# Quality of Life and Diet Satisfaction in Type II Diabetes

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**Abstract**
Background : TYPE 2 Diabetes mellitus (DM) appears to be a silent epidemic in  many parts of the world. The prevalence of Diabetes mellitus is rapidly increasing all over the world. Diet therapy should be the basic treatment approach for all patients with DM the efficacy of diet therapy in D.M is widely recognized.
Aim of study: determine the quality of life (QOL) of patients with DM in Babylon and factors that affect( QOL ) and diet satisfaction of those patients and the relation between diet satisfaction and quality of life (QOL).
Study design: Cross-sectional study of (200) patients attending the Diabetic and Endocrinology clinic.
Patients and methods: Data obtained included questionnaires, measurement of anthropometric indices includes (Body mass index BMI, waist circumference, and waist to a hip ratio), and blood  pressure with laboratory investigation includes glycated hemoglobin (HbA1c), the collected data   were analyzed by SPSS program version 18.
Results: diet satisfaction there was statistical significant association between quality of life and feeling that meals are delicious, , history to make menus, economic burden of diet therapy, not being able to eat same foods as other family members, history to cook the diabetic diet, feeling that the  health condition is good, feeling that the glycemic control status is good, and feeling that worsening of diabetes has been successfully kept under check.
Conclusions:
This study reports that Quality of Life of diabetes mellitus patients was good which appears to be related to demographics, medical history, and management regimens, and D.M significantly affects physical, social,  and psychological health because QOL improvement in diabetic patients should be developed for multidimensional purposes.
Keywords: diabetes, quality of  life, diet satisfaction

## 1. Introduction

Diabetes mellitus is one of the chronic non-communicable diseases ,    it is defined as clinical syndrome characterized by hyperglycemia caused by absolute      or relative deficiency of insulin(Davidson`s Principles 2010).
Diabetes mellitus type 2 (formerly noninsulin-dependent diabetes mellitus (NIDDM) or adult-onset diabetes) is a metabolic disorder that is characterized by high blood glucose in the context of insulin resistance and relative insulin deficiency (Kumar et al,2005). Type 2 diabetes makes up about 90% of cases of diabetes with the other 10% due primarily to diabetes mellitus type 1 and gestational diabetes (Vijan, 2010)
 Obesity is thought to be the primary cause of type 2 diabetes in people who are genetically predisposed to the disease (Smyth, S; Heron,2006) .
Rates of type 2 diabetes have increased markedly over the last 50 years in parallel with obesity. Globally as of 2010 it was estimated that there were 285 million people with diabetes (type 2 diabetes making up about 90% of diabetes cases) ,of those affected, the majority live in the developing world compared to around 30 million in 1985, increasing to 135 million in 1995 and 217 million in 2005(Williams,2009) (Smyth, S; Heron,2006) .This is equivalent to about 6.4%  of the world's adult population (Shaw JE, et al 2010). Diabetes is common both in the developed and the developing world.  It remains uncommon, however, in the underdeveloped world (Vijan, 2010)(Williams,2009) .This increase is believed to be primarily due to the global population aging, a decrease in exercise, and increasing rates of obesity (Smyth, S; Heron,2006) .The five countries with the greatest number of people with diabetes  as of 2000 are India having 31.7 million, China 20.8 million, the United States 17.7 million, Indonesia 8.4 million, and Japan 6.8 million. It is recognized as a global epidemic by the World Health Organization (Wild S, Roglic G et al 2004).
In the Arabian Gulf, (Mabry RM, et al 2010) studies have reported that nearly 17% of adults in the United Arab Emirates (Saadi H, et al 2007)15% of Kuwaitis (Al-Adsani AM et al 2009), and 14% of Saudis (Al-Nozha MM, et al 2004) suffer from type 2 diabetes mellitus. A recent study has suggested that approximately 11% of Oman's youthful population has type 2 diabetes mellitus (Al-Lawati JA, et al2007).
In Iraq, according to the national chronic non-communicable diseases risk factor    survey done in 2006, the

prevalence of DM is 10.4% (WHO 2006).

