**ORIGINAL ARTICLE**

# The Effect of Educational Intervention based on PEN-3 Model Constructs on Diabetic Preventive Behaviors in Pre-diabetic Women in Iran: A Field Trial Study

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## ABSTRACT

**Background:** The aim of this study was to determine the effect of educational intervention based on PEN-3 Model Constructs on diabetic preventive behaviors in pre-diabetic women in Iran.

**Methods:** The present study was a field trial study was conducted on 200 pre-diabetic women referred to health centers of Dezful city (Iran) during 2018 (intervention group, n= 100; control group, n= 100). A questionnaire based on PEN-3 model as well as Health-Promoting Lifestyle Profile (HPLP-II) questionnaire were used for data collection. The intervention group received training on diabetes prevention behaviors (nutritional functions and physical activity) in 8 face-to-face sessions. The control group did not receive any intervention. Three months after the intervention, data were collected again in both groups and analyzed by SPSS 24.

**Results:** The mean of weight, BMI, FBS and HbA1c in the intervention group were significantly lower than the control group after educational intervention (P-Value<0.05). The mean of the PEN-3 Model Constructs in the intervention group were significantly higher than the control group after educational intervention for nutritional behavior and physical activity (P-Value<0.05). The scores of knowledge as a perceptual dimension was a significant predictor for the score of the preventive behaviors (β=0.39), nutritional behaviors (β=0.24) and physical activity (β=0.29)

**Conclusions:** The educational intervention based on the PEN -3 model can be effective in increasing the level of perceptual (knowledge and attitude), enablers (structural factors), and nurturers (social factors) in pre-diabetic women and reduce the level of negative pattern structures and lead to improved diabetes preventive behaviors.

**Key words:** Educational Intervention, PEN -3 model, pre-diabetic, women, diabetic preventive behaviors, Iran

## INTRODUCTION

Diabetes is one of the most common chronic glandular diseases worldwide which characterized by chronic hyperglycemia and impaired metabolic activity due to insulin deficiency[1]. This disease is the main cause of blindness, advanced kidney disease and amputation, especially in the active years of life, and ultimately disability and premature death [2]. The prevalence of diabetes has increased considerably over the past decade, World Health Organization is estimated the number of people with diabetes will increase to over 438 million by 2030 [3]. There are more than 3 million people with diabetes in Iran and its prevalence is 7.3% in the population over 30 years. According to the report of WHO, the number of diabetics will reach more than 6 million people in Iran by 2030 [4-6]. Some studies have shown a higher prevalence of this disease in women compared to men in Iran and have recommended the study of this disease by gender [7]. Lack of healthy nutrition and sedentary lifestyle will lead to pre-diabetes and then diabetes. Prediabetes is a blood sugar disorder which the blood sugar range is between 125-100 mg / dL [8, 9]. People with prediabetes are 20 times more likely to develop diabetes than healthy people. In many people with pre-diabetics, proper diet and exercise can play a major role in controlling blood sugar and preventing diabetes [10-12].

There are many unhealthy behaviors in any society that can predispose people to various diseases. Therefore, people need to learn the right lifestyle to maintain health and prevent disease, which requires changing unhealthy behaviors to healthy behaviors and implementing training programs to achieve these behaviors [13-16]. Health education planners should adapt the design, implementation and evaluation of their health programs according to the cultural conditions of the study community because cultural sensitivity in health promotion and behavior change programs depends on adapting these programs to cultural conditions and frameworks [17, 18]. New approaches to health education emphasize that people's lifestyles are influenced by the culture of society. Researchers have proposed various theories and models to evaluate the determinants and factors influencing behavior. In this model, community culture is the main basis of preventive or health-promoting behavior. Attention to cultural diversity led to the introduction of the PEN-3 model. The model designer suggested that cultural differences in society should be taken into account when planning for educational intervention [17, 19, 20]. The PEN-3 model consists of three main domains that each domain

includes three factors forming the acronym PEN: 1- Cultural Identity: (Person, Extended Family, Neighborhood), 2- Relationships and Expectations: (Perceptions, Enablers, and Nurturers) and 3- Cultural Empowerment: (Positive, Existential and Negative) (Figure 1) [17, 21]. Given the nature of diabetes-preventing behaviors and the fact that the PEN-3 model places culture at the center of prevention or health-promoting behavior as well as the limited studies conducted in this field, the study was designed to determine the effect of educational intervention based on PEN-3 Model Constructs on diabetic preventive behaviors in pre-diabetic women in Iran.

