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Effect of Diabetes Education on Type 2 Diabetic Patients' Disease Knowledge at Suez Canal University Hospitals

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Abstract

Background: With the alarming soaring statistics of diabetes mellitus, type 2 diabetic patients in a real need to control associated morbidity and mortality. The aim of this study was to measure the effect of diabetes education on type 2 diabetic patients' disease knowledge at Suez Canal University Hospitals. Subjects and Methods: Aquasi-experimental design made up of a control group and a study group with pre- and post-test judgment was applied. The study included 92 type 2 diabetic patients. The socio-economic scale and the diabetes knowledge questionnaire were used for data collection in the two groups. Then the educational program was used in the intervention group. The diabetes knowledge questionnaire was administered in two groups at baseline and after sessions completion. Results: revealed that differences regarding socio-demographic characteristics were statistically insignificant, except for age and educational level for the studied sample groups. Also indicated rare statistical significant difference regarding family history of diabetes and diabetes related complications for the studied sample groups. There were negative statistical significance associations in the following cases for the study group; age, occupational status, whereas for the control group, they were positive statistical significance associations in the following cases; educational level & socio-economic level. there was only positive statistical significance association between the total score of knowledge and treatment regimen of the control-group. Conclusion: Those patients who received educational program achieved better total score of knowledge & knowledge related practice about DM, compared with the control group, therefore it is proposed to conduct specialized educational program workshops about importance of diet & exercises, blood glucose monitoring, adherence to medications and diabetic foot care to decrease the incidence of complications.

Keywords: Diabetes education; Type 2 diabetes mellitus; Diabetes knowledge questionnaire.

1. Introduction

Diabetes Mellitus (DM) is a complex, chronic disease that caused by inherited and/or acquired deficiency in production of insulin by the pancreas or by the ineffectiveness of the insulin produced; both require continuous medical care with multifactor risk-reduction strategies beyond glycemic control. It is defined as a metabolic disorder caused by different factors and is characterized by hyperglycemia (elevated level of blood glucose) with disturbances in carbohydrate, fat and protein metabolism [1, 2].

It is expected that the threat of diabetic mellitus continues to increase worldwide due to various factors such as the socio-economic changes (sedentary lifestyle), urbanization and the increase of life expectancy for diabetic patients. It was estimated that 451 million people (adults aged between 18-99 years) had DM in 2017 whereas the prevalence of DM is expected to grow to 693 million by 2045. The major growth is expected to take place in countries of dynamic economies that move from low to middle income levels [3].

In developing nations, the rate of non-communicable diseases (NCDs) connects with the degree of modernization and the changes of ways of life (i.e., unhealthy diets and physical inactivity), causing 32 million of global non-communicable disease deaths occur. Evidence indicates that 15 million of all deaths related to NCDs occur largely between the ages of 30 and 69 years [4].

It is universally known that Type 2 diabetes mellitus (T2DM) is considered the commonest form of diabetes, affecting all classes of the society. It is the greatest contributor to the burden of diabetes globally accounting for up to 90% of people with diabetes worldwide. The prevalence is becoming alarmingly high among younger age groups. Approximately 1.9% of the global disability adjusted life years (DALY) is attributed to diabetes [5].

If T2DM is ineffectively controlled, it'll raise the risk ratios of various diabetes-related complications such as coronary artery disease, stroke, visual deficiency, renal failure and foot amputation driving to increased morbidity.

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Luckily, these complications can be controlled and anticipated by intense glycemic control [6]**.** There is a real need to design planned diabetes educational program to enhance patients' knowledge about T2DM [7]**.** Those patients necessities lifelong medical and nursing intervention so, this study aimed to measure the effect of diabetes education on type 2 diabetic patients' disease knowledge and knowledge related practice at Suez Canal University Hospitals

2. Subjects and Methods

2.1. Research Design

A quasi-experimental design was used to conduct the present study.

2.2. Research Setting

The study was conducted at the Family Medicine Outpatient Clinic and the Diabetic Outpatient Clinic of Suez Canal University Hospitals, which are considered teaching referral tertiary hospitals at Ismailia city in Egypt. These clinics provide research, preventive and curative services according to the patients' condition on a monthly basis.

2.3. Study Sample

The sample size was calculated according to Wassertheil-Smoller [8] as the following equation:

$$n = \frac{(p_1 q_1) + (p_2 q_2)}{(p_2 - p_1)^2} \times f(alpha, power) \text{ x } 2$$

Where:

n= sample size

f = the value of (alpha, power) for a two-tailed test = 11.7

p_1 = 59% (rate of improvement with structured lifestyle modification plan) [9].

p_2 = 14% (rate of improvement with unstructured plan) [9].

$q_2 = 1 - p_2$;

n (sample size) was 41 patients in each group (41 patients in the control group and 41 patients in the study group). After adding 10 % dropout, each group was consisted of 46 patients.

