



Research Paper



An Artificial Neural Network to Predict Depression Symptoms Through Emotional Divorce and Spiritual Beliefs in Married University Students

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ABSTRACT

Background and Objectives: Spirituality and spiritual beliefs are among the factors playing key roles in preventing psychological disorders. The present study aimed to investigate the relationship between depression symptoms with emotional divorce and spiritual beliefs using artificial neural networks (ANN) in married university students.

Methods: The statistical population of this descriptive-correlational study included all married students at the Islamic Azad University of Ahvaz (Khuzestan Province, Iran) during the 2021–22 academic year. The convenience sampling technique was adopted to select 301 married students as the research sample. An ANN was employed and data collection was done using the Beck’s depression inventory, emotional divorce scale, and religious orientation scale. Data analysis was performed through the Pearson correlation coefficient, stepwise regression, and an ANN.

Results: The results showed a significant positive relationship between emotional divorce and depression symptoms, whereas there was a significant negative relationship between intrinsic religious beliefs and depression symptoms ($P < 0.001$). However, a significant positive relationship existed between extrinsic religious beliefs and depression symptoms ($P < 0.001$). Furthermore, depression symptoms were associated with emotional divorce and intrinsic/extrinsic religious beliefs in married university students. The results of the ANN also showed that emotional divorce had the most relationship with the depression symptoms of married students.

Conclusion: The ANN appropriately predicted depression symptoms through an emotional divorce and spiritual beliefs among married university students. The results indicated the necessity of paying more attention to marital relationships, emotional divorce improvement, and depression alleviation.

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Introduction

Emotional divorce is considered a social problem and serious trauma in modern societies. The highest rate of emotional divorce occurs in couples under the age of 40, and communication outside the marital framework is one of the important factors affecting this type of divorce [1]. Given the undeniable importance of family in every society, it seems essential to analyze the causes of emotional divorce, its traumas, and consequent conditions that a person may experience [2]. After emotional divorce, women will face further changes and challenges in life than men [3]. Emotional divorce is accompanied by increasing depression symptoms in couples [4, 5].

Depression is an emotional disorder characterized by changes in mood and emotions [6]. This disorder is a chronic, relapsing, and potentially life-threatening illness and is associated with symptoms of dissatisfaction, loss of past interests and abilities, low self-esteem, and feelings of sadness and guilt [7]. Depressive schemas typically exist in attitudes referred to as dysfunctional attitudes. Such schemas are activated due to negative events in life. When one of such depressive schemas is activated, a relevant information processing model is activated with a negative bias, characterized by negative errors in thinking (e.g. the biased interpretations of negative events in life, such as overgeneralization and catastrophe creation) [8].

Negative errors in thinking increase the likelihood that an individual develops a negative cognitive triangle [9]. When a person forms such a cognitive triangle, he/she will experience depressive symptoms [10]. Dysfunctional attitudes predict depression symptoms. In conclusion, people with dysfunctional attitudes will experience higher levels of stress and further depression symptoms in the face of everyday life events, which can lead to negative moods [11]. Negative moods respond to rumination rather than learning other cognitive response style strategies, such as problem-solving or distraction. In response to negative moods, individuals focus on themselves or the symptoms, causes, and outcomes of negative moods [12, 13].

People's reactions to stressful factors depend significantly on cultural, spiritual, and social factors and their previous experiences. Spirituality and spiritual beliefs are among the factors playing key roles in preventing psychological disorders. Spirituality is considered a very effective psychological source of support, saving people from suspension and meaninglessness by providing explanatory support in specific

conditions [14]. People with religious beliefs or those who perform religious rituals are characterized by higher mental health and adjustment levels [15, 16]. Different studies on religion, spirituality, and health were analyzed in a systematic review and the results indicated the effectiveness of spirituality on depression, anxiety, suicide, and psychological disorders [17]. Spirituality also helps people perceive the meanings of life events, especially painful and stressful ones. Most experts now believe that spirituality undeniably affects physical health and other dimensions of human life [18].

An artificial neural network (ANN) is an information-processing idea inspired by the biological neuro-system. This system consists of a large number of interconnected processing elements called neurons that work together to solve a problem [19]. In research, if the data is complex, the assumptions of the model may not be valid; therefore, it seems very useful and valuable to provide methods, such as ANN, based on which the prediction has a minimum error and maximum reliability [20].

Marriage meets many personal and social needs of both men and women in psychosocial and physical relationships and social and normative customs. In other words, when a family provides a constructive, healthy environment where family members can experience intimate and interpersonal interactions, it can help them grow and improve. In contrast, many marital problems are rooted in how and what couples think about each other and their relationships [21]. Considering the relatively high prevalence of depression following emotional divorce in married individuals, this study analyzed the key role of depression in academic failure and suicide among students. Accordingly, we investigated the relationship between depression symptoms and emotional divorce and spiritual beliefs using ANN in married university students.

