Relationship between psychological hardiness and self-efficacy in patients with type 2 diabetes: (The mediating role of self-esteem and social support) using structural equation modeling

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Abstract

According to the importance of type 2 diabetes and the variety and intensity of physical, mental, economic and social effects and factors such as psychological hardiness, self-efficacy, self-esteem, social support to manage treatment of this type of diabetes, this study is aimed in assessing the model of relationship of hardiness with self-efficacy with the mediating role of self-esteem and social support in these patients. In a cross-sectional survey, 212 patients with type 2 diabetes (90 male and 122 female) in Health Centers of Islmashahr were selected using available random sampling. The data collection was done using psychological hardiness scale, Coppersmith self-esteem inventory, self-efficacy and social support scales and the data were then analyzed using structural equation modeling (SEM) using Lisrel and SPSS-22 software. Correlation of main research variables were tested using Pearson correlation test and normality of variables were tested using regression analysis. Then, model fitness and coefficients of variables were measured. Most paths with significant coefficients were maintained in final model. The results obtained from the study are as follows: 1) psychological hardiness can affect self-efficacy directly 2) psychological hardiness can affect self-efficacy indirectly with the mediation of social supports and self-esteem 3) the proposed model is fit based on obtained fitness indices (GFI= 0.94; AGFI= 0.93; RMSEA= 0.032; NNFI= 0.94; SRMR= 0.031; NFI= 0.97 and IFI= 0.97). The correlations between variables in this study are mostly in consistence with the existing literature and theories. It could be concluded that variables such as psychological hardiness, self-efficacy, self-esteem and social support have been considered as effective factors to manage and treat patients with type 2 diabetes in domestic and foreign literature. The proposed model shows potential infrastructural mechanisms that can facilitate the process of treatment and better coping and even reduction of costs of the disease through training patients and their families under current social and economic conditions of Iran. Due to the applied significance of the results for clinical specialists and diabetes treatment centers, appropriate interventions are required in this filed. Paying attention to these results is important to enhance self-care behaviors of diabetes, reduction of complications and reduction of relevant costs and more importantly, general health of society.

Key words: type 2 diabetes, psychological hardiness, self-efficacy, self-esteem, social support

Introduction

Till before 20th century, majority of people used to being died as a result of acute infections and the life expectancy was low in chronic diseases. Although the life expectancy is increased at the current age, the probability of chronic diseases is also increased alongside.

In general, chronic disease refers to those types of diseases that are continued uncertainly and can't be prevented by vaccination and can't mostly be treated by drugs and treatment. Such long-term diseases can lead to continuous and progressing pain, suffering from disease and disability and reduction of quality of life.

In general, more than 65% of total mortality rate in 2012 has been because of chronic diseases (heart attack, stroke, cancer, chronic pulmonary diseases and diabetes) (WHO, 2012).

Although chronic diseases are most likely the output of complicated interaction of effects of genetic, behavioral and environmental factors; the evidences show that behavioral and environmental effects play more important role than biological effects in creation and continuity of chronic diseases.

Diabetes is a worldwide spread disease and it is being spread in all communities. The spread of diabetes in Iran is currently about 1.5million people and it is predicted that the rate reaches to 5.1million people by 2025. Due to high and increasing spread of the disease and its disabling complications and the impact of the disease in quality of life, it is necessary to investigate relevant factors of controlling the disease and improving quality of life of patients (American Diabetes Association (ADA), 2010).

Diabetes is heterogeneous group of metabolic diseases and its clear symptom is chronic increase in blood sugar and metabolic disorder of carbohydrate, fat and protein and as a result, some dysfunctions are created in insulin secretion or insulin action (ADA, 2006). The most serious complications of diabetes include retinal damage, blindness, peripheral neuropathy, pain in the feet and legs, stroke, myocardial infarction, peripheral vascular disease, end-stage kidney disease and amputations (WHO, 2006).