## METHODS

**Study Design and Subjects:** The present study was a field trial study that aimed to determine the effect of educational intervention based on PEN-3 Model Constructs on diabetic preventive behaviors in pre-diabetic women in Iran. The study population included all pre-diabetic women referred to health centers of Dezful city (Iran) during 2018. Inclusion criteria consisted of age 65-30 years, informed consent to participate in the study, permanent residence in Dezful city to reduce loss to follow-up, fasting blood sugar (FBS) 100-125 mg / dl , HbA1c 5.7 – 6.5% and having an active record in the health center. Exclusion criteria consisted of having a special diet, prohibition of physical activity, known physical and mental illness and pregnant or lactating women.

**Data collection:** In addition, the checklist included demographic, anthropometric (weight and BMI), and biochemical variables (FBS and HbA1c), a questionnaire based on PEN-3 model as well as Health-Promoting Lifestyle Profile (HPLP-II) questionnaire were used for data collection. The validity and reliability of the questionnaire based on PEN-3 model was confirmed in the study conducted by Naghibi et al.[22]. Content Validity Ratio (CVR) and Content Validity Index (CVI) were approved with the advice of 10 experts with 0.62 and >0.79; respectively. Also, the reliability of the questionnaire was determined using Cronbach's alpha test which was greater than 0.7 for all structures by test-retest on 30 women.

The PEN-3 Model questionnaire for nutritional behaviors consisted of three sections. The first part consisted of 34 questions related to perceptual factors (knowledge and attitude 11 and 23 questions; respectively). The second part 11 questions related to enabler's factors; the third part consisted of 6 questions about nurturer factors. The questionnaire scoring method was the 5-point Likert scale (completely agree=4, agree=3, have no idea=2, disagree=1 and completely disagree=0) for the attitude factors, that the spectrum scores in this section were from 0 to 92. The "true=2, I do not know = 1 and false=0" options were used for questions of knowledge with range of scores 0 -22. Likewise, the "Yes=2, somewhat = 1 and No=0" options were used for questions of enabler's factors with range of scores 0 -22. The questionnaire scoring method was the 5-point Likert scale (very much=4, much=3, low=2, very low=1 and not at all=0) for the nurturer factors.

Likewise, the PEN-3 Model questionnaire was designed in three sections for physical activity. The first part consisted of 23 questions related to perceptual factors (knowledge and attitude 8 and 15 questions; respectively). The second part 7 questions related to enabler's factors; the third part consisted of 6 questions about nurturer factors. The scoring method of this questionnaire was the same as nutritional behaviors.

Finally, Health-Promoting Lifestyle Profile (HPLP-II) questionnaire which used for measuring health-promoting behaviors consisted of two parts: 1- nutritional function 2- physical activity function with 9 and 7 questions; respectively. The scoring method of the nutritional function was the 4-point Likert scale (always=4, mostly=3, sometimes=2 and never=1) with rang of scores 9 to 36. Likewise, the scoring method of physical activity function was the same as the nutritional function with rang of scores 7 to 28.