Methods

An ANN was employed in this descriptive-correlational study. The statistical population included all married students at the [Islamic Azad University of Ahvaz](#) (Iran) during the 2021–22 academic year. The multi-stage cluster sampling method was adopted to select 301 students as the research sample. In this method, [Islamic Azad University](#) was selected randomly among the universities of Ahvaz City. Among the faculties of this university, two faculties were randomly selected and the research questionnaires were provided to married students. According to Kline's proposition [22], at least 10-25 participants are required for every parameter calculated to test a model in path analysis. Among the 356 eligible university students, 301 cases were considered as samples.

The inclusion criteria were being married, filling out all questionnaires completely, those aged 22-44 years, being married for at least one year, and giving consent for participation in the study. The exclusion criteria were failure to complete all questionnaires and unwillingness to continue participating in the study.

Instruments

Beck's depression inventory (BDI): This questionnaire consists of 21 four-choice items that measure the severity of depression symptoms. Each item is scored between 0 and 3; hence, the total score ranges from 0 to 63. It can be implemented on people aged 13 and older. Its 21 items are classified into three categories: Emotional symptoms, cognitive symptoms, and physical symptoms. The scores of 0–13, 14–19, 20–28, and 29–63 denote minimum depression, minor depression, moderate depression, and severe depression, respectively [23]. The validity of the Persian version of this questionnaire was confirmed by Ghassemzadeh et al. [24]. The authors reported a Cronbach's α coefficient of 0.87 for the Persian version of the BDI. Also, in our work, Cronbach's α coefficient was 0.83.

Emotional divorce scale: This scale includes various sentences on different aspects of life, with which participants may agree or disagree. It consists of 24 yes/no items. An affirmative response is scored one, whereas a negative response is scored zero. The more affirmative responses, the higher the risk of emotional divorce. After the affirmative responses are collected, if there are eight or more of them, the marriage is at risk of separation [25]. Kamalian et al. [26] reported a Cronbach's α coefficient of 0.87 for the scale. In this study, its Cronbach's α coefficient was 0.80.

Religious orientation scale: Allport and Ross [27] designed a 20-item scale for religious measurements. Its 11 items address extrinsic orientation, whereas nine items consider intrinsic orientation. The items are scored on a Likert scale. It was first translated and then revised many times by different experts to match Iran's cultural and religious contexts and evaluate the validity of this scale. Ghorbani et al. [28] reported a Cronbach's α coefficient of 0.79 for this scale. In this study, its Cronbach's α coefficient was 0.81.

Data analysis

Data analysis was performed using SPSS software, version 27 and MATLAB software, version 22. The Mean \pm SD were used for descriptive analysis. The Pearson correlation coefficient and artificial neural networks (ANN) were used for inferential analysis.

Results

According to the demographic findings, there were 181(60.13%) female married students and 120(39.87%) male married students. The findings also indicated that 24%, 60%, and 16% of the participants were bachelor, master, and PhD students, respectively. Table 1 reports the Mean \pm SD of research variables.

Table 2 presents the correlation coefficients of the research variables, indicating a significant positive correlation between emotional divorce and depression symptoms ($r=0.31$, $P=0.001$). Also, a significant negative correlation existed between intrinsic religious beliefs and depression symptoms ($r=-0.29$, $P=0.001$). There was a significant positive correlation between extrinsic religious beliefs and depression symptoms ($r=0.33$, $P=0.001$).

In this study, an ANN was designed and developed in MATLAB software, version 22. The research question is, "can an ANN be adopted to predict depression symptoms through an emotional divorce and religious beliefs among married university students of Ahvaz?" First, the data were divided into three sections to be entered into the network: 70% for the training set, 15% for the evaluation set, and 15% for the test set. Two inputs and one output were given as an Excel file and a matrix to the network. The best output was obtained from two hidden layers, the first one had nine neurons, whereas the second layer had one neuron. Figure 1 demonstrates the structure of this ANN with the best approximation possible.

