Human Emotions on the Onset of Cardiovascular and Small Vessel Related Diseases

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Abstract. *Background/Aim:* The aim of the present study was to examine the relation between understanding of emotions and cardiovascular related diseases, namely coronary heart disease, diabetes mellitus and obesity. The uniqueness of this study lies in the fact that it examined the relationship between the cardiovascular related diseases named above and the understanding of emotions in the context of Emotional Intelligence (EI). *Patients and Methods:* The study was conducted in 300 participants during a 3 year period. All participants completed a self-report questionnaire, assessing various aspects of EI, such as self-emotion appraisal, other emotion appraisal, emotion regulation and use of emotions. As hypothesized, coronary heart disease is a prognostic factor of regulation of emotions. *Results:* The present study is an attempt to examine the relation between emotional understanding and cardiovascular related diseases, namely coronary heart disease, diabetes mellitus and obesity. Establishing which diseases are independent risk factors for the understanding of emotions, could have a significant impact on emotional health, through the treatment of these cardiovascular related diseases. Emotions

were studied within the theoretical context of Emotional Intelligence (EI), which affects people's physical and mental health. *Conclusion:* The results of this study emphasize on the relationship of cardiovascular related diseases and psychological characteristics, such as anxiety and anger, being aspects of EI. Additionally, this work fills a gap in the relevant Greek literature, as a first attempt to examine the correlation of EI with cardiovascular related diseases.

Emotions and coronary heart disease. Coronary heart disease is a significant public health issue, due to its high prevalence and mortality rate (1). A number of clinical and experimental studies indicate that strong emotions, especially negative emotions, such as hostility, anger, depression and anxiety, precipitate coronary heart disease (2, 3). On the one hand, coronary heart disease patients have difficulty in coping with stress and depression and experience negative emotions, like anger or frustration. On the other hand, positive emotions, especially hope, contribute to health benefits and lead to lower levels of coronary heart disease and other diseases (4-7).

Stress is one of the most predisposing factors of people with coronary heart disease. Between 20% and 40% of all middle-aged women and men report stress-related symptoms in population studies (8). The relation between anxiety and coronary heart disease has been the subject of several studies, most of which indicate that stressful events are associated with coronary heart disease. Sudden and profound emotional stress, namely, death of relatives, domestic abuse, severe arguments, medical diagnoses, devastating financial loss, can trigger acute heart failure in individuals who are free from cardiac disease (9). Social relationships, size and

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diversity of networks, and positive support from others have also received empirical attention as psychosocial factors linked to coronary heart disease. Studies show that greater conflict in close relationships predicted myocardial infarction for both genders (10). With respect to the stressful aspects of relationships, the Stockholm Female Coronary Risk Study reported that marital stress nearly tripled the risk for recurrent events (11), and a follow-up analysis concluded that it was the combination of work and marital stress that was the strongest predictor of recurrent disease (11). Two analyses conducted with the Whitehall II cohort study found that both job strain and effort-reward imbalance were positively associated with the occurrence of coronary heart disease for men and women (12, 13). An analysis of the Framingham Offspring study reported that more demanding and stressful jobs increased risk of coronary heart disease incidents mainly in women (14).

Apart from anxiety disorders, numerous studies confirm the prominence of depressive symptoms and major depression in patients with coronary heart disease (15-18). A strong suggestion of a dose-response relationship between depression and coronary heart disease was identified. Depression meeting diagnostic criteria was associated with a higher risk of coronary heart disease compared to depressive symptoms (19, 20). For both genders, the somatic symptoms of depression, such as fatigue, may be more closely related to clinical coronary heart disease events. These somatic symptoms may be a marker of early coronary heart disease, poor general health, and/or sickness behaviour related to systemic inflammatory processes (21).

The personality of an individual has profound effects on the peripheral physiology, due to modulatory influence of brain structures on peripheral organs and tissues through the autonomic, the endocrine and the immune system. These modulatory influences are relevant for the understanding of coronary heart disease (22, 23). Personality is associated with factors that cause disease and may lead to behaviours that protect or diminish health, or may relate to the successful implementation of health-related coping efforts and adherence to treatment regimens (24, 25). Heart activity is directly and indirectly modulated by personality or behavioural factors (26, 27). Type A behaviour, Type D behaviour, anger (28) and hostility or inadequate coping style have all been shown to influence risk of coronary heart disease (29-31). Hostility is an enduring personality trait that includes emotional (32) as well as attitudinal (cynicism and mistrust of others) and behavioural (overt and repressed aggression) components and numerous cross-sectional and prospective studies have highlighted hostility as a robust independent risk factor for coronary heart disease and all-cause mortality in humans (33-35). Relative to negative psychological factors, positive factors have received relatively little study in relation to coronary heart disease.

Optimism, a dispositional tendency to expect positive outcomes, was associated with reduced risk for myocardial infarction and coronary heart disease mortality in the Women's Health Initiative study (36).

Emotions and diabetes mellitus. According to the World Health Organization, approximately 220 million people worldwide have type-2 diabetes mellitus (World Health Organization, 2009). It has been definitely established that emotions play a role in the fluctuation of sugar level in cases of diabetes (37, 38). There is also considerable growing evidence that such factors may be important in the precipitation of the condition. Patients with type 2 diabetes mellitus have a higher risk level for depression and suffer from high levels of emotional stress compared to healthy controls (39-41). Anxiety and fear are the most frequent emotional disorders among diabetic patients, which have been confirmed by the results of many studies (42-44). Numerous studies have confirmed that the course of depression in patients with diabetes is more severe, and the relapses of depression episodes are more frequent, especially in patients with unbalanced diabetes. Data from the National Health and Nutrition Examination Survey indicate that attaining good diabetes control is possible in only approximately 40% of patients (45). The prevalence of depression among patients with diabetes is 1.5 to 3 times higher than in the general population.

The studies show that diabetic patients experience various types of psychosocial and emotional problems due to which the monitoring of own state of health is not the priority in life (46, 47). In patients with diabetes, depression has been related to an increased risk of diabetic vascular complications (47), poor glycaemic control (48), and non-adherence to treatment and self-management behaviours (49-51). According to the assessments by researchers, 1 in 8 diabetic patients suffers from fully symptomatic depression (47, 52), whereas as many as 1 in 5 of the remaining patients show symptoms of depression (47). Patients with diabetes complications report primarily the deterioration of the quality of life caused by emotional disorders (32, 53-55). In about half of diabetic patients hospitalized due to cardiovascular diseases, concomitant depressive and anxiety symptoms were also noted (32, 56, 57). The patients with diabetes are associated with difficulty in expressing positive emotions and a strong belief for non-expression of emotions. Studies dealing with the role of emotional expression in diabetes have observed that expressed emotion is a significant predictor of glucose control in diabetes (58).

On the other hand, recent studies indicate that the implementation of an emotional intelligence program to diabetic patients, has positive results including glycaemic control, quality of life and wellbeing of the individuals. The investigators' purpose was to improve EI skills of the

patients with a twelve-week emotion intelligence workshop, as it has been already established that high EI is positively correlated with well-being, quality of life and improvements of their anxiety and burnout levels. In other words, patients with high EI seem to be less vulnerable to psychological disorders, as compared with patients with low EI levels (59). It has been shown that people with high levels of EI can manage their emotions more effectively, can be more successful at solving emotional problems and managing stress, and can as a result be more productive and positive in their family and social relations (60). They have also been reported to use more effective coping strategies in the solution of problems and to be more successful in terms of emotional awareness and control. Furthermore, it is supported that health care providers can be better educated on EI and understanding of emotions, so that they can use them into everyday diabetes care. Various techniques (supportive or counselling therapy, cognitive behaviour therapy) and skills (coping skills, problem-solving skills training, stress management) can be used (61-63) in order to improve EI of diabetes patients and their health care providers. Researchers have suggested that more optimistic patients, who exhibit stronger beliefs in self-sufficiency and have a generally more positive disposition, have higher levels of health-related quality of life and feel less so-called toxic emotions, including anger, guilt, pessimism and denial (64).