The main purpose of treatment is controlling blood sugar and preventing its complications and this could be realized through educating patients, changing their lifestyle (correct nutrition and sport activities), blood glucose self-monitoring, and scheduling regular appointments with specialists and using medications if necessary (ADA, 2005; Kennedy Levlen, 2006).

In all steps of prevention and mentioned treatments, except for medication, role of psychological factors like hardiness and self-efficacy is highlighted and play key role in different scopes of short-term prevention, long-term prevention, treatment scheduling, constant implementation of schedules and preserving the efforts for treatment (Bayer and Femaria, 2008).

Hence, this study tends to recognize the relations and effects of these psychological factors on each other and their effects in management of the chronic disease and has tried to explain the directions and significance of correlations of psychological factors in structural modeling, which could help doctors and specialists and even patients and their families in best way to achieve the above mentioned goals.

Methodology

Due to nature and desired goals, this study is a descriptive correlation research.

Statistical population and sample

Statistical population in this study consists of all people with type-2 diabetes in Islamshahr and surrounding settlements. The studied sample consists of 212 patients (122 female and 90 male) with type 2 diabetes. Sampling method in this study is random sampling from the patients referred to health centers of Islamshahr. At the first some information are provided for the patients and after gaining their consent, the questionnaires were distributed among them to fulfill them. According to theory of Kline (1989), at least 20 samples are considered per parameter in model, since there are 9 components and parameters in the model. Hence, for more external validity, sample size is considered to 212 people.

Measurement instruments

1-   Psychological Hardiness scale

The Kobasa's third-generation hardiness test (1984) is a 50-item scale containing 17 questions of commitment, 16 questions of challenge and 17 questions of control based on Likert scale and the questions are 4-choice questions.

In a study conducted by Maddy (1990), acceptable reliability is reported for hardiness scale. The relevant investigations show that the hardiness components including control, commitment and challenge have respectively reliability coefficients to 0.70, 0.52 and 0.52 and the coefficients are estimated to 0.75 for total hardiness (Jamhari, 2001).

2-   Self-efficacy scale

Sherer's self-efficacy scale contains 17 items and 15 points; point 1 refers to the option "totally disagree" and the point 14 refers to the option "totally agree" and higher points refer to stronger self-efficacy. Reliability of this scale was confirmed by Barati and Bakhtiari using correlation test of self-efficacy and internal-external control to V= 0.79 (Barati and Bakhtiari, 1997) and its validity was confirmed by scholars.

3-   Coppersmith self-esteem inventory

The 58-item inventory contains 4 fields of family self-esteem, educational self-esteem, general self-esteem and social self-esteem. The scoring style of the questionnaire is as 0 and 1. Finally, through summation of relevant items of each subscale and entire inventory, the points are measured. The inventory is tested in terms of validity and reliability in Iran. In this field, findings of Poorshafei (2012), Shini Jaberi et al (2014) and Kushki et al (2013) could be referred, which reported respectively Cronbach's alpha of 0.83, 0.81 and 0.80 for the instrument. In this study, total Cronbach's alpha is obtained to 90%.

4-   Philips' Social Support Appraisals (SS-A) Scale

The social support appraisals scale (SS-A) developed by Philips, Thompson, Williams and Stewart (1986) is the most well-known instrument in this field. The scale is also known as Wax Social Support Questionnaire (SS-A). The Philips' SS-A scale contains 23 items and the items are pointed in two ways. The questionnaire measures 3 scopes of social support: family, friends and others.

Family subscale contains 8 questions (2, 4, 4, 7, 9, 11, 13, 18 and 22), the friend subscale includes 7 questions (1, 6, 10, 15, 16, 19 and 23) and other items are related to support of other people.

Reliability of this scale is obtained to 0.84 by Razi (2007) using Cronbach's alpha. In this study, reliability coefficients of the SS-A scale are estimated by Cronbach's alpha and split-half method respectively to 0.75 and 0.71.

Procedure

After preparation of questionnaires and after determining sample size (due to the section of sample size and sampling method), the author and several assistants referred to health centers for several days and after preparing required coordination, the subject was explained to participants completely and in level of their understanding.