**Implementation of the Intervention:** First, a list of all urban-rural health centers in Dezful city was prepared, which were 14 centers. Then 4 centers were selected randomly, 2 centers were selected as intervention and 2 centers as control. Samples in the control and intervention groups were selected from 4 rural-urban centers that were located in 4 socio-culturally similar areas. The intervention group received training on diabetes prevention behaviors (nutritional functions and physical activity) in 8 face-to-face sessions. In the mentioned sessions, lecturing methods, group discussion, questions and answers, individual counseling and teaching aids (pamphlets and tracts) were used to provide information. Also, in order to motivate and strengthen social support, one of the literate members of the family was invited to attend the training sessions with the pre-diabetic woman. Four sessions of educational intervention were organized by a health education specialist and a nutritionist for nutritional behaviors consisted of familiarity with the generalities of the disease, types of sugars, food pyramid, benefits and obstacles to a healthy diet, and nutritional skills. Also, 4 sessions of educational intervention were designed by a health education specialist and a sports expert for physical activity consisted of the role of exercise and physical activity in health, maintaining health through physical activity, benefits of physical activity and planning for physical activity. In physical activity training sessions, they were asked to have a group walk by forming friendship groups. After the training sessions, the educational booklet for home study was given to the intervention group and the sports halls of the region were introduced and after 3 months, the questionnaires were completed again by the intervention and control groups. It should be noted that the control group did not receive any intervention. Also, before and after the intervention, blood samples were received from each of the women in the intervention and control groups then weight, FBS and HbA1c were measured.

**Statistical analysis:** For the descriptive analysis mean (S.D) and frequency (%) were used. Then, depending on the assumption of non-normality (according to Kolmogorov-Smirnov test), the Independent-Samples T-test or Mann–Whitney U test was used for comparison the means of the quantitative variables between two groups under study. For comparison of the qualitative variables in two group under study Chi-square test and Fisher's exact test were applied. Also, Pearson correlation coefficient was applied to determine the correlation between different behavioral scores with PEN-3 Model Constructs (perceptual, enablers,

and nurturer factors). Finally, multiple linear regression analysis was used to predict behavioral scores in based on PEN-3 Model Constructs. It should be noted that the SPSS24 software was used to data analysis and P-Value <0.05 was considered as a significant level.

**Ethics approval and consent to participate:** Before the intervention, the goals of the study were fully explained to the participants, then informed consent was obtained from them. This study was performed according to the principles expressed in the Declaration of Helsinki and was approved by the Deputy of Research and Ethics Committee of Yazd University of Medical Sciences (ID-number: IR.SSU.SPH.REC.1395.114).

## RESULTS

Table 1&2 shows the baseline characteristics (demographic, biochemical and anthropometric) in the intervention and control groups under study. The mean of age (SD) of intervention and control groups were 44.86 (5.75) and 46.84 (6.19) years; respectively. In both groups, the majority were married (75 vs. 69%). In terms of ethnicity, most people in both groups were Arabs (46 vs. 49%). Most of the people in both groups had no academic education (89 vs. 89%) and were housewife (56 vs. 61%). Also, 46 and 43% of women had a family history of diabetes in the intervention and control groups, respectively. Other details of the baseline variables can be seen in Table 1&2. Generally, there were no significant statistical difference between the two groups under study in terms of baseline variables of age, marital status, ethnicity, education, employment status, income level, household size, family history of diabetes, chronic diseases, weight, BMI, FBS and HbA1c before educational intervention (P-Value>0.05), which this lack of significant statistical difference between the two groups can be a reason that randomization process has occurred correctly (Table 1 & 2).

Table 2 shows the effect of educational intervention on biochemical and anthropometric variables in intervention and control groups. As can be seen, the results of Independent sample t test indicated that the mean of weight, BMI, FBS and HbA1c in the intervention group were significantly lower than the control group after educational intervention (P-Value<0.05).

Table 3 shows the effect of educational intervention on PEN-3 Model Constructs for nutritional behavior and physical activi ty in intervention and control groups. As can be seen, the results of Independent sample t test demonstrated that the mean of the PEN-3 Model Constructs (knowledge, attitude, enablers and nurturers factors) in the intervention group were significantly higher than the control group after educational intervention for nutritional behavior and physical activity (P-Value<0.05). In addition, the results of Independent sample t test demonstrated that the mean scores of the preventive behaviors, nutrition and physical activity in pre-diabetic women of the intervention group were significantly higher than the control group after educational intervention (P-Value<0.05) (Table 4).