Emotions and eye related (small vessel disease) conditions that may lead to stress and depression. The relation between emotions and eye is bidirectional namely there is evidence that emotional state can influence our vision and the quality of our vision influence our emotional status. Behavioural studies demonstrate that there is a relation between what we are thinking and how we see the world. In particular impaired vision and depression are strongly associated. Depression, increases the odds of functional impairment independent of vision impairment and treating depression may reduce excess disability associated with impaired vision (65). Also, in a community-based study of people 70 to 75 years of age from Italy revealed that visual impairment was significantly and independently associated with an increased risk for depression, and visual dysfunction was independently associated with fewer social relationships. In this study, subjects with impaired vision were 2.11 times more likely to have depression than those with non-impaired vision after adjusting for the other covariates (66).

In another study Visual function was associated with depressive symptomatology but not the degree of impairment of visual acuity (67). Severe visual impairment beyond the level required to be registered blind may not add further the sense of loss, so the gradual visual loss allows the adaptation. Depressive symptoms may be more common at the onset of the loss. Self-reported visual function loss, rather than loss of

visual acuity, is significantly associated with depression. Health professionals should be aware of the risk of depression among persons reporting visual function loss (68).

Pupillometry is another area where changes in pupil diameter can index cognitive functioning. Coarsely put, the pupil dilates when participants are in conditions of increased attention or cognitive load or of emotional or cognitive arousal (69).

In Central serous chorioretinopathy, angiographically there is delayed arterial filling followed by capillary and venous hyperemia in one or more choroidal lobules, which might be the reason of associated choroidal hyperpermeability. In a retrospective study of 230 patients the authors state that their findings reinforce the concept that stress and adaptation to stress play a role in this disorder (70, 71). In another study a consecutive series of newly-diagnosed patients with central serous chorioretinopathy (CSC) was compared to two independent control groups chosen from the same patient population (72). The patients selected as matched controls had painless, reduced central vision and other chorioretinal diseases (Group I), or non-chorioretinal ocular conditions (Group II) for the presence of a Type A behavioural pattern based on the Jenkins Activity Survey. The Type A behaviour was significantly more frequent in study patients than in either Control Group.

Emotions and obesity. Obesity rates and associated comorbidity are increasing globally (73) and are attributed to detrimental lifestyle practices (74-76). Sociodemographic factors appear to interplay with lifestyle to drive obesity. Obesity rates tend to be higher among the socioeconomically deprived and the less educated (75, 77, 78). There is growing interest in the psychology of health (79), lifestyle (80) and obesity (81). That obesity is common among those diagnosed with clinical psychosis (82, 83) has sparked the notion that obesity may be linked to psychological health and well-being. Previous studies of obesity and psychological well-being among healthy adults have almost exclusively considered depression and to a lesser extent stress. Research which has considered waist circumference and depression and/or stress has indicated a link between greater waist circumference and depression (84-87). Obesity and depression represent critical public health challenges of particular significance in children and youth. Obesity is associated with poor health outcomes that include insulin resistance, cardiovascular disease and early mortality (88-90).

According to the emotion regulation strategy (91-93), the individuals' emotional state *per se* also affect their eating behaviour, in other words, people eat in order to decrease an unpleasant feeling. For example, some people eat in order to relieve sadness. Since obese people often suffer from depressive symptoms and low self-esteem (4, 94), their increased food intake could be also explained as a false

coping strategy used to reduce their negative feelings (95). In obese people, negative feelings, such as anger (96), boredom (97), anxiety (98), stress (99), depression and loneliness indeed tend to increase food intake and lead to the overconsumption of food. Unhealthy eating habits are one of the contributing factors to the aetiology of obesity (100). It is stated that eating behaviour is a significant predictor of one's nutritional status through its influence on body weight. Body mass index is one of the common indicators used to determine one's nutritional status in research studies. Researchers support that healthy nutritional status reflects physical, intellectual and emotional health (101). A recent study highlights the two most common phenomena in the current obesity epidemic, which are stress-related emotional eating, as well as overeating as a form of addiction (102). This study found that high caloric and highly palatable foods have the strongest influence on negative mood states and addictive behaviours. Other studies showed that obese individuals have greater urge to eat in response to negative emotions than normal weight ones (103). Increased stress has been associated with high-fat food consumption, decreased fruit and vegetable intake and decreased breakfast consumption (4). It can be supported that low levels of control of emotions may be related to high levels of emotional eating that can lead to obesity (104).

Emotional intelligence. EI is a relatively new subject of study, though its roots go back to the time of Darwin, who pointed out that emotional expression was essential for survival and that emotions serve a biological purpose (105). Until the last century, the understanding of intelligence was strictly related to cognitive functions, such as learning and memory. However, by the 1900s, scientists had begun to understand that non-cognitive aspects of intelligence also exist. Thorndike (1920) described a type of social intelligence that was related to a person's ability to understand and manage other people and to engage in adaptive social interactions. In 1940, David Wechsler also advocated non-intellective factors, when measuring total intelligence. In 1983, Howard Gardner published a work entitled "Frames of Mind: The Theory of Multiple Intelligences". He argued that people have more than one type of intelligences, which are, as important, as traditional intelligence in predicting performance and success in life. He divided intelligence into seven separate domains: visual-spatial; verbal-linguistic; logical-mathematical; bodily-kinaesthetic; musical-rhythmic; interpersonal and intrapersonal. Gardner's 'interpersonal' and 'intrapersonal' intelligences became the subject of further studies (106), which have sought to identify intellectual ability that incorporated social, personal, and emotional skills.

The term EI was first used in the doctoral thesis of Wayne Payne (1986), entitled: "A Study of Emotion: Developing

Emotional Intelligence", where he defined EI as the ability to express emotions openly. In 1995, Daniel Goleman published his book "Emotional Intelligence: Why It Can Matter More than IQ". It was after this publication that the term became widely used. Salovey and Mayer (1990) defined EI as the ability to perceive emotion, integrate emotion to facilitate thought, understand emotions and regulate emotions to promote personal growth. There are two different constructs of EI, trait EI and ability EI. Trait EI concerns emotion-related self-perceptions measured by self-report questionnaires and ability EI concerns emotion-related cognitive abilities that ought to be measured by maximum performance questionnaires (107). Hein (2005), while introducing his definition of Emotional Intelligence, explains EI as an innate ability, which can be either developed or damaged by experiences of life.

Over a number of years, various studies showed that health and general well-being are improved dramatically through the adaptation and adoption of good EI practices. In 1988, Eysenck found that smoking was less of a factor in predicting death from cancer and cardiovascular disease than emotional stress. People unable to handle stress experienced 40% higher death rates than those more capable of managing stress (108). Another study indicated that a 22% lower risk of heart disease was related to higher levels of positive emotions. The researchers concluded that, while further study was required, increased positive feelings and reduced depression might be indicated as a preventative factor for heart disease (109). Scientists also found that, diabetics who used emotional management techniques were able to reduce their HbA1 levels. In another study was concluded that 95% of male University students who did not characterise their parents positively (loving, open) and indicated that they were not caring, experienced diseases in midlife (110). The good news is that through the adoption and practice of EI competencies, through good emotional self-management techniques has shown to produce positive results in helping improve the health of people.