Total number of the study sample was 92 type 2 diabetic patients (half of them "46" were in the control group and the second half were in the study group) at the Family Medicine Outpatient Clinic and the Diabetic Outpatient Clinic of Suez Canal University Hospitals who were purposively selected according to the following:

Inclusion criteria: Newly diagnosed type 2 diabetic patients, ≤ 5 years; aged 30 years or older; treated with diet regime and /or oral hypoglycemic agents only; agreed to participate in the study.

Exclusion criteria: Had a history of psychiatric disorders; attended to previous diabetes education.

2.3.1. Study Tools

Two tools were used to collect the study data:

Tool 1: A structured- interview questionnaire: Which was developed by the researcher to include two parts: ***Part I:*** Socio-demographic data: It was constructed by the researcher to include socio-demographic characteristics of the study group such as gender, age, marital status, family type, residence educational level, and occupational status. The socio-economic scale was developed by El-Gilany, *et al.* [10] which included including 7 domains (education and cultural domain, occupation domain, family domain, family possessions domain, home sanitation domain, economic domain and health care domain) with a total score of 84. The socio-economic level was classified into 4 levels: " very low, low, intermediate and high" depending on the quartiles of the score calculated to assess the socio-economic status (i.e., very low level ≤ 21, low level 22 – 42, intermediate level 43 – 63, and high level 64 – up to 84). ***Part II:*** Diabetes history data which was constructed by the researcher to collect data related to duration of the previous diagnosis of diabetes, family history of diabetes, presence of diabetes related complications, presence of previous surgical history, presence of hypoglycemia, following a planned diet, physical activity regularity, glucose monitoring regularity, treatment regimen, medication adherence and regular follow up.

Tool II: The Diabetes Knowledge Questionnaire (DKQ): Which is a 24-item test developed by the Starr County Texas, Diabetes Education Study. Possible answers to each question were: yes, no, and I don't know. The items were scored with one point given for a correct answer and zero points given for an incorrect answer or (I don't know response). The score ranges from 0 to 24; the higher score, the greater the knowledge [11]. It was used two times to assess type 2 diabetic patients' disease knowledge and knowledge related practice.

2.4. Ethical Considerations

All relevant ethical issues are considered for ensuring patients' privacy and confidentiality of the collected data during the study. The purpose of the study and the importance of intervention in diabetes were explained to each patient, and then an oral consent for participation in the study was obtained from each one of them. Voluntary participation and right to refuse to participate in the study and withdrawn at any time was emphasized to the patients.

2.5. Tools Validity and Reliability

It was be ascertained by five expertise of professors and lecturers from community health nursing and medical staff who were reviewed the tools content for clarity, relevance, comprehensiveness, and understandable. To assess

reliability of the Diabetes Knowledge Questionnaire, test re-test reliability was computed and found to be 0.76. The questionnaire was translated from English into Arabic to help the patient understand them.

2.6. Pilot Study

A pilot study was conducted on ten type 2 diabetic patients from the Family Medicine Outpatient Clinic and the Diabetic Outpatient Clinic of Suez Canal University Hospitals to test the tools for its clarity, organization, applicability and to determine the length of time needed to collect the data. They were later excluded from the sample. The purpose of the pilot study was to test the clarity and applicability of the study tools and to determine the time needed to fill out the questionnaire sheet.

2.7. Procedure

Official written permissions to conduct this study were obtained from the director of Suez Canal University Hospitals and the director of outpatient clinics in Ismailia city. Subjects who met the criteria for inclusion and exclusion were approached by the researcher. At that time, the purpose and nature of the study were explained. The course of study was conducted through four phases: Assessment, planning, implemmentation and then ended with the evaluation. Collection of the data covered a period of seven months from 1st of November 2018 until the end of May 2019. Data were collected on socio-demographic data related to gender, age, education…etc. Also disease related information and pre-test Diabetes Knowledge Questionnaire were assessed for each subjects before exposure to diabetes education program. The researcher interviewed and crammed the form for every diabetic patient one by one. The average time taken for filling each sheet was approximately 10-15 minutes. Each patient was reassured that the information obtained was confidential and would be used only just for the aim of the study. The studied sample groups were divided into two groups and the program was conducted for the study group. The study group divided into six small subgroups (6 to 7 patients/group). The study cluster was exposed to the diabetes educational program that were eight Arabic sessions (two times per month per group) extending for four months during the period from the beginning of February 2018 to the end of January 2019 (with a single session per time) including the following: Definition, classification and etiology of diabetes mellitus; definition and signs & symptoms of type 2 diabetes mellitus; treatment regimen for type 2 diabetic patients; complications of diabetes mellitus, hyperglycemia and hypoglycemia; healthy nutrition; physical activity; self-monitoring of blood glucose level; self-care for type 2 diabetic patients to achieve the desired glycemic control. The length of every session was variable considering patients and their conditions, approximately 30:35 minutes. Teaching strategies comprised lectures, group discussions on individual experiences and demonstrations. The program was bestowed in clear, concise and targeted on the purpose of learning, using an Arabic booklet. Evaluation of the program impact was then tested. Data were collected concerning patients' knowledge & knowledge related practice immediately after completion of the program using the same tool which was used in the pre-test.