As total number of items is equal to 208, the average time of fulfilling the scales was predicted to 45min.

Statistical methods

For purpose of data analysis, in addition to relevant descriptive indices of each scale, structural equation modeling (SEM) is used to measure main research purpose. For purpose of data analysis, SPSS-22 and Lisrel software programs are used.

In this study, SPSS-22 is used for purpose of data analysis. Reliability of the instrument was measured using internal consistency of elements and evaluation of Cronbach's alpha. In the section of descriptive statistics, main research variables and demographic variables are described using statistical indices of frequency, frequency percent, mean value and standard deviation. Normality of research variables was tested using Kolmogorov-Smirnov test. In the section of inferential statistics and testing hypotheses, Pearson correlation and multivariate regression test (to test mediation) are used. Maximum p-value of alpha to test hypotheses is considered to ($p \leq 0.05$). for purpose of data analysis, in addition to relevant descriptive indices of each scale, SEM is used to test main research purpose.

Results

- In this study, 212 samples are selected including 120 male and 92 female (57% male and 43% female). 72% of sample individuals were married and 28% were single.
- Checking the birth place of samples showed that 24% of sample individuals are born in Islamshahr and 76% in other cities or surrounding settlements.
- In field of checking living place of participants, it could be found that 37% of participants live in islamshahr and 62% live in surrounding settlements.
- The educational level of participants was worrying; it means that 89% of participants had education degree below diploma (35% illiterate) and only 13% had educational levels higher than post-diploma.
- In terms of age, the mean value was obtained to 52 with SD of 8 years. The youngest person was 34 years old and the oldest person was 78 years old.
- Descriptive analysis of research variables based on central parameters (mean, median and mode) and distribution parameters (SD, variance and variation range) for main factors in presented in table 1.
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Table 1: descriptive analysis of research variables

	Number	Mean	Median	Mode	SD	Variance	Variation range	Min	Max
hardiness	212	3.409	3.458	3.458	0.548	0.300	2.917	1.958	4.875
Self-esteem	212	3.557	3.556	3.556	0.549	0.301	2.815	2.000	4.815
Social support	212	3.572	3.579	3.579	0.563	0.317	3.053	1.684	4.737
Self-efficacy	212	3.548	3.619	3.810	0.565	0.319	2.905	1.952	4.857

According to table 1, it could be found that 212 people have answers all research items truly. Moreover, maximum mean value is related to social support to 3.572 that is also higher than maximum likert range. The variation range varies from 1 to 4. Median and mode show that majority of respondents have selected options 3 and 4 as average and high level.

Inferential statistics

Inferential statistics are used to answer research questions and hypotheses. First, normality test is performed to specify that whether parametric methods could be applied or not. Then, appropriate statistical methods and mean population tests are used due to case.

Data normality test

Before using statistical tests, first normality test should be used, since normality of data should be proved before any kind of test performed with the assumption of normality of the data. While testing normality, H0 based on normal data distribution is tested with p-value of 5%. Hence, if significance level is ≥ 0.05, H0 is not rejected. In other words, data distribution is normal. The hypothesis of data normality in p-value of 5% is tested using Kolmogorov-Smirnov test. To test normality of data, statistical hypotheses are arranged as follows:

H_0: data distribution is normal

H_1: data distribution is not normal

As the studies using SEM are based on normality of data, here normality test is done at the first. In confirmatory factor analysis (CFA) and SE<, there is no need for normalization of all data, but also the factors (structures) should be normal (Kline, 2010)

Table 2: data normality test

	Hardiness	Self-esteem	Social support	Self-efficacy
N	212	212	212	212
Mean	3.409	3.557	3.572	3.548
SD	0.548	0.549	0.563	0.565
K-S test	1.062	1.110	1.254	1.506
Sig	0.210	0.170	0.086	0.056

According to table 2, in all cases, sig level is obtained higher than 0.05. Hence, there is no reason for rejecting H0; it means that distribution of measurement data for each dimension is normal. Therefore, parametric tests and CFA could be applied.