Focused on several components of trait EI, such as emotion appraisal, use and regulation of emotions, the study aims to examine, whether the scores on psychometric tools for measuring trait EI are associated with the occurrence of specific cardiovascular related diseases in Greek urban population. Emotional intelligence can be affected by many factors. The exploration of these factors and determination of the predictive values of these variables may be helpful in conducting EI research in the area of hospitalized patients. This study will be significant in the understanding of the factors that influence EI.

Following the evidence presented above, attesting to a link between EI and disease, the hypothesis made in the present study was that individuals who suffer from coronary heart disease, diabetes mellitus or obesity, would have low rates

of EI and present difficulty in dealing with their emotions. In other words, it is expected that the perceived ability to use, regulate and express emotions would be associated with decreased incidence of coronary heart disease, diabetes mellitus and obesity. Hospitals may offer some courses and arrange guidance and counselling services to enable the patients to improve their EI skills, in order to be more healthful, to lead a more stress-free life, to realise better relationships. With the potential to realise such health benefits, treating emotional distress in patients can prevent or delay the onset of sickness, or helps patients heal more quickly, by improving their EI. Although it is a limited study, it will provide a basis for further research in this field.

Patients and Methods

Sample. The data is gathered from selected hospitals in Athens, Greece. Three hundred hospitalized patients were recruited for participation in this study by convenience method. Written informed consents were obtained from all studied subjects. The characteristics of the subjects measured, included age, gender, body mass index and prevalence of coronary heart disease and diabetes mellitus. The clinical data were collected from medical files. The study examined the relationship between emotional intelligence and cardiovascular related diseases among hospitalized patients.

Four (predictor) variables and four dependent (criterion) variables were examined. The independent variables were the cardiovascular related diseases and gender. The dependent variables were the four subscales of the questionnaire assessing EI. Four models were conducted. The research question that guided the study was: "Do cardiovascular related diseases affect the prediction of emotional intelligence among hospitalized patients?" The scientific board of the General Hospital of Greece "KAT" signed the ethics approval for this study on the 19/01/2009, Protocol number: 17.

Definition of cardiovascular related diseases. Coronary heart disease: Coronary heart disease patients were characterized as those who had a documented history of myocardial infarction, accompanied by angiographic evidence of coronary artery disease and/or positive treadmill ECG test (111). Diabetes mellitus (type 2) patients were characterized as those who had recurrent or persistent hyperglycaemia and were diagnosed by fasting plasma glucose level ≥ 7.0 mmol/l (126 mg/dl) or plasma glucose ≥ 11.1 mmol/l (200 mg/dl) two hours after a 75 g oral glucose load or glycated haemoglobin (HbA1c) $\geq 6.5\%$ (Expert Committee on the Diagnosis and Classification of Diabetes Mellitus, 1997).

Obesity. Obesity was defined by Body Mass Index (BMI). BMI is calculated by dividing the subject's mass by the square of his or her height (kilograms/meter²). The WHO definition of obesity is a BMI greater than or equal to 30 (World Health Organization, 1998).

Measures. The Greek version of the self-report Wong & Law EI Scale (WLEIS) was used in order to assess EI (112). The scale consists of 16 items and four dimensions that are consistent with Mayer and Salovey's (1990) definition of EI. The self-emotion appraisal dimension (4 items) assesses an individual's self-perceived ability to understand their emotions (*e.g.*, "I have a good

understanding of my own emotions"). The others' emotion appraisal dimension (4 items) assesses a person's tendency to be able to perceive other peoples' emotions (*e.g.*, "I am sensitive to the feelings and emotions of others"). The use of emotion dimension (4 items) concerns the self-perceived tendency to motivate oneself to enhance performance (*e.g.* "I always set goals for myself and then try my best to achieve them"). The regulation of emotion dimension (4 items) concerns individuals' perceived ability to regulate and control their own emotions (*e.g.*, "I am able to control my temper and handle difficulties rationally"). The scale is categorized with a 7-likert scale (1=strongly disagree, 2=disagree, 3=moderately disagree, 4=neither agree nor disagree, 5=moderately agree, 6=agree, 7=strongly agree). Validity of the Greek version of the WLEIS questionnaire was established by Kafetsios and Zampetakis (2008) (112). The findings suggested that the WLEIS items for EI measurement can serve effectively as a reasonable estimate of their dimensions, and that the dimensions in turn can represent an underlying multidimensional EI construct. Cronbach Alpha reliability coefficients of the Greek version of the WLEIS factors were found to be 0.70, 0.71, 0.78, and 0.78.

Data analysis methods. Various analyses were done to the gathered data at the end of the study. Normality of distribution was assessed using the Kolmogorov-Smirnov test. Comparison between two groups was performed with Student's *t*-tests or Mann-Whitney *U*-tests, whether they follow the normal distribution or not. Pearson's Chi-square calculations were used to compare qualitative variables represented as frequencies. A step-wise multiple linear regression analysis was conducted to evaluate to what extent CHD and cardiovascular related risk factors predict emotional intelligence. All tests were two-sided and $p < 0.05$ was considered statistically significant. Statistical analyses (Mann-Whitney *U*-test, Pearson χ^2 test, Cronbach Alpha and Multiple Linear Regression) were performed using SPSS 17.0 (IBM SPSS, Inc., Chicago, USA).

Results

The mean age of male participants was 69.19 years (SD=10.39) and 70.32 (SD=10.06) for the female participants. It was found that 112 men (50.0%) had coronary heart disease and 45 (20.1%) had diabetes mellitus. In women, coronary heart disease and diabetes mellitus were found in 38 patients (50.0%) and 17 patients (22.4%), respectively. The percentages of coronary heart disease and diabetes mellitus patients did not differ by gender ($p=1.000$; $p=0.672$). Women had a significantly higher BMI than men (29.01 vs. 27.47 kg/m², $p < 0.05$). The psychological characteristics of the two groups are summarized in Table I. There was no other statistically significant difference between men and women. In order to examine whether cardiovascular diseases may be good predictors of aspects of EI, a multiple linear regression analysis was conducted on the data (see Table II). In this analysis, the outcome measure was the EI subscale (self-emotion appraisal, other emotion appraisal, use of emotion and regulation of emotion). For this purpose, four models of multiple regression analysis were conducted using the backward elimination method. The independent variables were the three

cardiovascular diseases (coronary heart disease, diabetes mellitus, obesity) and gender. In the four multiple linear regression models, the coefficient for coronary heart disease was -0.735 , -0.756 , -0.973 and -1.328 , respectively. This means that, when the disease is present, there is a predicted decrease in the self-emotion appraisal of 0.735 , 0.756 , 0.973 and 1.328 . Because the relationship is significant, we are confident of an actual linear association between coronary heart disease and the aspects of EI attributed to hospitalized patients. In the second model, the regression coefficient for diabetes mellitus is negative, (-0.291) indicating that the presence of the disease decreases the other emotion appraisal by 0.291 and the relationship is statistically significant ($p < 0.001$). A tolerance of less than 0.20 or 0.10 and/or a VIF of 5 or 10 and above indicates a multicollinearity problem (113). In Table III, VIF are less than 5 and tolerance more than 0.20 , indicating that the models have not multicollinearity problems.