2.8. Statistical Analysis

The researcher has the collected data organized, categorized, tabulated, processed, and analyzed by the use of Statistical Package for Social Sciences version 22, (SPSS Inc., and Chicago, IL). Descriptive statistics were bestowed as frequency, percentage, mean, standard deviation. Independent t-test and paired t-test, and Kendall Tau Correlation Coefficient to test statistical significance of some variables and test effectiveness of the program. P-value < 0.05 indicates significant results.

3. Results

Table (1) revealed that differences regarding socio-demographic characteristics were statistically insignificant, except for age (P-value<0.020) and educational level (P-value<0.019) for the studied sample groups. The distribution between the studied sample groups was homogeneous foremost sub-class groups.

Figure (1) illustrated that more than half of the studied sample groups (56.5 %) were of low socio-economic status level (i.e., their score was 22 – 42); whereas least fraction (the minority of them) (3.3 %) were of very low socio-economic status level (i.e., their score was ≤ 21).

Results also indicated rare statistical significant difference (*i.e.* family history of diabetes, P-value<0.047; diabetes related complications, P-value<0.034) for the studied sample groups. The distribution between the studied sample groups was homogeneous for most sub-class groups (Table 2).

Table (3) showed that the highest correct patients' answers of the control-group were equally for the two questions; Q15 '*Cuts and abrasions on diabetes heal more slowly*' and Q20 'Diabetics should take extra care when cutting their toenails' (being equivalently 43 individuals; 93.5%). Paralleled with the former results of the control group, the highest correct patients' answers of the study-group were for questions number 20 'Diabetics should take extra care when cutting their toenails' (being 44 individuals; 95.7%) followed by questions number 15 '*Cuts and abrasions on diabetes heal more slowly*'. From the other hand, the highest incorrect respondents' answers for both the control-and study-groups were for question 17 '*A person with diabetes should clean his/her cuts& injuries with iodine and alcohol* ' (being 1 individuals; 2.2 % for the former and 3 for the later); followed consistently by question 24 for both the control-and study-groups were for question 17 '*A diabetic patient's diet consists mostly of special foods*' (being 4 individuals; 8.7% for the former and 7 individuals; 15.2% for the later).

Table (4) showed that there were statistical significance associations in the following cases; first: Study-group-pre-test's total score of knowledge & knowledge related practice with age (r = -0.291; P-value ≤ 0.023); second: Study-group-post-test's total score of knowledge & knowledge related practice with occupational status (r = -0.285;

P-value ≤ 0.021); still, third: Control-group-pre-test's total score of knowledge & knowledge related practice with educational level (r = 0.411; P-value ≤ 0.001) & socio-economic level (r = 0.249; P-value ≤ 0.042); and finally, Control-group-post-test's total score of knowledge & knowledge related practice with educational level (r = 0.299; P-value ≤ 0.012). These results of significance association measures exposed that all values as regards to Study group were negative & intermediate. On the contrary for Control group, they were positive & ranged from intermediate to high.

Table (5) revealed that there was only statistical significance association, positive & intermediate, between the total score of knowledge & knowledge related practice and treatment regimen of the control-group-post-test's (r = 0.325; P-value ≤ 0.004).

Table (6) showed that there was highly statistical significant difference between pre- and post-tests regarding total score of knowledge & knowledge related practice about DM in the study group (P-value ≤ 0.0001). Patients who received diabetes education had higher total score of knowledge & knowledge related practice values. Whereas, there was statistically high significant difference between pre- and post-tests regarding total score of knowledge & knowledge related practice about DM in the control group (P-value ≤ 0.0001). Patients, who haven't had a diabetes education intervention, had an increase in their total score of knowledge & knowledge related practice but still inadequate and insufficient.

4. Discussion

Diabetes education aims to improve metabolic control, prevent serious diabetes related complications and improve the quality of life of type 2 diabetic patients [12]. One of the crucial nursing priorities for those patients is education, especially regarding their condition, treatment options and possible associated complications [13] so, this study aimed to measure the effect of diabetes education on type 2 diabetic patients' disease knowledge and knowledge related practice at Suez Canal University Hospitals.

The present study revealed that there was a significant negative association between Study-group-pre-test's total score of knowledge & knowledge related practice about DM and age. This result was consistent with Al-Adsani, *et al.* [14]; Fenwick, *et al.* [15]; Kueh [16]; Mohamed [17] who found that there was significant negative correlation between age and diabetes knowledge and those who were younger scored higher in diabetes knowledge compared to those who were older. From the researcher point of view, this could be clarified as, the patients younger in age are assumed to get better accessibility of information and this influences the way they got data makes this effect differs significantly.