Women seem to be at a greater risk as do certain ethnic groups (Williams2009), such as South Asians, Pacific Islanders, Latinos, and Native Americans (Abate N, Chandalia M 2001). This may be due to enhanced sensitivity to a western lifestyle in certain ethnic groups (Carulli, L et al 2005). Traditionally considered a disease of adults, type 2 diabetes is increasingly diagnosed in children in parallel with rising obesity rates. Type 2 diabetes is now diagnosed as frequently as type 1 diabetes in teenagers in the United States (Vijan, S 2010).

Morbidity and mortality due to diabetes have a subtle but debilitating burden on individuals, and society which, in turn, create undue burden to public health(El Achhab Y, et al 2008).

Diabetes mellitus permanently changes a patient's life. Patient's self care, consisting of daily insulin injections or oral anti-diabetic agents, self monitoring of blood glucose and diabetic diet has an impact on quality of life (QOL).

QOL "refers to the physical, psychological and social domains of health that are influenced by a person's experiences, beliefs, expectations and perceptions" (Testa MA,et al 1998) (Glasgow RE,et al 1997).

Chronic diseases like diabetes may affect a person's quality of life (QOL)in many ways. Although better glycaemic control is associated with higher quality of life, complexity of regimens aimed at achieving the glycaemic control may have an adverse impact on patients' quality of life (Rubin RR, Peyrot M,1999). Reduced compliance to diet and medications and increased risk of diabetes related complications are also associated with depression among diabetic patients, which may affect their quality of life. Thus, a    diabetic patient's quality of life should be a primary consideration when prescribing a treatment regimen (de Groot M, et al2001) .

Studies have documented poor quality of life among diabetic patients who have suffered from this condition for a long time and is associated with old age(Papadopoulos AA, et al 2007) gender (especially women), diabetic complications, concomitant  diseases (Oldridge NB, et al 2006), and disease severity (Maddigan SL, et al2003).

Quality of life provides a multidimensional perspective that encompasses a patient's physical, emotional, and social functioning( Fortin M, et al 2006).

Generally, patients with more than one co-morbid condition report the poorest level of QOL, but some chronic conditions, like cancer, cardiovascular and pulmonary diseases and, not at least, DM, are more strongly associated with poor QOL than others (Vinik A.I., et al 2007).

Measuring QOL in chronically ill patients(including DM) provides an important source of medical information in addition to laboratory or diagnostic tests (Vijan, S 2010), and is becoming increasingly relevant to controlled clinical trials(Vinik A.I., et al 2007).

One goal of the measurement of QOL is to have objective evaluations of how and how much the disease influences patient's life and how patients cope with it. These evaluations may be useful as a baseline and outcome measures and should provide the framework to determine the impact of any change on patient's QOL (Wee HL, et al 2005).

Glycemic control in DM by determining HbA1C becomes an important measurement for preventing long term complications and provides a better QOL to diabetic patient. Current guidelines for diabetes mellitus recommend that patients maintain glycolsylated hemoglobin (HbA1c) of less than 7% (Diabetes Care 2007).

The duration and type of diabetes are related to QOL. Intensive diabetes therapy is shown to improve glycemic levels, which are associated with better QOL (Martha M, Funnell A. 2008).

Diet education for diabetic patients is aimed at improving the patients' QOL while maintaining proper glycemic control . Accordingly, determination of the diet-related QOL (DDR-QOL)appears to be of great significance (Bradley C, Speight J2002).

The Diabetes Diet-Related Quality-of-Life(DDRQOL) scale was compiled by a slight modification of the Renal Failure Diet- Related QOL scale of Suzukamo et al.(Suzukamo Y,et al 2000 )( Suzukamo Y, et al 2000).The scale of Suzukamo et al. was designed to determine the quantitative  and qualitative satisfaction with diet and the degree and of restriction of daily life and social life functions due to the dietary changes.

The modifications were as follows: the terminology changes from "protein restriction" to "energy restriction" in three places and the addition of two items relating to perceived merits of diet therapy. As a result, the DDRQOL scale consisted of a total of 31 items. Among these, 17 items directly pertained to diet therapy.

For examination of the convergent and discriminate validity of the DDRQOL

scale, the SF-36 Japanese version(Fukuhara S, et al 2001),  which is widely used as a comprehensive  scale to evaluate health-related QOL, was used. In the SF-36, a higher subscale score is reflective of a better QOL.