As presented in Table III, in the regression models, the ANOVA F statistic tests whether the model as a whole is significant. The p -value for all regression models is < 0.001 . The models are highly significant, and it can be concluded that these four independent variables (coronary heart disease, diabetes mellitus, obesity and gender) together predict the dependent variables. But any model is only as good as it is able to predict the actual outcome with accuracy. The Adjusted R^2 is a measure of how well the model is able to predict the changes in the actual data. In most cases of Linear Regression, the R^2 value lies between 0 and 1 . In social and behavioural science models typically low values are acceptable, with values over 0.2 indicating a satisfactory fit between the predictions and actual data. The Adjusted R^2 statistic in the fourth model means that 30.6% (Adj $R^2 = 0.306$) of the variation in the regulation of emotion can be explained by coronary heart disease. The remaining 69.4% can be explained by other factors that are not in the model. Very low values (< 0.2) in the first three models (0.137 , 0.171 and 0.186) indicate that the variables in these models, do not explain the outcome satisfactorily. Durbin-Watson Statistic for all four models was near to the ideal value of 2 indicating that errors are not correlated, whereas values from 1.75 to 2.25 are considered acceptable.

In sum, the model suggests that participants with higher rates of regulation of emotion tend to suffer from coronary heart disease. In that case, knowledge of one's coronary heart disease condition would be sufficient to determine the value of his ability to regulate his emotions. It also suggests that diabetes mellitus, obesity and gender have no observable effect on the aspects of EI. Certainly, additional research is warranted to focus on a variety of related questions concerning causality: does coronary heart disease decrease regulation of emotion of hospitalized patients, or does low regulation of emotion influence the incidence of coronary heart disease?

Table I. Mean scores, standard deviations and statistical significance for the psychological characteristics of the two groups.

EI (WLEIS)	Men (n=224)	Women (n=76)	p -Value
Self-emotion appraisal	5.93 ± 1.00	5.88 ± 0.97	0.586
Other emotion appraisal	5.81 ± 1.04	5.77 ± 0.95	0.416
Use of emotions	5.83 ± 1.11	5.74 ± 1.19	0.747
Regulation of emotions	5.63 ± 1.25	5.65 ± 1.07	0.604

Discussion

The purpose of this study was to examine the relationship between EI and cardiovascular related diseases. As hypothesized, coronary heart disease was found to be good predictor of the regulation of emotion, which is an aspect of trait EI. The variables were perfectly related in a negative linear sense. Neither regression nor correlation analyses can be interpreted as establishing cause-and-effect relationships. They can indicate only how or to what extent variables are associated with each other.

It is likely that people suffering from coronary heart disease have a lack of understanding of their emotions and score low in questionnaires assessing EI. Similar to other psychological variables, such as anxiety and depression, low EI may cause damage to the cardiovascular system through physiological alterations and by influencing lifestyle choices and practices (114-116). One possible explanation for this result may be that people, who have low EI, do not have the ability to regulate and control their emotions, for example their temper, and they experience often negative emotions. They do not have the ability to stop and think before acting, and to pause and consider the best course of action in the present situation. Hostility, anger or other uncontrolled negative emotions, relate to multiple behavioural risk factors, including smoking, alcohol consumption, sodium consumption, and exercise behaviour (117-120).

A number of specific positive emotions (optimism, control of specific emotions, joy, contentment, interest, love) have been proposed as potentially important to health (121). These emotions promote cognitive flexibility and innovation, whereas negative emotions serve to narrow attention to specific cognitive processes (122-124). Individuals facing stress and adversity may be more likely to utilize adaptive means of coping when positive emotion is high (123) and negative emotion is low. Some studies have shown that positive emotions promote immune functioning, while at the same time emotion inhibition compromise it (125, 126). Positive emotions can also facilitate recovery to resting cardiovascular levels following arousal by negative emotions (121, 127). Furthermore, positive emotions such as interest

Table II. Multiple linear regression analyses and related statistics for the effect of cardiovascular related diseases on emotions.

	B	95% Confidence interval	t	Tolerance	VIF	p-Value
Self-emotion appraisal						
CHD	-0.735	-0.945 to -0.525	-6.892	1.000	1.00	<0.001
Constant	6.287					
Other emotion appraisal						
CHD	-0.756	-0.972 to -0.540	-6.898	0.954	1.04	<0.001
Diabetes mellitus	-0.291	-0.558 to -0.025	-2.152	0.954	1.04	0.032
Constant	6.234					
Use of emotions						
CHD	-0.973	-1.205 to -0.742	-8.265	1.000	1.00	<0.001
Constant	6.298					
Regulation of emotions						
CHD	-1.328	-1.557 to -1.100	-11.452	1.000	1.00	<0.001
Constant	6.298					

Table III. Multiple Correlation Coefficient R², Durbin-Watson and ANOVA F statistics for multiple linear regression analysis.

	R ²	Adj R ²	Durbin-Watson	F (Sig)
Self-emotion appraisal	0.137	0.135	2.021	47.496 (<0.001)
Other emotion appraisal	0.171	0.166	2.008	30.689 (<0.001)
Use of emotions	0.186	0.184	1.916	68.318 (<0.001)
Regulation of emotions	0.306	0.303	2.080	131.146 (<0.001)

and engagement may facilitate attention to health-relevant information, participation in treatment planning, and involvement in lifestyle intervention programs. Future research is needed to examine the possibility that positive emotions predict health behaviours, and to explore the mechanisms that may explain these effects.

The results of this study clearly indicate the role of emotions in maintaining good health. Emotions are often helpful, but sometimes destructive. Among other things, a major challenge is to find ways of understanding one's emotions so that one retains their helpful features while limiting their potentially destructive aspects (John, Gross, 2004). There is evidence to suggest that unresolved negative emotions, such as emotionally stressful events or an outburst of anger, can trigger acute life-threatening cardiac events. It seems reasonable to assume that high EI would be associated with better stress management, better situation selection as to maximize pleasant feelings and lower levels of psychological distress (128). Both theory and research findings suggest a link between emotional intelligence and emotional well-being. Persons who are able to understand and regulate their emotions will have greater feeling of emotional well-being, greater optimism and less depression (129). On the other hand, persons who are poor at perceiving and regulating their emotions may actually tend to have less

social support and be more sensitive to the effects of stress (106, 130).

The relationship between coronary heart disease and emotional intelligence was also examined in another Greek sample of 56 coronary heart disease patients (131). The researchers indicated that various aspects of EI, such as decreased ability to use and regulate emotions as well as frequency of negative expressiveness are associated with incidence of coronary heart disease. Similarly, researchers have found that negative emotions, such as depression and anxiety, are negatively associated with occurrence of coronary artery disease in Greek urban population while taking into account already identified highly significant risk factors for the disease, namely, age, gender, cigarette smoking, presence of hypertension, obesity and family history of coronary artery disease (15, 132). These researchers argued that perceived ability to use, regulate and express emotions as well as frequent expression of positive emotions would be associated with decreased incidence of coronary heart disease. The present study is in line with these previous findings. Both studies provide a useful step towards this direction by providing evidence that there is a link between understanding of emotions and coronary heart disease. Lack of understanding of emotions may be a precursor of disease. Through behavioural and physiological

pathways, specific negative emotions, such as hostility and anger, may increase coronary risk, whereas control of emotions may represent health protective factors. Future research, however, is needed in order for the present findings to be generalized to a greater sample.

It is seen in the literature that many questionnaires assessing EI have already been developed and used in different studies. However, the variability of these scales causes confusion among the researchers. In addition, the selection of inappropriate questionnaires may negatively affect the results of the studies (133). Within this context, in the present study, the EI scale used have been examined for its reliability and found reliable. It can be concluded that since this scale is short and easy to apply, it can be used in hospitalized patients.