The current study showed that, there was a significant negative association between Study-group-post-test's total score of knowledge & knowledge related practice about DM and occupational status, this significance has developed with the implementation of the program. This result disagreed with Asmelash, *et al.* [18]; Fenwick, *et al.* [15] who found that diabetes information was significantly higher in those who were employed. From the researcher point of view, it appeared that as the rank of employee raised they became busy to search for or to memorize knowledge.

The present study revealed that, there was a significant positive association between Control-group-pre-test's total score of knowledge & knowledge related practice about DM and educational level, this significance has continued to be in effect with the Control-group-post-test. This result was steady with those of other studies conducted by Al-Adsani, *et al.* [14]; Asmelash, *et al.* [18]; Chilton, *et al.* [19]; Mohamed [17]; Ntontolo, *et al.* [20]**.** From the researcher point of view, those patients got the motivating force somehow to induce their information from other sources which in turn to diminish the dissimilarity of data values among various educational groups. It highlighted the significance of education for effective disease management.

In addition, there was a significant positive association between Control-group-pre-test's total score of knowledge & knowledge related practice about DM and socio-economic level. This result agreed with Al-Adsani, *et al.* [14] and Kaniz, *et al.* [21] who found that the association between socio-economic status of the diabetic patients and overall level of knowledge, practice & attitude regarding diabetes was found to be statistically significant. From the researcher point of view, those patients got the motivation somehow or another to induce more data from other sources.

Furthermore, the association between knowledge &knowledge related practice about DM and treatment regimen, the current research reported that there was a highly significant positive association between control-group-post-test's total score of knowledge & knowledge related practice about DM and their treatment regimen, this significance has risen with the Control-group-post-test. This result was against the study results of Gillani, *et al.* [22] who found that insulin users acquired a better level of information about DM than those who had oral anti-diabetic medications. From the researcher point of view, those patients who were uninterested in taking medications and did not have the scheme to secure more data versus those who are curios in taking their medications, did have the mindfulness to gain more knowledge.

The present study displayed that, there was a highly statistical significant difference between pre- and post- tests regarding total score of knowledge & knowledge related practice about DM in the study group, this result agreed with the study about "Effect of lifestyle intervention on health behaviors, weight and blood glucose level among patients with diabetes mellitus" conducted in Egypt by Mohamed [17] who reported that higher scores of diabetes related knowledge after participation in lifestyle intervention program. Among the study sample this result in agreement with Castillo, *et al.* [23] who studied "Community-based Diabetes Education for Latinos: The Diabetes Empowerment Education Program ", in Chicago and reported that there was significant improvement in knowledge about the diabetes among the patients after receiving diabetes educational program.

On the same respect, Attridge, *et al.* [24] who studied "Culturally appropriate health education for type 2 diabetes mellitus in ethnic minority groups", and found improvement in knowledge of the intervention groups after application of socially suitable health education. This could be affirmed, as illustrated in a few of researches conducted by Yasobant, *et al.* [25] who studied "Improving knowledge about diabetes among diabetic population of Gujarat, India: A community based Interventional study", and found that the knowledge and practices around administration of diabetes can be altered with reasonable planned community based intervention programs. From the researcher point of view, all kind of health education and lifestyle modification for diabetic patients help in improving and increasing their knowledge and practice related to diabetes control.

The present study illustrated that, there was highly statistical significant difference between pre- and post-tests with respect to total score of knowledge & knowledge related practice about DM in the control group. Patients thought didn't receive a diabetes education, had an increment in their total score of knowledge & knowledge related practice about DM. However, those patients were still having insufficient and inadequate total score of knowledge & knowledge related practice about DM. From the researcher point of view, the explanation of this change might be that group had certain friends in the study group and obtained information from them so their knowledge improved about the disease but still inadequate.

5. Conclusion

The study findings have showed inadequate knowledge and knowledge related practice among type 2 diabetic patients at pre stage. Those patients who received educational program achieved better total score of knowledge & knowledge related practice about DM, compared with the control group. Also the study has shown that there were negative statistical significance associations in the following cases for the study group; age, occupational status, whereas for the control group, they were positive statistical significance associations in the following cases; educational level & socio-economic level. there was only positive statistical significance association between the total score of knowledge and treatment regimen of the control-group.

Recommendations

According to the results of the present study, the following recommendations could be deduced:

1. Increasing health awareness of type 2 diabetic patients regarding self-care of diabetes mellitus.
2. Conducting health educational programs training sessions about importance of diet & exercises, blood glucose monitoring, adherence to medications and diabetic foot care.
3. The developed educational program for type 2 diabetic patients should be implemented on a wider scale and evaluated for further improvement.
4. The illustrated booklet should be available and distributed for each diabetic patient attended to diabetic outpatient clinics according to their needs.
5. Further researches should be conducted to assess the impact of health education programs in other settings as well as how to improve glycemic control of type 2 diabetic patients.

References

[1] American Diabetes Association, 2018. "Standards of Medical Care in Diabetes—2018." *Diabetes Care*, vol. 41, pp. S1- S156.