Since the optimal iteration of training was unclear, the early stopping method was employed to provide the network with the evaluation data only for prediction in addition to presenting training data and optimizing network weights. Training iterations will continue until error improvement has not reached a low rate. Finally, the best iteration was confirmed and selected with respect to the minimum summation of training data. Figure 2 depicts how the ANN training process was implemented through input data. According to the settings, the network stopped at the evaluation set error after five consecutive iterations. The ANN terminated at the 11th iteration. As shown in Figure 2:

- 1) The final mean square error was small.
- 2) The training set error was nearly equal to the evaluation set error in behavior and characteristics.
- 3) No fitness occurred until the 5th iteration (when the best efficiency of the evaluation set was recorded). The ANN was then

Table 1. Mean±SD of the research variables

Variables	Mean±SD
Depression symptoms	18.61±4.00
Emotional divorce	11.05±3.72
Intrinsic spiritual beliefs	21.89±3.59
Extrinsic spiritual beliefs	35.03±8.01



Table 2. Pearson correlation coefficients among the research variables

Variables	Depression Symptoms	
	r	P
Emotional divorce	0.31	0.001
Intrinsic spiritual beliefs	-0.29	0.001
Extrinsic spiritual beliefs	0.33	0.001



used to approximate the research variables' relationships with depression symptoms. According to Figure 3, emotional divorce had the most significant relationship with depression symptoms in married university students, followed by extrinsic and intrinsic religious beliefs came next. Hence, it can be concluded that the ANN properly predicts depression symptoms of married university students.

Discussion

This study aimed to investigate the relationship between depression symptoms and emotional divorce and spiritual beliefs using ANN in married university students. The first research findings indicated that depression symptoms could be predicted through an emotional divorce in married university students. This finding is consistent with the results of Sohrabzadeh and Hakim Javadi [29].

Depression symptoms are generally the direct outcome of insufficient dispute resolution competencies. Hence, emotional divorce denotes a set of subjective standards and hypotheses, predetermined frameworks, and norms that couples consider in relation to their spouses and marital lives. These standards, frameworks, and norms might be either realistic or unrealistic. Most people have unrealistic expectations in life. They expect their spouses to fill all the gaps they had before marriage. If spousal expectations are unrealistic, intimacy will be reduced. Lower intimacy levels predict detrimental outcomes, such as domestic violence and depression symptoms in marriage [30].

The second research finding indicated that depression symptoms could be predicted through the spiritual beliefs of married university students. This finding is consistent with the results of Habibi et al. [31]. Given the construc-

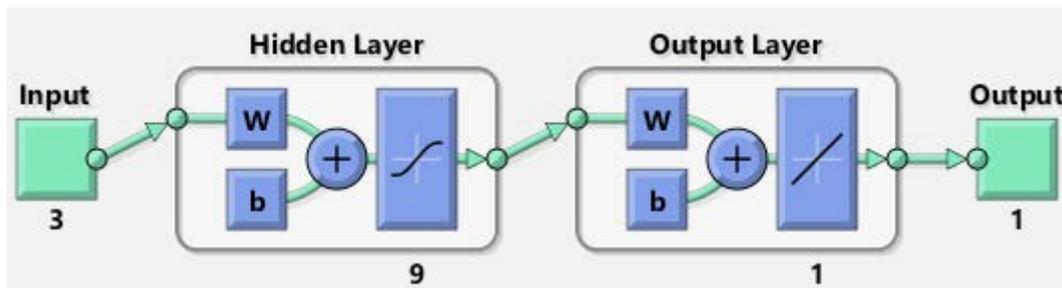


Figure 1. The structure of the artificial neural network with the best possible estimate



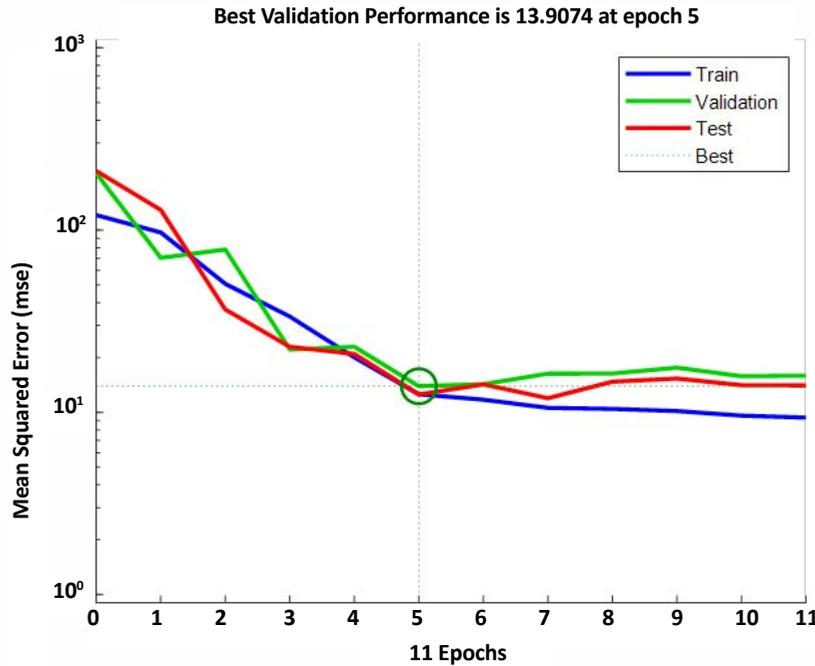


Figure 2. Network efficiency diagram

tive effects of spiritual beliefs on people’s moods and consequent improvement in the quality of their personal and social lives, it is possible to observe further positive effects, such as peace of mind, enhanced right decision-making, feeling safe, and reduced depression symptoms. Spiritual beliefs are the latest known dimension of health classified in addition to other dimensions of health, such

as physical, mental, and social health [31]. Support from religious or spiritual sources and connections to a higher power can improve the quality of life and bring about positive medical outcomes. Religious beliefs mean communicating with others, having goals and meanings in life, and connecting with a semantic source of power.