The treatment of D.M appears to have a complex effect on QOL. Jacobson et al found that patients with T2DM taking oral agents worried more about their condition than patients receiving insulin treatment or those treated by diet modification alone, suggesting the possibility that this transitional period was one in which the reality of having an illness was felt most intensely by patients(Jacobson AM,et al 1994). The same study also reported that insulin treatment of T2DM led to decreased satisfaction with HRQOL and greater impact of the illness. study found little difference in the QOL between patients treated by diet, oral agents, or insulin therapy (Mayou R,et al 1990).

This is significant because improved diabetes management reduces the incidence of  type 2 diabetes complications (Nathan, D. M., et al 2009). Effective type 2 diabetes management and  improved quality of life of individuals' are interrelated. The measurement of quality of life is an important component in continuous improvement      of chronic disease management in primary care settings (Narelle Borrott& Robert Bush 2008). There was no previous study in Iraq ,Babylon Governorate about evaluation the quality of  life of patients with type 2 diabetes and even in surrounding governorates.

So the aim of this study are:- to assess the Quality Of Life And Diet Satisfaction of patients with type 2 diabetes mellitus

## 2. Patients and methods::

2.1: A cross sectional study was conducted in Hilla city. in Diabetic and Endocrine center at Merjan Medical City. Data collection was carried out during the period from 1st  of March  to 30th  of May 2013.

The total patients collected were 235 patients (129females and 106 males) with age of 35 - 65 years old with type 2 diabetes , at least 12 months interval after the diagnosis of D.M. About 20 patients refuse to participate in the study .The main reasons for a non-participant were fatigue or being too ill. Other 15 patients did not bring complete investigation. Of the 235 total established clinic patients served by the clinic, 200 agreed to participate (114females and 86 males).All the patients with type 2 Diabetes  are attending the Diabetic and Endocrine centre in a Merjan medical hospital during the time of study who accepted to participate in the study.

All the  patients had type 1 DM, Any patient  with other chronic diseases like chronic renal failure, malignancy, serious underlying disease, cognitive disorder, or psychiatric disorder interfering with Diabetes Diet Therapy ,inability to fill out the self- administered, and restriction of protein intake as advised by a doctor , pregnant women (gestational diabetes). Were excluded from this study.

Data collection tools:A specially designed data sheet was used; to assess the quality of life and diet satisfaction in Type II  Diabetic  patients attending the Diabetic and Endocrine center in Merjan Medical City and this sheet contain:

1. Questionnaires.
2. Blood pressure and anthropometric measurements (weight, height, BMI, WC,              HC, and  WHR).
3. Biochemical investigations .

Data collection took place in three steps. The first step was face  to face  interview with   patients and to fill out the questionnaires, and the second steps  was to perform the anthropometric measurements and the last one to take the biochemical investigations .

The Diabetes Diet-Related Quality-of-Life (DDRQOL) scale to determine  the quantitative and qualitative satisfaction with diet and the degree of restriction of daily life and social life functions due to the dietary changes. The other questionnaire was framed with the intention of reflecting health related quality of life (HRQOL) and the diabetes specific quality of life (DSQOL).Each individual domain score was then standardized by dividing by maximum possible domain score and multiplying by 100. The total sum of QoL range was divided into poor QoL (<60%), moderate QoL (60%–80%), and good QoL (>80%).

2.1 Data Analysis:

Recording information was checked for missing values and data entry errors. Statistical analysis was performed using Statistical Package for Social Science software (SPSS, version 18).Variables were described using frequency distribution and percentage for the patients according to their characteristics and mean (-x); standard deviation (SD) for continuous variable, also  Chi-squared test  and Fisher exact test were used for the assessment of association between the variables studied. The p- value of less than 0.05    was significant statistically.