[2] Meng, D., Chunyan, W., Xiaosheng, D., and Xiangren, Y., 2018. "The effects of qigong on type 2 diabetes mellitus: A systematic review and meta-analysis." *Evidence-Based Complementary and Alternative Medicine*, pp. 1-8. Available: https://www.ncbi.nlm.nih.gov/pubmed/29507593

[3] Cho, N., Shaw, J., Karuranga, S., Huang, Y., da Rocha Fernandes, J., Ohlrogge, A., and Malanda, B., 2018. "IDF diabetes atlas: global estimates of diabetes prevalence for 2017 and projections for 2045." *Diabetes Research and Clinical Practice*, vol. 138, pp. 271-281.

[4] World Health Organization, 2019. "Noncommunicable diseases." Available: https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases

[5] Gopalakrishnan, S. and Muthulakshmi, M., 2018. "Type 2 diabetes mellitus and its determinants among adults in an urban area of Kancheepuram district, Tamil Nadu." *International Journal of Community Medicine and Public Health*, vol. 5, pp. 1956-1962.

[6] Dussa, K., Parimalakrishnan, S., and Sahay, R., 2015. "Assessment of diabetes knowledge using diabetes knowledge questionnaire among people with type 2 diabetes mellitus." *Asian Journal of Pharmaceutical and Clinical Research*, vol. 8, pp. 254-256.

[7] Chong, S., Ding, D., Byun, R., Comino, E., Bauman, A., and Jalaludin, B., 2017. "Lifestyle changes after a diagnosis of type 2 diabetes." *Diabetes Spectrum*, vol. 30, pp. 43-50.

[8] Wassertheil-Smoller, S., 2004. *Biostatistics and epidemiology. A primer for health and biomedical professionals*. 3rd ed. Springer-Verlag, Springer Science, pp. 153-158.

[9] Sanghani, N., Parchwani, D., Palandurkar, K., Shah, A., and Dhanani, J., 2013. "Impact of lifestyle modification on glycemic control in patients with type 2 diabetes mellitus." *Indian Journal of Endocrinology and Metabolism*, vol. 17, pp. 1030-9.

[10] El-Gilany, A., El-Wehady, A., and El-Wasify, M., 2012. "Updating and validation of socioeconomic status scale for health research in Egypt." *Eastern Mediterranean Health Journal*, vol. 18, pp. 962-968.

[11] Garcia, A., Villagomez, E., and Brown, S., 2001. "The starr county diabetes education study. Development of the spanish-language diabetes knowledge questionnaire." *Diabetes Care*, vol. 24, pp. 16–21.
[12] Formosa, C., McInnes, A., and Mandy, A., 2012. "Rethinking diabetes education." *Journal of Diabetes Nursing*, vol. 16, pp. 234- 238.
[13] Deakin, T., 2011. "Diabetes education drives quality and fuels NHS efficiency savings." *Primary Health Care*, vol. 21, pp. 21-24.
[14] Al-Adsani, A., Moussa, M., Al-Jasem, L., Abdella, N., and Al-Hamad, N., 2009. "The level and determinants of diabetes knowledge in Kuwaiti adults with type 2 diabetes." *Diabetes and Metabolism*, vol. 35, pp. 121-128.
[15] Fenwick, E., Xie, J., Rees, G., Finger, R., and Lamoureux, E., 2013. "Factors associated with knowledge of diabetes in patients with type 2 diabetes using the diabetes knowledge test validated with rasch analysis." *PLoS ONE*, vol. 8, p. e80593.
[16] Kueh, Y., 2014. *Modelling knowledge, attitudes, self-management, and quality of life in type 2 diabetes mellitus*. Published Doctorate Thesis, College of Sport and Exercise Science, Victoria University.
[17] Mohamed, S., 2014. "Effect of lifestyle intervention on health behaviors weight and blood glucose level among patients with diabetes mellitus." *Journal of Nursing Education and Practice*, vol. 4, pp. 75-87.
[18] Asmelash, D., Abdu, N., Tefera, S., Baynes, H., and Derbew, C., 2019. "Knowledge, attitude, and practice towards glycemic control and its associated factors among diabetes mellitus patients." *Journal of Diabetes Research*, p. 9. Available: https://doi.org/10.1155/2019/2593684
[19] Chilton, L., Hu, J., and Wallace, D., 2006. "Health-promoting lifestyle and diabetes knowledge in hispanic American adults." *Home Health Care Management and Practice*, vol. 18, pp. 378-385.
[20] Ntontolo, P., Lukanu, P., Ogunbanjo, G., Fina, J., and Kintaudi, L., 2017. "Knowledge of type 2 diabetic patients about their condition in kimpese hospital diabetic clinic, democratic republic of the congo." *African Journal of Primary Health Care and Family Medicine*, vol. 9, p. a1385.
[21] Kaniz, F., Sharmin, H., Khurshid, N., Hasina, C., Jesmin, A., Tahmina, K., and Liaquat, A., 2017. "Knowledge attitude and practice regarding diabetes mellitus among Nondiabetic and diabetic study participants in Bangladesh." *BMC Public Health*, vol. 17, p. 364.
[22] Gillani, S., Ansari, I., Zaghloul, H., Sulaiman, S., Rathore, H., Baig, M., Abdul, M., and Althagfan, S., 2019. "Predictors of health- related quality of life among patients with type ii diabetes mellitus who are insulin users: A multidimensional mode." *Current Therapeutic Research*, vol. 90, pp. 53-60.
[23] Castillo, A., Giachello, A., Bates, R., Concha, J., Ramirez, V., Sanchez, C., Pinsker, E., and Arrom, J., 2010. "Community-based diabetes education for latinos: The diabetes empowerment education program." *Diabetes Educator*, vol. 36, pp. 586-94.
[24] Attridge, M., Creamer, J., Ramsden, M., Cannings-John, R., and Hawthorne, K., 2014. "Culturally appropriate health education for type 2 diabetes mellitus in ethnic minority groups." *Cochrane Database of Systematic Reviews*, p. CD006424. Available: https://doi.org/10.1002/14651858.CD006424.pub3
[25] Yasobant, S., Thube, N., Saxena, D., Patel, S., and Pate, M., 2016. "Improving knowledge about diabetes among diabetic population of Gujarat, India: A community based Interventional study." *Integrative Obesity and Diabetes*, vol. 2, pp. 271-275.