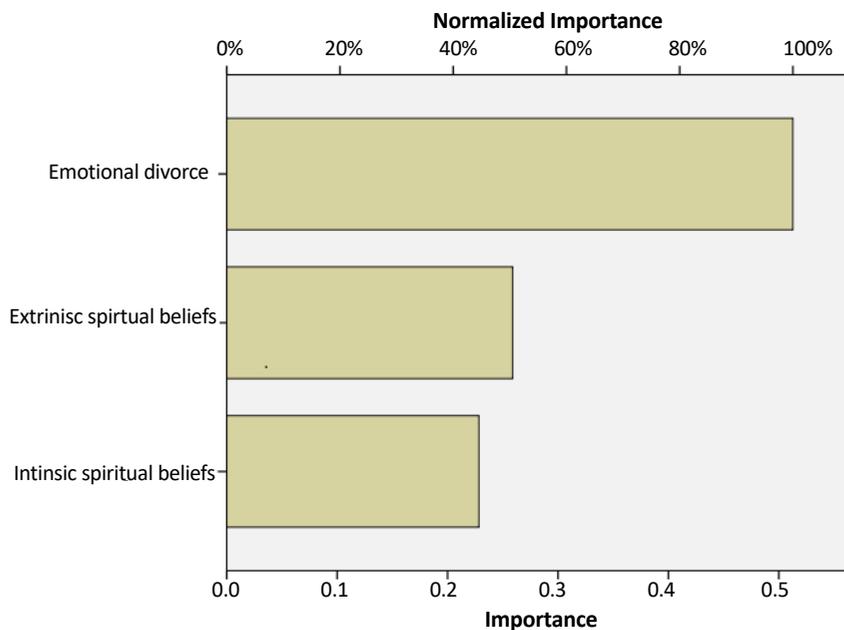


Figure 3. Network efficiency diagram

These beliefs can affect the behaviors, biochemistry, and physiology of humans [32].

According to our results, emotional divorce had the most significant relationship with depression symptoms of married university students, followed by extrinsic and intrinsic religious beliefs. Hence, the ANN properly predicts depression symptoms among married university students. Since university students account for an important group of society, their spiritual orientation can be key in improving mental health and coping with physical/mental disorders. It has also grown substantially, given the prevalence of depression and the enforcement of quarantine laws. However, no study has analyzed spiritual health and depression among married university students. In conclusion, certain behaviors, such as trusting God and saying prayers, can lead to inner peace and greatly alleviate situational anxiety by infusing hope and encouraging positive attitudes. In other words, spirituality can actively be effective in the coping process [31].

This study faced limitations, which should be evaluated to conduct further studies and reduce or eliminate research constraints. Since the statistical population included the married university students of Ahvaz, the results cannot be generalized to the married university students of other regions with different cultures and diverse cultural/personal characteristics. It is recommended that future studies control other effective variables, such as having children, age differences of spouses, and educational differences between spouses, to compare the results with the present study's findings. It is also recommended that this study be conducted in other cities. The results should then be compared.

Conclusion

According to the results, the ANN appropriately predicts depression symptoms through an emotional divorce and spiritual beliefs among married university students. Depression symptoms in married university students have multiple relationships with emotional divorce and intrinsic/extrinsic religious beliefs in married university students. The results indicated the necessity of paying more attention to marital relationships, emotional divorce improvement, and depression alleviation. These goals can be achieved by holding proper training workshops and courses. It is recommended that necessary arrangements be made to enhance the spiritual beliefs of university students.

Ethical Considerations

Compliance with ethical guidelines

The study was approved by the Ethics Committee of Islamic Azad University, Ahvaz Branch, (Code: IR.IAU.AHVAZ.REC.1401.012). Written informed consent was obtained from all participants, ensuring that the research data would be kept confidential and used anonymously, before conducting the research.

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Authors' contributions

Conceptualisation, study design, drafting the manuscript and supervision: Alireza Heidari; Analysis, data interpretation and statistical analysis: Behnam Makvandi; Critical revision of the manuscript, administrative, technical and material support: Parviz Asgari; Data gathering: Soheila Zakizadeh.

Conflict of interest

The authors declared no conflict of interest.

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