Table 5 shows Pearson correlation coefficients between different behavioral scores with perceptual, enablers, and nurturer factors in pre-diabetic women. As can be seen, the score of preventive behaviors was significantly correlated with the scores of perceptual, enablers, and nurturer factors (P-Value<0.05). Also, the score of nutritional behaviors was significantly correlated with the scores of perceptual, and nurturer factors (P-Value<0.05). However, the score of physical activity was not significantly associated with perceptual, enablers, and nurturer factors (P-Value>0.05).

Multiple linear regression analysis showed that among different PEN-3 constructs, the scores of knowledge as a perceptual dimension was a significant predictor for the score of the preventive behaviors (β=0.39 ), nutritional behaviors (β=0.24 ) and physical activity (β=0.29 ). As well as, the scores of nurturers factors was a significant predictor for the score of the physical activity (β=0.19). Other variables were not significant predictors (Table 6).

## DISCUSSION

The aim of this study was to determine the effect of educational intervention based on PEN-3 Model Constructs on diabetic preventive behaviors in pre-diabetic women in Iran. The results of this study showed that the mean of weight, BMI, FBS and HbA1c in the intervention group were significantly lower than the control group after educational intervention (P-Value<0.05). The mean of the PEN-3 Model Constructs in the intervention group were significantly higher than the control group after educational intervention according to nutritional behavior and physical activity (P-Value<0.05). The score of preventive behaviors was significantly correlated with the scores of perceptual, enablers, and nurturer factors (P-Value<0.05). Also, the score of nutritional behaviors was significantly correlated with the scores of perceptual, and nurturer factors (P-Value<0.05). in addition, multiple linear regression analysis showed that among different PEN-3 constructs, the scores of knowledge as a perceptual dimension was a significant predictor for the score of the preventive behaviors (β=0.39 ), nutritional behaviors (β=0.24 ) and physical activity (β=0.29).

Studies have shown that the use of a theoretical framework in health-oriented interventional research can be useful because the use of health education theories helps to increase the effectiveness of intervention programs and better organize them [23]. In the present study, after the educational intervention, the mean knowledge scores of nutritional behaviors and physical activity in the intervention group increased significantly, but this difference was not seen in the control group, these findings reflects the positive impact of the training program which are consistent with the results of similar studies conducted in this field , because the majority of studies have shown that educational intervention has played an effective role in increasing the knowledge of nutritional behaviors and physical activity of population under study [24-30]. Increasing the knowledge score in the intervention group can be valuable because having enough knowledge to promote diabetes-preventive behaviors, including having a proper diet and regular physical activity in pre-diabetic people is a key factor in changing behavior. However, knowledge alone is not enough to perform long-term health-promoting behaviors and individual attitudes or beliefs and other psychosocial factors and changes in

negative attitudes to adopt these behaviors are very important that should be considered in the prevention of type 2 diabetes in pre-diabetics [31-33].

A likewise, the mean attitude scores of nutritional behaviors and physical activity were significantly higher than the control group after educational intervention. These findings were in line with other similar studies in this area [24, 25, 34-37]. Studies have suggested when people feel that performing a behavior leads to positive health consequences (such as weight loss, physical health, reducing treatment costs, blood sugar control, etc.) they adopt and maintain that behavior [29, 34].

This study showed the mean scores of enabling factors (existence of resources for following a healthy diet and optimal physical activity) for nutritional behaviors and physical activity in the intervention group were significantly higher than the control group which this finding was consistent with other similar studies in this field, because these studies have shown that enabling factors are effective in the formation of optimal nutritional behaviors and physical activity [38-41]. In addition, the mean scores of nurturer's factors (support and encouragement from family, friends, and health care providers) in the intervention group were significantly higher than the control group after educational intervention for nutritional behaviors and physical activity which was similar to studies conducted in this field. These studies have reported that adequate social support through participation and social interaction affects health-promoting behaviors and leads a person's actions and thoughts to perform the correct behaviors [42, 43]. Therefore, it can be said that educational interventions, regardless of structural and social factors, only increase people's awareness and will fail to promote healthy behaviors.