Results

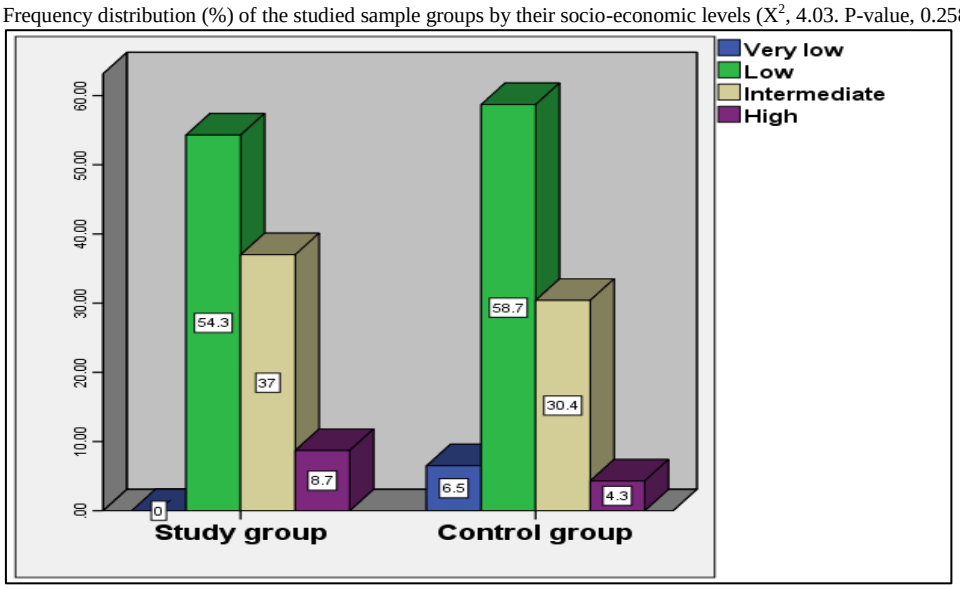
Table-1. Distribution of the studied sample groups according to their socio-demographic characteristics (n= 92)

Variables	Study group (n= 46)		Control group (n= 46)		X^2 Test	P-value
	No.	%	No.	%		
Gender					0.453	0.501
Male	13	28.3	16	34.8		
Female	33	71.7	30	65.2		
Age groups (years)					7.83	0.020*
30-44	17	37.0	10	21.7		
45-64	29	63.0	30	65.2		
>=65	0	0.0	6	13.0		
Marital status					3.32	0.345
Single	1	2.2	1	2.2		
Married	41	89.1	37	80.4		
Divorced	2	4.3	1	2.2		
Widow	2	4.3	7	15.2		
Educational level					11.76	0.019*
Illiterate	13	28.3	26	56.5		
Basic education	5	10.9	3	6.5		
Secondary education	14	30.4	5	10.9		
Intermediate education	0	0.0	2	4.3		
Higher education	14	30.4	10	21.7		
Occupational status					5.56	0.352

Non-working	29	63.0	29	63.0		
Unskilled	1	2.2	0	0.0		
Skilled	1	2.2	0	0.0		
Business	3	6.5	8	17.4		
Clerk	7	15.2	7	15.2		
Professional	5	10.9	2	4.3		
Residence					1.26	0.262
Rural	12	26.1	17	37.0		
Urban	34	73.9	29	63.0		

SD: Standard deviation; *P value is significant at level of < 0.05.