Confirmatory Factor Analysis (CFA)

CFA measures the correlation of items (items of questionnaire) with factors. In fact, until the time that it is not proved that items of questionnaire have measured latent variables properly, research hypotheses based on data of questionnaire could not be used. Therefore, to prove that the data are measured accurately, CFA is used. The intensity of correlation factor (latent variable) and observed variable is shown by factor load. Factor load is in range of (0, 1). If factor load is below 0.2, the correlation is weak and is neglected. The factor load between 0.2 and 0.6 is acceptable and if it is higher than 0.6, it is highly favorable (Kline, 1998). Minimum acceptable factor load in considered as 0.2 in some references; although the main criterion for judgment is t-value. If t-value is higher than critical value t=0.05 (1.96), the observed factor load is significant (e.g. refer to management applied statistics, Adel A and Momeni M, vol.2).

The next step is related to model fitness. One general index to measure free parameters in estimation of fitness indices is normal chi-square (x2) that is estimated through simple division of chi-square to DF. If the value is in range (1, 5), it is favorable (Schumacher and Lomax, 1988, 88; Kline, 2005, 59; quoted from Ghasemi, 2010: 162). Moreover, the RMSEA index is used as a main fitness index in most CFA analyses and SEM models. The index is favorable; if it is lower than 0.05.

Confirmatory factor analysis (CFA) of psychological hardiness

The results of CFA of hardiness are illustrated in figure 1. Observed factor load in all cases has a value higher than 0.3, which shows that the correlation between latent variables (dimensions of each main structure) with observed variables is acceptable.

According to measurement indices of each scale used at the confidence level of 5%, t-value is higher than 1.96 and shows that the observed correlations are significant.

RSMEA fitness index is obtained to 0.028, which is even lower than the level of 0.05. Normal chi-square (chi-square divided to df) is also obtained to 1.578 and is close to 1. Hence, observed structural model has good fitness.
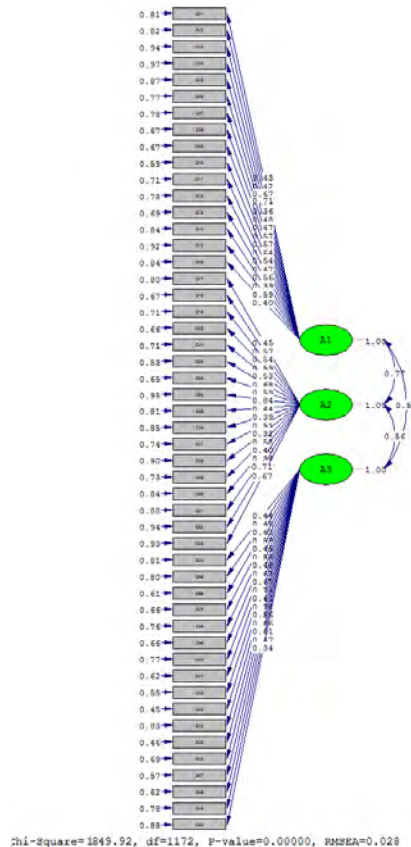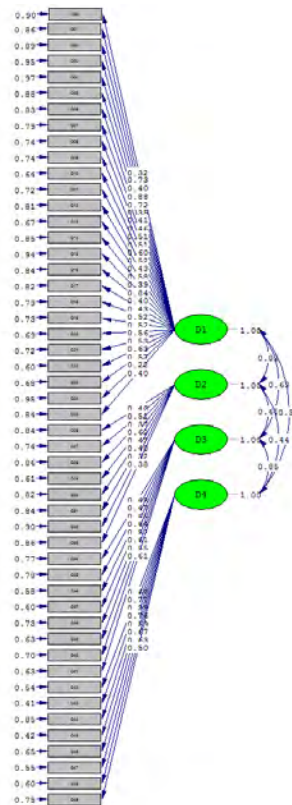

Figure 1: standard factor loads of psychological hardiness

Confirmatory factor analysis of self-esteem

The results obtained from CFA of self-esteem are illustrated in figure 2. The observed factor load more than 0.3 in all cases shows significant correlation between latent variable (dimensions of each main structure) and observed variable.