Conclusion

Finally, the present findings may have practical implications. It is important to highlight that as long as studies support that EI can be taught and developed (134), it means that the brain Centres for emotion may be capable of change in patients with coronary heart disease. If, for example, patients with coronary heart disease are trained to control and manage their emotions and improve their EI, their problem may be eliminated. It would be interesting for future research to examine whether or not EI could make a comparable contribution to health and recognize the changes needed in hospitals that might be of interest to both cardiologists and psychologists.

Conflicts of Interest

No conflicts of interest exist regarding this study.

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References

- 1 Lung and blood diseases. National Heart, Lung and Blood Institute, 2012. <https://www.nhlbi.nih.gov/>
- 2 Tunstall-Pedoe H: "Coronary heart disease" is not tautologous. *BMJ* 323(7314): 695, 2001.
- 3 Gouni-Berthold I, Krone W and Berthold HK: Vitamin d and cardiovascular disease. *Curr Vasc Pharmacol* 7(3): 414-422, 2009.
- 4 Cartwright M, Wardle J, Steggle N, Simon AE, Croker H and Jarvis MJ: Stress and dietary practices in adolescents. *Health Psychol* 22(4): 362-369, 2003.
- 5 Koelsch S, Enge J and Jentschke S: Cardiac signatures of personality. *PLoS One* 7(2): e31441, 2012.
- 6 Ollonen P, Lehtonen J and Eskelinen M: Stressful and adverse life experiences in patients with breast symptoms; a prospective case-control study in kuopio, Finland. *Anticancer Res* 25(1B): 531-536, 2005.
- 7 Cha W, Park SW, Kwon TK, Hah JH and Sung MW: Endoplasmic reticulum stress response as a possible mechanism of cyclooxygenase-2-independent anticancer effect of celecoxib. *Anticancer Res* 34(4): 1731-1735, 2014.
- 8 Tibblin G, Bengtsson C, Furunes B and Lapidus L: Symptoms by age and sex. The population studies of men and women in gothenburg, sweden. *Scand J Prim Health Care* 8(1): 9-17, 1990.
- 9 ngel GL: Sudden and rapid death during psychological stress. Folklore or folk wisdom? *Ann Intern Med* 74(5): 771-782, 1971.
- 10 De Vogli R, Chandola T and Marmot MG: Negative aspects of close relationships and heart disease. *Arch Intern Med* 167(18): 1951-1957, 2007.
- 11 Orth-Gomer K, Wamala SP, Horsten M, Schenck-Gustafsson K, Schneiderman N and Mittleman MA: Marital stress worsens prognosis in women with coronary heart disease: The Stockholm female coronary risk study. *JAMA* 284(23): 3008-3014, 2000.
- 12 Kuper H and Marmot M: Job strain, job demands, decision latitude, and risk of coronary heart disease within the whitehall ii study. *J Epidemiol Community Health* 57(2): 147-153, 2003.
- 13 Kuper H, Singh-Manoux A, Siegrist J and Marmot M: When reciprocity fails: Effort-reward imbalance in relation to coronary heart disease and health functioning within the whitehall ii study. *Occup Environ Med* 59(11): 777-784, 2002.
- 14 Eaker ED, Sullivan LM, Kelly-Hayes M, D'Agostino RB, Sr. and Benjamin EJ: Does job strain increase the risk for coronary heart disease or death in men and women? The Framingham offspring study. *Am J Epidemiol* 159(10): 950-958, 2004.
- 15 Panagiotakos DB, Pitsavos C, Chrysoshoou C, Stefanadis C and Toutouzas P: Risk stratification of coronary heart disease in greece: Final results from the cardio2000 epidemiological study. *Prev Med* 35(6): 548-556, 2002.
- 16 Musselman DL, Evans DL and Nemeroff CB: The relationship of depression to cardiovascular disease: Epidemiology, biology, and treatment. *Arch Gen Psychiatry* 55(7): 580-592, 1998.
- 17 Goldston K and Baillie AJ: Depression and coronary heart disease: A review of the epidemiological evidence, explanatory mechanisms and management approaches. *Clin Psychol Rev* 28(2): 288-306, 2008.
- 18 Rozanski A, Blumenthal JA and Kaplan J: Impact of psychological factors on the pathogenesis of cardiovascular disease and implications for therapy. *Circulation* 99(16): 2192-2217, 1999.
- 19 Rugulies R: Depression as a predictor for coronary heart disease. A review and meta-analysis. *Am J Prev Med* 23(1): 51-61, 2002.
- 20 Van der Kooy K, van Hout H, Marwijk H, Marten H, Stehouwer C and Beekman A: Depression and the risk for cardiovascular diseases: Systematic review and meta analysis. *Int J Geriatr Psychiatry* 22(7): 613-626, 2007.
- 21 Reichenberg A, Yirmiya R, Schuld A, Kraus T, Haack M, Morag A and Pollmacher T: Cytokine-associated emotional and cognitive disturbances in humans. *Arch Gen Psychiatry* 58(5): 445-452, 2001.