Figure-1. Frequency distribution (%) of the studied sample groups by their socio-economic levels (X^2, 4.03. P-value, 0.258) (n= 92)



The socio-economic level was classified into 4 levels: " very low, low, intermediate and high" depending on the quartiles of the score calculated to assess the socio-economic status (i.e., very low level ≤ 21, low level 22 – 42, intermediate level 43 – 63, and high level 64 – up to 84)

Table-2. Distribution of the studied sample groups according to their diabetes history (n= 92)

Variables	**Study group (n= 46)**		**Control group (n= 46)**		**X^2 Test**	**P-value**
	No.	**%**	**No.**	**%**		
Duration of the previous diagnosis of diabetes (years)					2.80	0.094
≤ 2	25	54.3	17	37.0		
2-5	21	45.7	29	63.0		
Family history of diabetes					3.94	0.047*
Yes	26	56.5	35	76.1		
No	20	43.5	11	23.9		
Presence of diabetes related complications					6.78	0.034*
Yes	15	32.6	27	58.7		
No	7	15.2	6	13.0		
Don't know	24	52.2	13	28.3		
Presence of comorbid diseases					2.14	0.144
Yes	28	60.9	21	45.7		
No	18	39.1	25	54.3		
Presence of hypoglycemic attacks					1.17	0.556
Frequent attacks	9	19.6	8	17.4		
Rarely occurrence	22	47.8	18	39.1		
Not occurred	15	32.6	20	43.5		
Treatment regimen					14.15	0.439
There is no medical treatment	1	2.2	2	4.3		
Oral hypoglycemic agents	45	97.8	44	95.7		
Medication adherence					3.45	0.063
Yes	37	80.4	43	93.5		
No	9	19.6	3	6.5		
Glucose monitoring regularity					0.39	0.532
Yes	25	54.3	22	47.8		

No	21	45.7	24	52.2		
Following planned diet regimen					0.21	0.646
Yes	2	4.3	3	6.5		
No	44	95.7	43	93.5		
Physical activity regularity					0.24	0.625
Yes	10	21.7	12	26.1		
No	36	78.3	34	73.9		

SD: Standard deviation; *P value is significant at level of < 0.05.

Table-3. Distribution of the studied sample groups regarding correct and incorrect answers (Numbers & %) of respondents concerning Diabetes knowledge questionnaire.

Question	**Study group (N=46)**				**Control group (N=46)**			
	Correct answer		**Incorrect answer**		**Correct answer**		**Incorrect answer**	
	No.	**(%)**	**No.**	**(%)**	**No.**	**(%)**	**No.**	**(%)**
Q1	12	26.1	34	73.9	8	17.4	38	82.6
Q2	31	67.4	15	32.6	21	45.7	25	54.3
Q3	13	28.3	33	71.7	12	26.1	34	73.9
Q4	27	58.7	19	41.3	16	34.8	30	65.2
Q5	39	84.8	7	15.2	38	82.6	8	17.4
Q6	34	73.9	12	26.1	35	76.1	11	23.9
Q7	21	45.7	25	54.3	17	37	29	63
Q8	37	80.4	9	19.6	31	67.4	15	32.6
Q9	30	65.2	16	34.8	29	63	17	37
Q10	39	84.8	7	15.2	27	58.7	19	41.3
Q11	21	45.7	25	54.3	25	54.3	21	45.7
Q12	15	32.6	31	67.4	5	10.9	41	89.1
Q13	39	84.8	7	15.2	24	52.2	22	47.8
Q14	37	80.4	9	19.6	32	69.6	14	30.4
Q15	43	93.5	3	6.5	40	87	6	13
Q16	41	89.1	5	10.9	43	93.5	3	6.5
Q17	3	6.5	43	93.5	1	2.2	45	97.8
Q18	40	87	6	13	40	87	6	13
Q19	34	73.9	12	26.1	34	73.9	12	26.1
Q20	44	95.7	2	4.3	43	93.5	3	6.5
Q21	21	45.7	25	54.3	15	32.6	31	67.4
Q22	34	73.9	12	26.1	24	52.2	22	47.8
Q23	31	67.4	15	32.6	30	65.2	16	34.8
Q24	7	15.2	39	84.8	4	8.7	42	91.3

DKQ; The Diabetes Knowledge Questionnaire which is a 24-item test developed by the Starr County Texas, Diabetes Education Study. Q1: Eating too much sugar and other sweet foods is a cause of diabetes; **Q2:** The usual cause of diabetes is lack of effective insulin in the body; **Q3:** Diabetes is caused by failure of the kidneys to keep sugar out of the urine; **Q4**: Kidneys produce insulin; **Q5:** In untreated diabetes, the amount of sugar in the blood usually increases; **Q6:** If I am diabetic, my children have a higher chance of being diabetic; **Q7** Diabetes can be cured; **Q8:** A fasting blood sugar level of 210 is too high; **Q9:** The best way to check my diabetes is by testing my urine; **Q10:** Regular exercise will increase the need for insulin or other diabetic medication; **Q11:** There are two main types of diabetes: Type 1 (insulin dependent) and Type 2 (noninsulin dependent); **Q12:** An insulin reaction is caused by too much food; **Q13:** Medication is more important than diet and exercise to control my diabetes; **Q14:** Diabetes often causes poor circulation; **Q15:** Cuts and abrasions on diabetes heal more slowly; **Q16:** Diabetics should take extra care when cutting their toenails; **Q17:** A person with diabetes should cleanse a cut with iodine and alcohol; **Q18:** The way I prepare my food is as important as the foods I eat; **Q19:** Diabetes can damage my kidneys; **Q20:** Diabetes can cause loss of feeling in my hands, fingers and feet; **Q21:** Shaking and sweating are signs of high blood sugar; **Q22:** Frequent urination and thirst are signs of low blood sugar; **Q23:** Tight elastic hose or socks are not bad for diabetics; **Q24:** A diabetic diet consists mostly of special foods