According to the results of measurement indices of each scale used at the confidence level of 5%, t-value is more than 1.96 and shows that the observed correlations are significant.

Fitness index of RSMEA is obtained to 0.042, which is even lower than 0.05 level. Normal chi-square (chi-square divided to df) is also obtained to 1.621 and is close to 1. Hence, observed structural model has good fitness.

Figure 2: standard factor loads of self-esteem

Confirmatory factor analysis of social support

The results obtained from CFA of social support are illustrated in figure 3. The observed factor load more than 0.3 in all cases shows significant correlation between latent variable (dimensions of each main structure) and observed variable.

According to the results of measurement indices of each scale used at the confidence level of 5%, t-value is more than 1.96 and shows that the observed correlations are significant.

Fitness index of RSMEA is obtained to 0.029, which is even lower than 0.05 level. Normal chi-square (chi-square divided to df) is also obtained to 1.610 and is close to 1. Hence, observed structural model has good fitness.

Confirmatory factor analysis of self-efficacy

The results obtained from CFA of self-efficacy are illustrated in figure 4. The observed factor load more than 0.3 in all cases shows significant correlation between latent variable (dimensions of each main structure) and observed variable.

According to the results of measurement indices of each scale used at the confidence level of 5%, t-value is more than 1.96 and shows that the observed correlations are significant.

Fitness index of RSMEA is obtained to 0.039, which is even lower than 0.05 level. Normal chi-square (chi-square divided to df) is also obtained to 1.368 and is close to 1. Hence, observed structural model has good fitness.
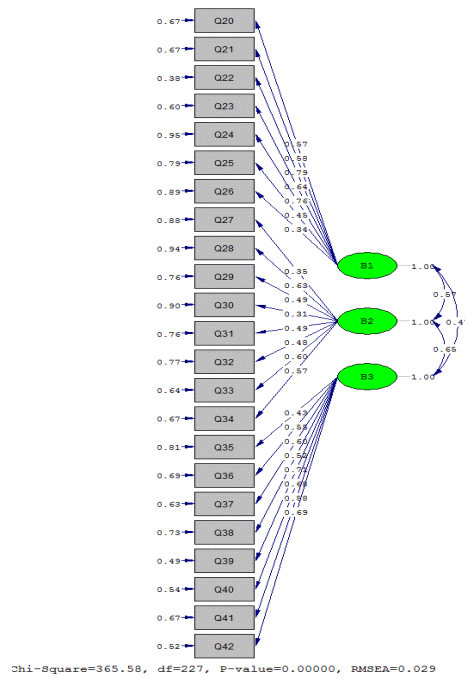
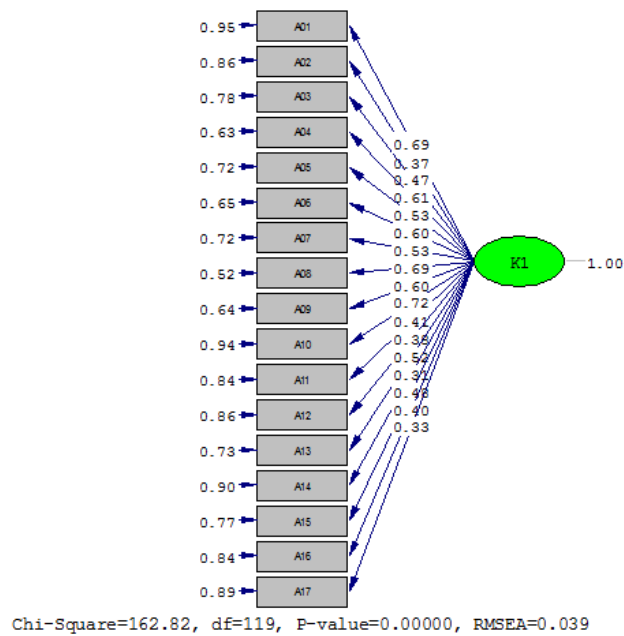**Figure 3: standard factor loads of social support**