- 22 Carney RM, Freedland KE and Veith RC: Depression, the autonomic nervous system, and coronary heart disease. *Psychosom Med* 67(Suppl 1): S29-33, 2005.
- 23 Kemp AH, Quintana DS, Gray MA, Felmingham KL, Brown K and Gatt JM: Impact of depression and antidepressant treatment on heart rate variability: A review and meta-analysis. *Biol Psychiatry* 67(11): 1067-1074, 2010.
- 24 Caspi A, Roberts BW and Shiner RL: Personality development: Stability and change. *Annu Rev Psychol* 56: 453-484, 2005.
- 25 Ozer DJ and Benet-Martinez V: Personality and the prediction of consequential outcomes. *Annu Rev Psychol* 57: 401-421, 2006.
- 26 Chechetto D: Forebrain control of healthy and diseased hearts. *In: Basic and clinical neurocardiology* by Armour JA, Ardell JL (eds). New York: Oxford University Press, 2004.
- 27 Craig A: Forebrain emotional asymmetry: A neuroanatomical basis? *Trends in Cognitive Sciences* 9: 566-571, 2005.
- 28 Bruno A, Pandolfo G, Scimeca G, Leonardi V, Cedro C, Racchiusa S, Zoccali RA and Muscatello MR: Anger in health, benign breast disease and breast cancer: A prospective case-control study. *In Vivo* 28(5): 973-977, 2014.
- 29 Littman AB: Review of psychosomatic aspects of cardiovascular disease. *Psychother Psychosom* 60(3-4): 148-167, 1993.
- 30 Denollet J and Brutsaert DL: Personality, disease severity, and the risk of long-term cardiac events in patients with a decreased ejection fraction after myocardial infarction. *Circulation* 97(2): 167-173, 1998.
- 31 Knox SS and Follmann D: Gender differences in the psychosocial variance of framingham and bortner type a measures. *J Psychosom Res* 37(7): 709-716, 1993.
- 32 Boulanger L, Zhao Y, Bao Y and Russell MW: A retrospective study on the impact of comorbid depression or anxiety on healthcare resource use and costs among diabetic neuropathy patients. *BMC Health Serv Res* 9: 111, 2009.
- 33 Miller TQ, Smith TW, Turner CW, Gujjarro ML and Hallett AJ: A meta-analytic review of research on hostility and physical health. *Psychol Bull* 119(2): 322-348, 1996.
- 34 Niaura R, Todaro JF, Stroud L, Spiro A, 3rd, Ward KD and Weiss S: Hostility, the metabolic syndrome, and incident coronary heart disease. *Health Psychol* 21(6): 588-593, 2002.
- 35 Chida Y and Steptoe A: The association of anger and hostility with future coronary heart disease: A meta-analytic review of prospective evidence. *J Am Coll Cardiol* 53(11): 936-946, 2009.
- 36 Tindle HA, Chang YF, Kuller LH, Manson JE, Robinson JG, Rosal MC, Siegle GJ and Matthews KA: Optimism, cynical hostility, and incident coronary heart disease and mortality in the women's health initiative. *Circulation* 120(8): 656-662, 2009.
- 37 Daniels GE: Present trends in the evaluation of psychic factors in diabetes mellitus: A critical review of experimental, general medical and psychiatric literature of the last five years. *Psychosom* 1: 527-552, 1939.
- 38 Daniels GE: Brief psychotherapy in diabetes mellitus. *Psychiatry* 7: 121-128, 1944.
- 39 Schram MT, Baan CA and Pouwer F: Depression and quality of life in patients with diabetes: A systematic review from the european depression in diabetes (edid) research consortium. *Curr Diabetes Rev* 5(2): 112-119, 2009.
- 40 Koszka A, Pouwer F, Jodko A, Radzio R, Mucko P, Bienkowska J, Kuligowska E, Smoczynska O and Skłodowska Z: Serious diabetes-specific emotional problems in patients with type 2 diabetes who have different levels of comorbid depression: A polish study from the european depression in diabetes (edid) research consortium. *Eur Psychiatry* 24(7): 425-430, 2009.
- 41 Vegh D, Banyai D, Hermann P, Nemeth Z and Ujpal M: Type-2 diabetes mellitus and oral tumors in hungary: A long-term comparative epidemiological study. *Anticancer Res* 37(4): 1853-1857, 2017.
- 42 Peyrot M and Rubin RR: Levels and risks of depression and anxiety symptomatology among diabetic adults. *Diabetes Care* 20(4): 585-590, 1997.
- 43 Pibernik-Okanovic M, Peros K, Szabo S, Begic D and Metelko Z: Depression in croatian type 2 diabetic patients: Prevalence and risk factors. A croatian survey from the european depression in diabetes (edid) research consortium. *Diabet Med* 22(7): 942-945, 2005.
- 44 Thomas J, Jones G, Scarinci I and Brantley P: A descriptive and comparative study of the prevalence of depressive and anxiety disorders in low-income adults with type 2 diabetes and other chronic illnesses. *Diabetes Care* 26(8): 2311-2317, 2003.
- 45 Saaddine JB, Cadwell B, Gregg EW, Engelgau MM, Vinicor F, Imperatore G and Narayan KM: Improvements in diabetes processes of care and intermediate outcomes: United states, 1988-2002. *Ann Intern Med* 144(7): 465-474, 2006.
- 46 Beverly EA, Hultgren BA, Brooks KM, Ritholz MD, Abrahamson MJ and Weinger K: Understanding physicians' challenges when treating type 2 diabetic patients' social and emotional difficulties: A qualitative study. *Diabetes Care* 34(5): 1086-1088, 2011.
- 47 de Groot M, Anderson R, Freedland KE, Clouse RE and Lustman PJ: Association of depression and diabetes complications: A meta-analysis. *Psychosom Med* 63(4): 619-630, 2001.
- 48 Lustman PJ, Anderson RJ, Freedland KE, de Groot M, Carney RM and Clouse RE: Depression and poor glycemic control: A meta-analytic review of the literature. *Diabetes Care* 23(7): 934-942, 2000.
- 49 Gonzalez JS, Safren SA, Cagliero E, Wexler DJ, Delahanty L, Wittenberg E, Blais MA, Meigs JB and Grant RW: Depression, self-care, and medication adherence in type 2 diabetes: Relationships across the full range of symptom severity. *Diabetes Care* 30(9): 2222-2227, 2007.
- 50 Egede LE: Effect of depression on self-management behaviors and health outcomes in adults with type 2 diabetes. *Curr Diabetes Rev* 1(3): 235-243, 2005.
- 51 Gonzalez JS, Safren SA, Delahanty LM, Cagliero E, Wexler DJ, Meigs JB and Grant RW: Symptoms of depression prospectively predict poorer self-care in patients with type 2 diabetes. *Diabet Med* 25(9): 1102-1107, 2008.
- 52 Katon WJ, Von Korff M, Lin EH, Simon G, Ludman E, Russo J, Ciechanowski P, Walker E and Bush T: The pathways study: A randomized trial of collaborative care in patients with diabetes and depression. *Arch Gen Psychiatry* 61(10): 1042-1049, 2004.
- 53 Boutoille D, Feraille A, Maulaz D and Krempf M: Quality of life with diabetes-associated foot complications: Comparison between lower-limb amputation and chronic foot ulceration. *Foot Ankle Int* 29(11): 1074-1078, 2008.
- 54 Moreira RO, Amancio AP, Brum HR, Vasconcelos DL and Nascimento GF: Depressive symptoms and quality of life in type 2 diabetic patients with diabetic distal polyneuropathy. *Arq Bras Endocrinol Metabol* 53(9): 1103-1111, 2009.