The mean scores of nutritional function and physical activity in the intervention group 3 months after the educational intervention were significantly higher than the control group, which was in line with almost similar studies conducted in this field [44-47] , which reflects the effect of educational intervention on these functions.

Finally, our findings demonstrated the mean scores of weight, BMI, FBS and HbA1c in the intervention group were significantly lower than the control group after educational intervention. These findings were consistent with other educational interventions based on different educational models. For example, Crithley CR et al. [48] and Aghamolaei T et al. [49] showed that lifestyle-based educational interventions promote nutritional behaviors and weight loss in pre-diabetic individuals. A likewise , the results of Gallegos EC et al. [50] , Salinero-Fort MA et al. [51] and Kyzer, H et al. [51] showed that self-care training and educational intervention reduced the mean of glycosylated hemoglobin in the intervention group compared to the control group. The positive effect of educational intervention in lowering blood sugar can also be found in the findings of Sharifirad G et al. [52] , Peyman N et al [53] . and Hazavehei MM et al [54].

This study, like other studies, has limitations. First, the generalizability of the results should be done with caution because PEN-3 is a model of cultural planning and the culture of the studied society is somewhat different from the Iranian society in terms of linguistic and ethnic characteristics, which can affect the nutritional behaviors and physical activity. Second, due to the lack of similar studies, was not possible to discuss and compare extensively. Third, data collection through questionnaires and self-report can always be associated with some errors and participants do not express the information honestly.

## CONCLUSION

The educational intervention based on the PEN -3 model can be effective in increasing the level of perceptual (knowledge and attitude), enablers (structural factors), and nurturers (social factors) in pre-diabetic women and reduce the level of negative pattern structures and lead to improved diabetes preventive behaviors.

**Declarations**

**Conflict of Interest:** The authors declare that they have no competing interests.

**Ethics statement:** Before the intervention, the goals of the study were fully explained to the participants, then informed consent was obtained from them. This study was performed according to the principles expressed in the Declaration of Helsinki and was approved by the Deputy of Research and Ethics Committee of Yazd University of Medical Sciences (ID-number: IR.SSU.SPH.REC.1395.114).

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**Table 3. The effect of educational intervention on PEN-3 Model Constructs for nutritional behaviors and physical activity in intervention and control groups**

| Variables | | Groups | | P-Value* |
|---|---|---|---|---|
| | | Interventional (%) | Control (%) | |
| Age (year) | 30 – 39 | 32 (32) | 26 (26) | 0.254 |
| | 40 – 49 | 37 (37) | 32 (32) | |
| | 50 – 59 | 25 (35) | 38 (38) | |
| | ≥ 60 | 6 (6) | 4 (4) | |
| Marital status | Single | 6 (6) | 12 (12) | 0.522 |
| | Married | 75 (75) | 69 (69) | |
| | Divorced | 8 (8) | 8 (8) | |
| | Widow | 11 (11) | 11 (11) | |
| Ethnicity | Persian | 25 (25) | 20 (20) | 0.717 |
| | Lur | 29 (29) | 31(3) | |
| | Arab | 46 (46) | 49 (49) | |
| Education | Illiterate | 27 (7) | 24 (24) | 0.646 |
| | Primary school | 17 (17) | 26 (26) | |
| | Middle school | 24 (24) | 21 (21) | |
| | Diploma | 21 (21) | 18 (18) | |
| | Academic | 11 (11) | 11 (11) | |
| Employment status | Housewife | 56 (56) | 61 (61) | 0.620 |
| | Employee | 13 (13) | 9 (9) | |
| | Other | 31 (31) | 30 (30) | |
| Income level (Rials) | <1000000 | 26 (26) | 31 (31) | 0.648 |
| | 1000000 – 2000000 | 45 (45) | 43 (43) | |
| | >2000000 | 29 (29) | 26 (26) | |
| Household size | ≤4 | 49 (49) | 45 (45) | 0.793 |
| | 5-6 | 44 (44) | 46 (46) | |
| | >6 | 7 (7) | 9 (9) | |
| Family history of diabetes | Yes | 46 (46) | 43 (43) | 0.776 |
| | No | 54 (54) | 57 (57) | |
| Chronic diseases | Yes | 42 (42) | 44 (44) | 0.776 |
| | No | 58 (58) | 56 (56) | |
| Type of chronic disease | Hypertension | 20 (47.60) | 25 (56.80) | 0.729 |
| | Hyperlipidemia | 22 (52.40) | 19 (43.20) | |
| *:Chi-square test | | | | |