Figure 4: standard factor loads of self-efficacy

Testing research questions

After confirmation of factor structure of research constructs, SEM is used to test the correlation between variables. The results obtained from analysis are presented separately. Moreover, total research model is also presented at the end.
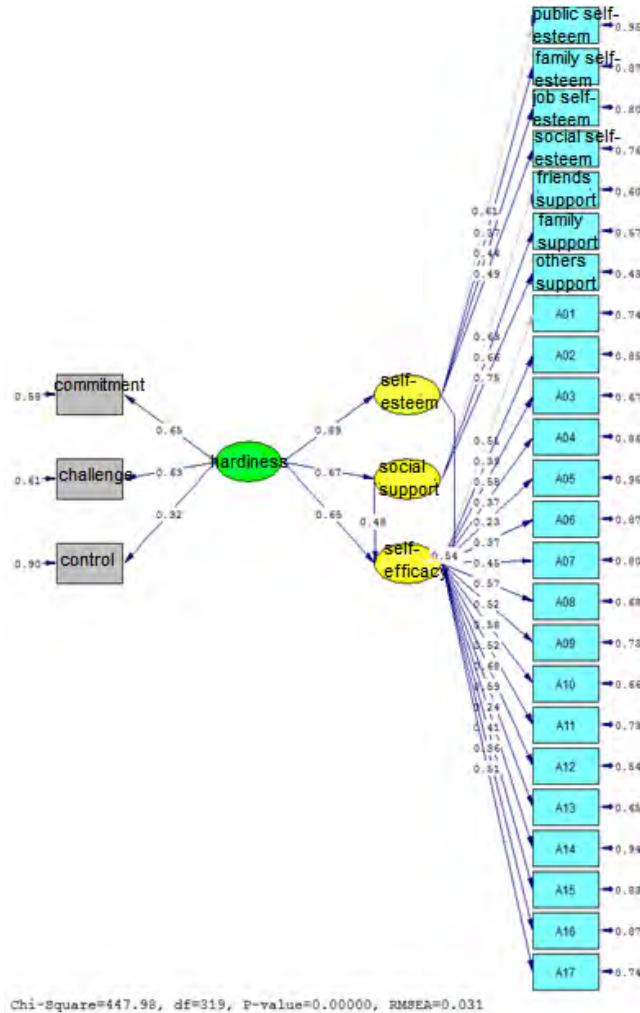

Chi-Square=447.98, df=319, P-value=0.00000, RMSEA=0.031

Figure 5: standard factor loads of testing research questions

Main research question:

Is the conceptual model fit to the collected data?

The above presented structural model is saturated in 3 steps. Fitness indices show favorable values. Normal chi-square value is also obtained to 1.404 and is in acceptable range (1-5). Hence, the structural model has good fitness.

$$\frac{\chi^2}{df} = \frac{447.98}{319} = 1.404$$

Moreover, as PMSEA fitness index is obtained to 0.031 and is lower than 0.05, the model has good fitness. Other indices of goodness of fit are also in acceptable range.

Table 3: indices of goodness of fit of structural model of main hypothesis

Fitness index	SRMR	RMSEA	GFI	AGFI	NFI	NNFI	IFI
Acceptable values	<0.05	<0.1	>0.9	>0.9	>0.9	>0.9	0 – 1
Calculated values	0.031	0.032	0.94	0.93	0.97	0.94	0.97

Secondary question 1:
Is hardiness correlated to self-efficacy?
The intensity of the correlation between hardiness and self-efficacy is estimated to 0.65 and is an acceptable value. The test value is also obtained to 7.98 and is more than critical t-value with p-value of 5% (1.96) and shows that the observed correlation is significant. Therefore, hardiness is significantly correlated to self-efficacy at the confidence level of 95%.