- 55 Winkley K, Stahl D, Chalder T, Edmonds ME and Ismail K: Quality of life in people with their first diabetic foot ulcer: A prospective cohort study. *J Am Podiatr Med Assoc* 99(5): 406-414, 2009.
- 56 Chazova TE, Voznesenskaia TG and Golitsyna T: Anxiety-depressive disorders in patients with type 2 diabetes mellitus complicated with acute coronary syndrome. *Kardiologiya* 47(6): 10-14, 2007.
- 57 Hermanns N, Kulzer B, Krichbaum M, Kubiak T and Haak T: Affective and anxiety disorders in a german sample of diabetic patients: Prevalence, comorbidity and risk factors. *Diabet Med* 22(3): 293-300, 2005.
- 58 Koenigsberg HW, Klausner E, Pelino D, Rosnick P and Campbell R: Expressed emotion and glucose control in insulin-dependent diabetes mellitus. *Am J Psychiatry* 150(7): 1114-1115, 1993.
- 59 Mavroveli S and Sanchez-Ruiz MJ: Trait emotional intelligence influences on academic achievement and school behaviour. *Br J Educ Psychol* 81(Pt 1): 112-134, 2011.
- 60 Matthews G and Zeidner M: The handbook of emotional intelligence: Theory, development, assessment and application at home, school and in the workplace. Jossey-Bass; 1 edition, 2000.
- 61 Winkley K, Ismail K, Landau S and Eisler I: Psychological interventions to improve glycaemic control in patients with type 1 diabetes: Systematic review and meta-analysis of randomised controlled trials. *BMJ* 333(7558): 65, 2006.
- 62 Adili F, Larijani B and Haghighatpanah M: Diabetic patients: Psychological aspects. *Ann NY Acad Sci* 1084: 329-349, 2006.
- 63 van der Ven NC, Lubach CH, Hogenelst MH, van Iperen A, Tromp-Wever AM, Vriend A, van der Ploeg HM, Heine RJ and Snoek FJ: Cognitive behavioural group training (cbgt) for patients with type 1 diabetes in persistent poor glycaemic control: Who do we reach? *Patient Educ Couns* 56(3): 313-322, 2005.
- 64 Rose M, Fliege H, Hildebrandt M, Schirop T and Klapp BF: The network of psychological variables in patients with diabetes and their importance for quality of life and metabolic control. *Diabetes Care* 25(1): 35-42, 2002.
- 65 Rovner B and Ganguli M: Depression and disability associated with impaired vision: The movies project. *J Am Geriatr Soc* 41: 401-407, 2015.
- 66 Carabellese C, Appollonio I, Rozzini R, Bianchetti A, Frisoni G, Frattola L and Trabucchi M: Sensory impairment and quality of life in a community elderly population. *J Am Geriatr Soc* 41(4): 401-407, 1993.
- 67 Diniz-Filho A, Abe RY, Cho HJ, Baig S, Gracitelli CP and Medeiros FA: Fast visual field progression is associated with depressive symptoms in patients with glaucoma. *Ophthalmology* 123(4): 754-759, 2016.
- 68 Hayman K, Kerse N, La Grow S, Wouldes T, Robertson M and Campbell A: Depression in older people: Visual impairment and subjective ratings of health. *Optom Vis Sci* 84(11): 1024-1030, 2007.
- 69 Laeng B, Sirois S and Gredebäck G: Pupillometry: A window to the preconscious? *Perspect Psychol Sci* 7(1): 18-27, 2012.
- 70 McEwen BS and Gianaros PJ: Central role of the brain in stress and adaptation: Links to socioeconomic status, health, and disease. *Ann N Y Acad Sci* 1186: 190-222, 2010.
- 71 Ranabir S and Reetu K: Stress and hormones. *Indian J Endocrinol Metab* 15(1): 18-22, 2011.
- 72 Yannuzzi LA: Type-a behavior and central serous chorioretinopathy. *Retina* 7(2): 111-131, 1987.
- 73 Finucane MM, Stevens GA, Cowan MJ, Danaei G, Lin JK, Paciorek CJ, Singh GM, Gutierrez HR, Lu Y, Bahalim AN, Farzadfar F, Riley LM, Ezzati M and Global Burden of Metabolic Risk Factors of Chronic Diseases Collaborating Group: National, regional, and global trends in body-mass index since 1980: Systematic analysis of health examination surveys and epidemiological studies with 960 country-years and 9.1 million participants. *Lancet* 377(9765): 557-567, 2011.
- 74 Bullo M, Garcia-Aloy M, Martinez-Gonzalez MA, Corella D, Fernandez-Ballart JD, Fiol M, Gomez-Gracia E, Estruch R, Ortega-Calvo M, Francisco S, Flores-Mateo G, Serra-Majem L, Pinto X, Covas MI, Ros E, Lamuela-Raventos R and Salas-Salvado J: Association between a healthy lifestyle and general obesity and abdominal obesity in an elderly population at high cardiovascular risk. *Prev Med* 53(3): 155-161, 2011.
- 75 Marcellini F, Giuli C, Papa R, Tirabassi G, Faloia E, Boscaro M, Polito A, Ciarapica D, Zaccaria M and Mocchegiani E: Obesity and body mass index (bmi) in relation to life-style and psycho-social aspects. *Arch Gerontol Geriatr* 49(Suppl 1): 195-206, 2009.
- 76 Barak Y and Fridman D: Impact of mediterranean diet on cancer: Focused literature review. *Cancer Genomics Proteomics* 14(6): 403-408, 2017.
- 77 Barrington DS, Baquero MC, Borrell LN and Crawford ND: Racial/ethnic disparities in obesity among us-born and foreign-born adults by sex and education. *Obesity (Silver Spring)* 18(2): 422-424, 2010.
- 78 Lawder R, Harding O, Stockton D, Fischbacher C, Brewster DH, Chalmers J, Finlayson A and Conway DI: Is the scottish population living dangerously? Prevalence of multiple risk factors: The scottish health survey 2003. *BMC Public Health* 10: 330, 2010.
- 79 Urry HL, Nitschke JB, Dolski I, Jackson DC, Dalton KM, Mueller CJ, Rosenkranz MA, Ryff CD, Singer BH and Davidson RJ: Making a life worth living: Neural correlates of well-being. *Psychol Sci* 15(6): 367-372, 2004.
- 80 Kyrozi A, Psaltopoulou T, Stathopoulos P, Trichopoulos D, Vassilopoulos D and Trichopoulos A: Dietary lipids and geriatric depression scale score among elders: The epic-greece cohort. *J Psychiatr Res* 43(8): 763-769, 2009.
- 81 Stewart-Knox BJ: Psychological underpinnings of metabolic syndrome. *Proc Nutr Soc* 64(3): 363-369, 2005.
- 82 McElroy SL, Kotwal R, Malhotra S, Nelson EB, Keck PE and Nemeroff CB: Are mood disorders and obesity related? A review for the mental health professional. *J Clin Psychiatry* 65(5): 634-651, quiz 730, 2004.
- 83 Weber-Hamann B, Hentschel F, Kniest A, Deuschle M, Colla M, Lederbogen F and Heuser I: Hypercortisolemic depression is associated with increased intra-abdominal fat. *Psychosom Med* 64(2): 274-277, 2002.
- 84 Rice MC, Katzel LI and Waldstein SR: Sex-specific associations of depressive symptoms and cardiovascular risk factors in older adults. *Aging Ment Health* 14(4): 405-410, 2010.