Table 2. The effect of educational intervention on biochemical and anthropometric variables in intervention and control groups

| Variables | Time | Interventional Group | Control Group | P-Value** |
|---|---|---|---|---|
| | | Mean ± S.D | Mean ± S.D | |
| Weight (kg) | Before | 70.05 ± 10.71 | 70.06 ± 10.75 | 0.979 |
| | After | 69.61 ± 10.70 | 70.05 ± 10.76 | 0.001 |
| BMI (kg/m2) | Before | 27.23 ± 4.29 | 27.13 ± 4.09 | 0.863 |
| | After | 27.06 ± 4.29 | 27.11± 4.09 | 0.001 |
| FBS (mg/dL) | Before | 110.14 ± 6.19 | 108.71± 6.35 | 0.108 |
| | After | 101.16 ± 7.40 | 111.57 ±6.59 | 0.001 |
| HbA1c | Before | 6.06 ± 0.24 | 6.03 ± 0.26 | 0.399 |
| | After | 6.02 ± 0.25 | 6.05 ± 0.27 | 0.015 |
| *S.D : Standard Deviation<br>** : Independent sample t test | | | | |

| Behavior | PEN-3 Model Constructs | | Time | Interventional Group | Control Group | P-Value** |
|---|---|---|---|---|---|---|
| | | | | Mean ± S.D | Mean ± S.D | |
| Nutritional behaviors | Perceptual Factors | Knowledge | Before | 10.84 ± 6.99 | 11.72 ± 6.65 | 0.363 |
| | | | After | 18.02 ± 5.15 | 11.52 ± 6.25 | 0.001 |
| | | Attitude | Before | 59.00 ± 14.45 | 62.35 ± 15.21 | 0.194 |
| | | | After | 75.09 ±9.98 | 60.54 ± 14.80 | 0.001 |
| | Enablers Factors | | Before | 6.80 ± 6.30 | 6.67 ± 5.78 | 0.870 |
| | | | After | 13.11 ± 7.20 | 6.20 ± 4.60 | 0.001 |
| | Nurturers Factors | | Before | 25.50 ± 8.16 | 25.40 ± 10.21 | 0.930 |
| | | | After | 38.75 ± 6.70 | 25.84 ± 10.60 | 0.001 |
| Physical activity | Perceptual Factors | knowledge | Before | 8.73 ± 3.96 | 8.31 ± 5.64 | 0.544 |
| | | | After | 11.76 ± 3.75 | 7.70 ± 5.84 | 0.001 |
| | | Attitude | Before | 39.22 ± 13.60 | 41.69 ± 12.60 | 0.180 |
| | | | After | 50.19 ± 10.60 | 42.20 ± 11.85 | 0.001 |
| | Enabler Factors | | Before | 4.99 ± 2.70 | 5.56 ± 2.33 | 0.097 |
| | | | After | 7.26 ± 2.55 | 5.54 ± 2.27 | 0.001 |
| | Nurturers Factors | | Before | 25.98 ± 7.18 | 27.03 ± 8.64 | 0.310 |
| | | | After | 40.54 ± 6.74 | 28.18 ± 6.83 | 0.001 |