0.65

| Hardiness | → | Self-efficacy |

Figure 6: factor load of correlation between hardiness and self-efficacy

7.98

| Hardiness | → | Self-efficacy |

Figure 7: t-value of correlation between hardiness and self-efficacy

Secondary question 2:
Can the self-esteem mediate the correlation between hardiness and self-efficacy?
The intensity of the correlation between research variables is estimated to 0.48 and is an acceptable value. The test value is also obtained to 38.51 and is more than critical t-value with p-value of 5% (1.96) and shows that the observed correlation is significant. Therefore, self-efficacy can mediate the correlation between hardiness and self-efficacy at the confidence level of 95%.
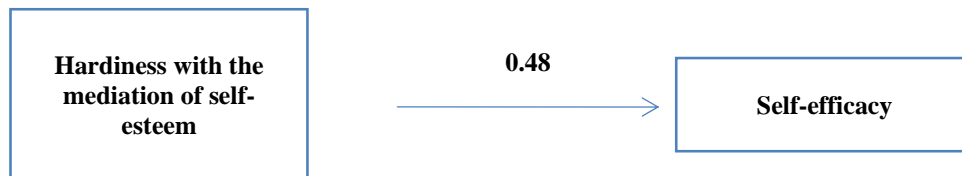
0.48

| Hardiness with the mediation of self-esteem | → | Self-efficacy |

Figure 8: factor load of hardiness and self-efficacy with mediation of self-esteem
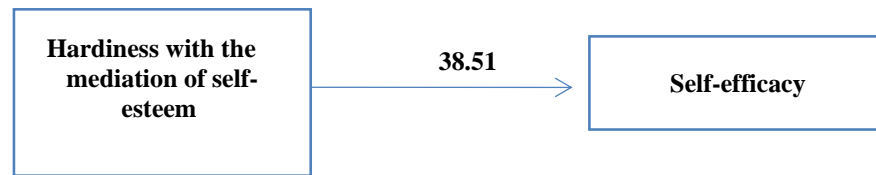
Figure 9: t-value of the correlation between hardiness and self-efficacy with the mediation of self-esteem

Secondary question 3:

Can social support mediate the correlation between hardiness and self-efficacy?

The intensity of the correlation between research variables is estimated to 0.32 and is an acceptable value. The test value is also obtained to 37.3 and is more than critical t-value with p-value of 5% (1.96) and shows that the observed correlation is significant. Therefore, social support can mediate the correlation between hardiness and self-efficacy at the confidence level of 95%.
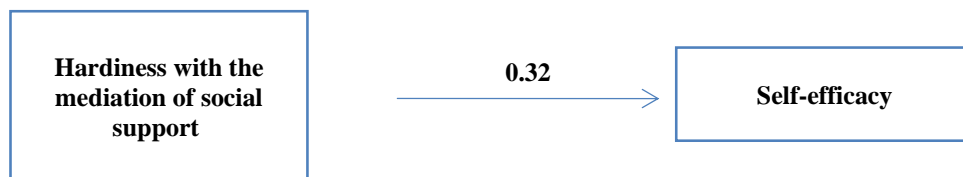

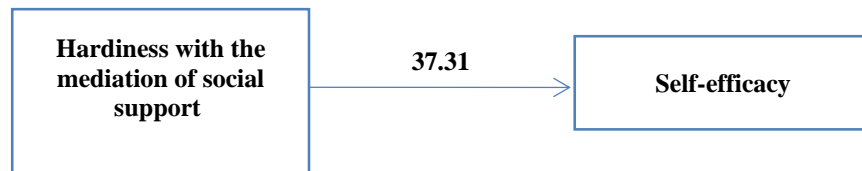**Figure 10: factor load of hardiness and self-efficacy with mediation of social support**

Figure 11: t-value of the correlation between hardiness and self-efficacy with the mediation of social support

Table 4: analysis of factor load of the correlation between hardiness and self-efficacy

