' such as tiredness, nausea, vomiting, or no symptoms, making it difficult to detect the onset of acute symptoms, further increasing the risk of fatal outcomes. In addition, their small blood vessels are more likely to experience angina during their regular daily activity, and their pain doesn't improve with the rest. This further increases their fear of adverse consequences in them. The onset of CHD in women occurs eight to ten years later than in men, mainly in old age, when they don't have emotional and social support from life partners to cope with stress.

The first hypothesis stated that 'the association between negative affect and perceived stress among people with coronary heart disease would be mediated by the use of emotion regulation strategies' was partially accepted. Based on the results, it was determined that cognitive reappraisal mediated the indirect effect of negative affect on perceived stress. The study revealed that cognitive reappraisal reduces the adverse impact of negative affect on perceived stress by changing the underlying appraisal leading to negative emotions (Gross, 1998). Changes in these three areas (physiological, behavioral, and experiential) of emotional reaction are facilitated (Ray et al., 2010). John and Gross (2004) and Gross and John (2003) also reported on the protective role of cognitive reappraisal; they discovered that positive reappraisal can decrease stress by selectively interpreting the event's meaning, producing negative emotion. Cognitive reappraisal also reduces the perceived stress by helping in the early identification of negative cognitions and by avoiding being trapped in negative emotions. With cognitive reappraisal, people learn to perceive stress as a positive challenge rather than a harmful state/threat.

Since cognitive reappraisal induces positive affect and is correlated to less physiological response (Aldao et al., 2010; Garnefski & Kraaij, 2006; Keng et al., 2013; Kraaij et al., 2002), it mediates the effect of negative affect (Mauss et al., 2007; Wolgast et al., 2011).

Numerous studies—including a cross-sectional one by Garnefski and Kraaij (2006), a longitudinal one by Kraaij et al. (2002), a controlled laboratory experiment by Keng et al. (2013), and a meta-analysis by Aldao and colleagues (2010)—have established a link between cognitive reappraisal and improved mood.

Conflict between the original negative appraisal and the new, less emotionally evocative reappraisal can make reappraisal less effective in emotionally intense situations (Ortner et al., 2016; Sheppes & Meiran, 2007). This suggests that cognitive reappraisal is most useful as a mediator if it is employed before the full emotional response has been created.

The second hypothesis, 'the relationship between negative affect and perceived stress would be mediated by emotion regulation strategies, while positive affect would moderate this effect', was accepted partially. Emotional regulation strategies would mediate the relationship between negative affect and perceived stress, with positive affect moderating the strength of the relationship. Positive emotions allow more cognitive resources to process information, control behavioral responses, and evaluate stimuli (Isen, 2008; Tice et al., 2007).

Reappraisal is made easier by the presence of positive at, whichffec broaden one's perspective (Fredrickson, 2004), boost one's cognitive flexibility (Malooly et al., 2013), and encourage one to adopt more imaginative and holistic ways of thinking (Chermahini & Hommel, 2012). In addition, positive emotions help restore cognitive resources (Franconeri et al., 2013), enhancing comprehension and task performance (Fredrickson, 1998).

Individuals in positive moods are more motivated to take action that can prolong their positive mood (Hirt et al., 2008). Hayes et al. (2010) and Brans et al. (2010) found similar things (2013). They claim that changing one's perspective through thought experiments might lessen the impact of negative emotions while simultaneously heightening the body's response to stimuli. As was noted before, cognitive reappraisal is linked to upbeat emotions and increases the ability to recognize alternative, more positive ways of looking at a

problem. In their research, Gross and Thompson (2007) discovered that cognitive reappraisal necessitates bare minimum mental exertion. Modulating the mind in the earliest stages of negative emotion can have a positive effect (Gross, 1998). Cognitive reappraisal (Abler et al., 2010; Larsen et al., 2012; McRae et al., 2012; Shiota & Levenson, 2012) is connected with positive emotion experience and expression, and can contribute to a reduction in perceived stress. The ability to deal with stressful conditions is aided by optimism, which in turn increases coping abilities, self-acceptance, and interpersonal connections (John & Gross, 2004). Stress can be alleviated through cognitive reappraisal because it dampens the physiological response to negative emotions (Mauss et al., 2007; Wolgast et al., 2011).

LIMITATIONS

The study was limited by its cross-sectional design, reliance on self-reported measures, and selection of participants from a relatively restricted area. Cross-sectional studies can have problems with validity and generalizability due to issues like response bias and sample flaws. More insight into the mediating and moderating effects of emotional regulation strategies and positive affect on the association between negative affect and perceived stress in patients with CHD can be gained through the use of a mixed-method design or longitudinal research.

CONCLUSION

The perceived stress was affected by the negative affect, cognitive reappraisal, expressive suppression, and positive affect. Expressive suppression failed to mediate the relationship of negative affect with perceived stress. The meditational effect of cognitive reappraisal for the relationship of negative affect with perceived stress was moderated by positive affect.

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