*S.D : Standard Deviation
** : Independent sample t test

Table 4. Comparison of the mean scores of preventive behaviors, nutrition and physical activity in pre-diabetic women before and after educational intervention in two groups of intervention and control

| Variables | Time | Interventional Group | Control Group | P-Value** |
|---|---|---|---|---|
| | | Mean ± S.D | Mean ± S.D | |
| Preventive behaviors | Before | 31.27 ± 7.08 | 31.29 ± 6.47 | 0.983 |
| | After | 38.86 ± 8.85 | 31.26 ± 5.70 | 0.001 |
| Nutritional behaviors | Before | 18.74 ± 5.24 | 18.27 ± 4.11 | 0.679 |
| | After | 23.96 ± 7.01 | 18.36 ± 4.50 | 0.001 |
| Physical activity | Before | 12.53 ± 3.01 | 13.02 ± 3.12 | 0.260 |
| | After | 14.09 ± 3.03 | 12.90 ± 2.80 | 0.001 |

*S.D : Standard Deviation
** : Independent sample t test

Table 5. Pearson correlation coefficients between different behavioral scores in pre-diabetic women with perceptual, enablers, and nurturer factors

| PEN-3 Model Constructs | | Preventive behaviors | | Dietary behaviors | | Physical activity | |
|---|---|---|---|---|---|---|---|
| | | r* | P-Value | r | P-Value | r | P-Value |
| Perceptual Factors | Knowledge | 0.527 | 0.001 | 0.445 | 0.001 | 0.322 | 0.005 |
| | Attitude | 0.451 | 0.001 | 0.390 | 0.002 | 0.248 | 0.001 |
| Enablers factors | | 0.348 | 0.001 | 0.318 | 0.265 | 0.079 | 0.240 |
| Nurturers factors | | 0.369 | 0.001 | 0.365 | 0.001 | 0.230 | 0.001 |

*r: Pearson correlation coefficient

Table 6. Multiple linear regression analysis to predict of the behavioral scores in pre-diabetic women based on perceptual, enabling and nurturer factors

| PEN-3 Model Constructs | | Preventive behaviors | | | | Dietary behaviors | | | | Physical activity | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | β* | P-Value | t | ** $R^2$ | β | P-Value | t | $R^2$ | β | P-Value | t | $R^2$ |
| Perceptual Factors | Knowledge | 0.39 | 0.001 | 4.42 | 0.30 | 0.24 | 0.004 | 2.80 | 0.122 | 0.29 | 0.001 | 3.68 | 0.25 |
| | Attitude | 0.06 | 0.506 | 0.67 | | 0.04 | 0.510 | 0.44 | | 0.11 | 0.228 | 1.29 | |
| Enablers factors | | 0.05 | 0.514 | 0.65 | | -0.008 | 0.945 | -0.11 | | 0.06 | 0.351 | 0.76 | |
| Nurturers factors | | 0.13 | 0.078 | 1.77 | | 0.13 | 0.259 | 1.67 | | 0.19 | 0.003 | 2.72 | |

β*: β- coefficient
** $\mathbf{R^2}$ : coefficient of determination

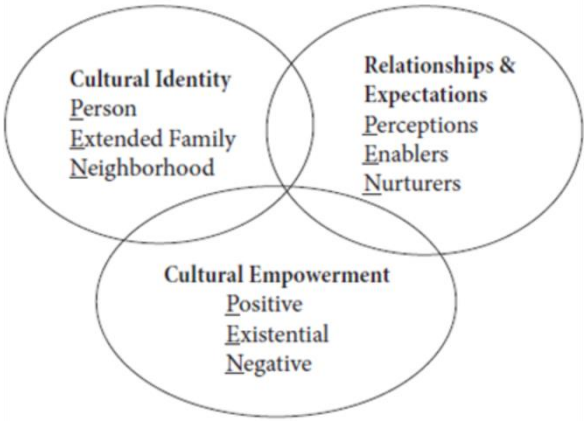


Figure 1. The PEN-3 Model and its various domains