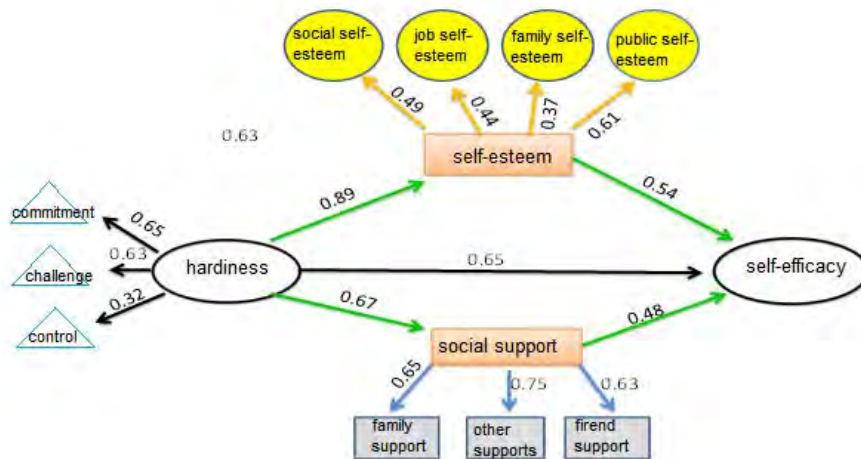| Predicting variable	Criterion variable	Direct effect	Indirect effect with mediation of self-esteem	Indirect effect with the mediation of social support
Hardiness	Self-efficacy	0.65	0.48	0.32

Figure 12: research model

Testing correlations between research variables

To test the correlations of variables, Pearson Product - Moment Correlation Coefficient is used.

Table 5: correlation of research variables

		Hardiness	Self-esteem	Social support	Self-efficacy
Hardiness	Correlation	1.000	0.741	0.734	0.738
	Sig	0.000	0.000	0.000	0.000
	Number	212	212	212	212
Self-esteem	Correlation	0.741	1.000	0.899	0.978
	Sig	0.000	0.000	0.000	0.000
	Number	212	212	212	212
Social support	Correlation	0.734	0.899	1.000	0.875
	Sig	0.000	0.000	0.000	0.000
	Number	212	212	212	212
Self-efficacy	Correlation	0.738	0.978	0.875	1.000
	Sig	0.000	0.000	0.000	0.000
	Number	212	212	212	212

Discussion and conclusion

The final research model created by different theories related to variables of hardiness and self-efficacy and fitted form of theoretical model could show the path of correlations between hardiness and self-efficacy and the path of mediation of self-esteem and social support in patients with type-2 diabetes. The most important finding of this study is: psychological hardiness can affect self-efficacy of patients with type-2 diabetes directly and can also affect self-efficacy of patients with type-2 diabetes indirectly through self-esteem and social support.

The results obtained from this study have shown the quality of the effect of components including hardiness, self-esteem and social support on each other. Most correlations between variables in this study have been in consistence with previous literature and existing theories. Some of the obtained correlations should be also tested in future and be developed and explained.

Final research model shows potential infrastructural mechanisms that can facilitate treatment and better coping and even reduction of treatment costs through training patients and their families in culture and social and economic conditions of Iran. Due to applied importance of the results for clinical specialists and the diabetes treatment centers, appropriate interventions are required in this field.

Considering the results could be useful for promotion of self-care behaviors of diabetes, reduction of complications, and reduction of relevant costs and more importantly, enhancement of general social health.

The model can affect health promotion and coping with type-2 diabetes and has acceptable fitness. In the treatment process, social team work, especially Health Psychologists, could be useful and efficient for psychological treatment of patients with type 2 diabetes. Therefore, due to importance of preservation and promotion of quality of life of patients with type 2 diabetes, measurement of hardiness with self-efficacy and self-esteem and social support and intervention to promote mental health and rehabilitation of these patients is advised for improvement and coping with the disease.

In this study, there was significant and positive correlation between hardiness and self-efficacy, self-esteem and social support. Hence, it could be found that patients with high hardiness could have better self-efficacy and in this regard, self-esteem and social support have had positive mediating role and are important and effective. In fact, high psychological hardiness and self-efficacy and sufficient social support and self-esteem of patients can make patients have health promotion and high quality of life.

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