Table-4. Correlation between Pre- and Post-tests' total score of knowledge and knowledge related practice about DM and socio-demographic characteristics for the studied sample groups [N=46/ group]

Socio-demographic characteristics		**Total score of knowledge and knowledge related practice about DM**			
		Study group		**Control group**	
		Pre-test	**Post-test**	**Pre-test**	**Post-test**
Gender	r	0.114	0.212	0.090	-0.059
	Sig.	0.370	0.107	0.480	0.642
Age groups	r	-0.291*	0.129	-0.065	0.054
	Sig.	0.023	0.326	0.594	0.658
Marital status	r	0.080	0.164	-0.076	-0.184
	Sig.	0.524	0.204	0.542	0.141
Educational level	r	0.127	-0.216	0.411**	0.299*
	Sig.	0.282	0.075	0.001	0.012

Occupational status	r	0.0001	-0.285*	0.028	0.012
	Sig.	1.000	0.021	0.816	0.920
Residence	r	-0.161	-0.042	0.159	0.131
	Sig.	0.208	0.751	0.213	0.303
Type of family	r	-0.127	0.124	-0.073	0.075
	Sig.	0.320	0.346	0.564	0.555
Socio-economic level	r	0.152	-0.187	0.249*	0.184
	Sig.	0.219	0.142	0.042	0.132

r = Kendall Tau Correlation Coefficient; Sig. = Significance (2-tailed); * P value is significant at level of < 0.05; ** P value is highly significant at level of < 0.01

Table-5. Correlation between Pre-and Post-tests of the Total score of knowledge and knowledge related practice about DM and Diabetes history data for the studied sample groups [N=46/ group]

Diabetes history data		**Total score of knowledge and knowledge related practice about DM**			
		Study group		**Control group**	
		Pre-test	**Post-test**	**Pre-test**	**Post-test**
Duration of the previous diagnosis of diabetes (years)	r	-0.017	-0.039	0.196	0.187
	Sig.	0.877	0.733	0.077	0.092
Family history of diabetes	r	-0.205	0.006	-0.240	-0.188
	Sig.	0.109	0.964	0.059	0.140
Presence of diabetes related complications	R	-0.195	0.114	-0.129	-0.164
	Sig.	0.111	0.364	0.292	0.181
Presence of comorbid diseases	R	0.123	-0.158	-0.031	-0.109
	Sig.	0.336	0.230	0.807	0.393
Presence of hypoglycemic attacks	R	0.151	-0.060	0.041	0.021
	Sig.	0.213	0.629	0.733	0.860
Treatment regimen	R	0.043	0.162	0.122	0.325**
	Sig.	0.707	0.172	0.279	0.004
Medication adherence	R	-0.190	0.055	0.088	0.040
	Sig.	0.136	0.673	0.488	0.754
Glucose monitoring regularity	R	0.068	-0.137	-0.149	-0.100
	Sig.	0.594	0.297	0.241	0.432
Following planned diet regimen	R	-0.031	-0.183	0.151	0.026
	Sig.	0.807	0.163	0.236	0.840
Physical activity regularity	R	-0.176	0.027	-0.078	-0.153
	Sig.	0.168	0.839	0.538	0.232

r = Kendall Tau Correlation Coefficient; Sig. = Significance (2-tailed); * P value is significant at level of < 0.05; ** P value is highly significant at level of < 0.01

Table-6. Testing of the Significance of Changing the studied sample groups' total knowledge and knowledge related practice about diabetes mellitus after diabetes education (N=46 / group)

Variables	**Study group**				**Control group**			
	Pre-test		**Post-test**		**Pre-test**		**Post-test**	
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
Total score of knowledge and knowledge related practice about DM	15.07	3.14	21.39	1.90	12.91	3.91	16.09	3.24
t-test (Sig.)	11.09 (0.0001)****				7.18 (0.0001)****			

SD: Standard deviation; **** P value is highly significant at level of < 0.001; Total score of knowledge & knowledge related practice about DM ranges from 0 to 24; unsatisfactory knowledge & practice about DM: less than 18; satisfactory knowledge & practice about DM: 18 or more