- 85 Zaninotto P, Pierce M, Breeze E, de Oliveira C and Kumari M: Bmi and waist circumference as predictors of well-being in older adults: Findings from the english longitudinal study of ageing. *Obesity (Silver Spring)* 18(10): 1981-1987, 2010.
- 86 Beydoun MA, Kuczmarski MT, Mason MA, Ling SM, Evans MK and Zonderman AB: Role of depressive symptoms in explaining socioeconomic status disparities in dietary quality and central adiposity among us adults: A structural equation modeling approach. *Am J Clin Nutr* 90(4): 1084-1095, 2009.
- 87 Toker S, Shirom A and Melamed S: Depression and the metabolic syndrome: Gender-dependent associations. *Depress Anxiety* 25(8): 661-669, 2008.
- 88 Gordon-Larsen P, Adair LS, Nelson MC and Popkin BM: Five-year obesity incidence in the transition period between adolescence and adulthood: The national longitudinal study of adolescent health. *Am J Clin Nutr* 80(3): 569-575, 2004.
- 89 Dachs G, Phillips E, Phung Y, Dyer A, Willis J, Currie M and Robinson B: Tumour growth in mice resistant to diet-induced obesity. *J Mol Biochem* 4(2): 42-49, 2015.
- 90 Champeris Tsaniras S and Vlachakis D: Diet, obesity and cancer. *J Mol Biochem* 4(2): 20, 2015.
- 91 Christensen L: Effects of eating behavior on mood: A review of the literature. *Int J Eat Disord* 14(2): 171-183, 1993.
- 92 Macht M, Haupt C and Ellgring H: The perceived function of eating is changed during examination stress: A field study. *Eat Behav* 6(2): 109-112, 2005.
- 93 Macht M and Simons G: Emotions and eating in everyday life. *Appetite* 35(1): 65-71, 2000.
- 94 Yanovski SZ: Binge eating disorder: Current knowledge and future directions. *Obes Res* 1(4): 306-324, 1993.
- 95 Kaplan HI and Kaplan HS: The psychosomatic concept of obesity. *J Nerv Ment Dis* 125(2): 181-201, 1957.
- 96 Kenardy J, Arnow B and Agras WS: The aversiveness of specific emotional states associated with binge-eating in obese subjects. *Aust N Z J Psychiatry* 30(6): 839-844, 1996.
- 97 Abraham SF and Beumont PJ: How patients describe bulimia or binge eating. *Psychol Med* 12(3): 625-635, 1982.
- 98 Meyer C, Waller G and Waters A: Emotional states and bulimic psychopathology. In: Hoek H, Treasure J and Katzman M (eds.) *Neurobiology in the treatment of eating disorders*. Wiley series on clinical and neurobiological advances in psychiatry. Chichester: Wiley, pp. 271-290, 1998.
- 99 Wallis DJ and Hetherington MM: Stress and eating: The effects of ego-threat and cognitive demand on food intake in restrained and emotional eaters. *Appetite* 43(1): 39-46, 2004.
- 100 Martyn-Nemeth P, Penckofer S, Gulanick M, Velsor-Friedrich B and Bryant FB: The relationships among self-esteem, stress, coping, eating behavior, and depressive mood in adolescents. *Res Nurs Health* 32(1): 96-109, 2009.
- 101 Currie J: Healthy, wealthy, and wise: Socioeconomic status, poor health in childhood, and human capital development. *Journal of Economic Literature* 47(1): 87-122, 2009.
- 102 Yau YH and Potenza MN: Stress and eating behaviors. *Minerva Endocrinol* 38(3): 255-267, 2013.
- 103 Ozier AD, Kendrick OW, Leeper JD, Knol LL, Perko M and Burnham J: Overweight and obesity are associated with emotion- and stress-related eating as measured by the eating and appraisal due to emotions and stress questionnaire. *J Am Diet Assoc* 108(1): 49-56, 2008.
- 104 Moon A and Berenbaum H: Emotional awareness and emotional eating. *Cognition and Emotion* 23(3): 417-429, 2009.
- 105 Darwin CR: The expression of the emotions in man and animals. London: John Murray, 1st edition, 1872.
- 106 Goleman D: Emotional intelligence. Bantam Books, USA, 1995.
- 107 Siegling AB, Furnham A and Petrides KV: Trait emotional intelligence and personality: Gender-invariant linkages across different measures of the big five. *J Psychoeduc Assess* 33(1): 57-67, 2015.
- 108 Eysenck HJ: Personality, stress and cancer: Prediction and prophylaxis. *Br J Med Psychol* 61 (Pt 1): 57-75, 1988.
- 109 Davidson KW, Mostofsky E and Whang W: Don't worry, be happy: Positive affect and reduced 10-year incident coronary heart disease: The canadian nova scotia health survey. *Eur Heart J* 31(9): 1065-1070, 2010.
- 110 Russek LG and Schwartz GE: Feelings of parental caring predict health status in midlife: A 35-year follow-up of the harvard mastery of stress study. *J Behav Med* 20(1): 1-13, 1997.
- 111 Scanlon PJ, Faxon DP, Audet AM, Carabello B, Dehmer GJ, Eagle KA, Legako RD, Leon DF, Murray JA, Nissen SE, Pepine CJ, Watson RM, Ritchie JL, Gibbons RJ, Cheitlin MD, Gardner TJ, Garson A Jr., Russell RO Jr., Ryan TJ and Smith SC Jr.: *Acc/aha guidelines for coronary angiography: Executive summary and recommendations*. A report of the american college of cardiology/american heart association task force on practice guidelines (committee on coronary angiography) developed in collaboration with the society for cardiac angiography and interventions. *Circulation* 99(17): 2345-2357, 1999.
- 112 Kafetsios K and Zampetakis L: Emotional intelligence and job satisfaction: Testing the mediatory role of positive and negative affect at work. *Pers Individ Dif* 44: 710-720, 2008.
- 113 O'Brien RM: A caution regarding rules of thumb for variance inflation factors. *Quality & Quantity* 41(5): 673-690, 2007.
- 114 Haines A, Cooper J and Meade TW: Psychological characteristics and fatal ischaemic heart disease. *Heart* 85(4): 385-389, 2001.
- 115 Krantz DS and Manuck SB: Acute psychophysiologic reactivity and risk of cardiovascular disease: A review and methodologic critique. *Psychol Bull* 96(3): 435-464, 1984.
- 116 Steptoe A: Psychosocial factors in the development of hypertension. *Ann Med* 32(5): 371-375, 2000.
- 117 Everson SA, Lynch JW, Chesney MA, Kaplan GA, Goldberg DE, Shade SB, Cohen RD, Salonen R and Salonen JT: Interaction of workplace demands and cardiovascular reactivity in progression of carotid atherosclerosis: Population based study. *BMJ* 314(7080): 553-558, 1997.
- 118 Leiker M and Hailey BJ: A link between hostility and disease: Poor health habits? *Behav Med* 14(3): 129-133, 1988.
- 119 Miller AH: Neuroendocrine and immune system interactions in stress and depression. *Psychiatr Clin North Am* 21(2): 443-463, 1998.
- 120 Scherwitz LW, Perkins LL, Chesney MA, Hughes GH, Sidney S and Manolio TA: Hostility and health behaviors in young adults: The cardia study. Coronary artery risk development in young adults study. *Am J Epidemiol* 136(2): 136-145, 1992.
- 121 Fredrickson BL, Mancuso RA, Branigan C and Tugade MM: The undoing effect of positive emotions. *Motiv Emot* 24(4): 237-258, 2000.
- 122 Fredrickson BL: The role of positive emotions in positive psychology. The broaden-and-build theory of positive emotions. *Am Psychol* 56(3): 218-226, 2001.

- 123 Aspinwall LG and Taylor SE: A stitch in time: Self-regulation and proactive coping. *Psychol Bull* 121(3): 417-436, 1997.
- 124 Isen AM: Positive affect. In: In Dalglish T & Power MJ (eds.), *Handbook of cognition and emotion*. London: Wiley, pp. 521-539, 1999.
- 125 Cohen S, Doyle WJ, Turner RB, Alper CM and Skoner DP: Emotional style and susceptibility to the common cold. *Psychosom Med* 65(4): 652-657, 2003.
- 126 Stone AA, Cox DS, Valdimarsdottir H, Jandorf L and Neale JM: Evidence that secretory iga antibody is associated with daily mood. *J Pers Soc Psychol* 52(5): 988-993, 1987.
- 127 Fredrickson BL and Levenson RW: Positive emotions speed recovery from the cardiovascular sequelae of negative emotions. *Cogn Emot* 12(2): 191-220, 1998.
- 128 Austin EJ, Saklofske DH and Egan V: Personality, well-being and health correlates of trait emotional intelligence. *Pers Individ Dif* 38: 547-558, 2005.
- 129 Reuven B-O: BarOn Emotional quotient inventory: Technical manual. Multi-Health Systems, 1997.
- 130 Ciarrochi J, Cahn A and Bajgar J: Measuring emotional intelligence in adolescents. *Pers Individ Dif* 31: 1105-1119, 2001.
- 131 Kravvariti E, Maridaki-Kassotaki K and Kravvaritis E: Emotional intelligence and coronary heart disease: How close is the link? *Glob J Health Sci* 2: 127-137, 2010.
- 132 O'Donnell CJ and Elosua R: Cardiovascular risk factors. Insights from framingham heart study. *Rev Esp Cardiol* 61(3): 299-310, 2008.
- 133 Aslan S and Erkus A: Measurement of emotional intelligence: Validity and reliability studies of two scales. *World Appl Sci J* 4(3): 430-438, 2008.
- 134 Boyatzis RE, Cowen SS and Kolb DA: *Innovation in professional education: Steps on a journey from teaching to learning*. Jossey-Bass: San Francisco, 1995.

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