**3.** Results:- the result show as in  table 1 presents the mean of study variables of all study population.

The overall mean age of study population was (55.99 ± 9.27) years old. Majority (57%) were female. There was significant difference between the mean age of male (58.12 ± 9.41) years old and female (54.39 ± 8.87) years old, (p= 0.005) (Figure 1) . Figure 2 shows the distribution of the study population by Body Mass Index (BMI =Kg/m2), majority (44%) of study population were obese. Majority (39%) of study population were illiterate(Figure 3). Majority (34%) of them with (1-5 years) disease duration (Figure 4). Figure 5 shows the distribution of the study population by type of diabetes treatment , where the  majority (65%) of them with oral hypoglycemic agents,  and only6% with diet management .Majority (42%) of study population were in pre-hypertensive stage (Figure 6). Majority (44%) of study population with good quality of life(Figure 7). There was significant association between quality of life and educational level, occupation and residence, meanwhile there were no significant association between quality of life and age, sex , marital status. (51%) of study population with poor quality of life were presented with (55-64) years age , (69%) of them were female, (66%) of them were illiterate, (71%) of them were unemployed , (60%) of them came from urban area and (83%) of them were married [table2] . There was significant association between quality of life and ischemic heart disease and presence of diabetic complication, meanwhile there were no significant association between quality of life and hypertension, dyslipidemia , smoking habit, duration of diabetes and family history of diabetes. (34%) study

population with poor quality of life had Ischemic heart diseases , (60%) of study population with poor quality of life had hypertension, while (97%) of them had diabetic complications[table3]. There was no significant association between quality of life and body mass index, waist to hip ratio and  hemoglobin A1c[table4] . There was significant association between quality of life and feeling that meals are delicious, meanwhile there were no significant association between quality of life and feeling satisfied after meals, able to enjoy meals and having a feeling of fullness after meals . (71%) of study population with poor quality of life had no feeling that meals are delicious, (51%) of them not satisfied after meals and not able to enjoy with meal , (54%) of them not feeling fullness after meals[table5]. There was significant association between quality of life and history to eat meals at regular hours, history to make menus, economic burden of diet therapy, not being able to eat same foods as other family members, history to cook or have someone cook the diabetic diet), meanwhile there were no significant association between quality of life and history to keep the energy intake constant, and not being able to eat favorite foods. (57%) of study population with poor quality of life had history to eat meals at regular hours, (74%) of them didn`t have history to keep the energy intake constant, (63%) of them did not have the history to make menu, while (54%) of them not being able to eat favorite foods, (60%) of them not being able to eat same foods as other family members, and (71%) of them had economic burden of diet therapy [table6]   .There was significant association between quality of life and feeling that the health condition is good, feeling that the glycemic control status is good, having learned to lead a regular life and feeling that worsening of diabetes has been successfully kept under check , meanwhile there were no significant association between quality of life and feeling that the family bond has become closer. (86%) of study population with poor quality of life had no feeling that the health condition is good, (80%) of them had no Feeling that the glycemic control status is good, and (89%) of them had feeling that the family bond has become closer [table7].

4. Discussion : Over the past few decades, quality of life (QoL) has become an important concept in medical researches and treatments. Different meaningful reasons are given for this development. In the current study two standard questionnaires for evaluating of QoL and to determined diet satisfaction in people with Type II DM were selected. There are lots of researches focusing on relationship between glycemic control and QOL in people with diabetes. They generally suggest that better glycemic control is associated with better QoL (Rubin RR, PeyrotM1999).

Mean of descriptive variables of the all respondents are presented in [Table1]as mean age, mean of height, mean of weight, and mean of BMI. In comparison to the mean age between male and female gender;  there was significant difference between the mean age of male (58.12 ± 9.41) years old and female (54.39 ± 8.87) years old, with (p= 0.005) this was shown in (Figure 1) .

The socio-demographic and clinical characteristics of 200 type 2 diabetes mellitus patients presented in (Figure 2); as the distribution of  the total study population by BMI show : the  majority 88(44%) of respondents were obese,84(42%) were overweight, and only 28(14%) of respondents with  normal BMI i.e.< 25 kg/m2  ( WHO 2009a).People with excess weight have an increased risk of developing diabetes.  This may indicate a great problem of obesity in Iraqi society. This result was consistent with data collected by WHO in Iraq in 2005 found overweigh and obesity were (50.8%), (16.8%) respectively and it was higher among female than male( WHO 2009a).Data show that approximately 85% of people with diabetes are  type 2, and of these, 90% are obese or overweight( WHO 2008).   This is due to unhealthy eating habits in our locality (lack of knowledge on selecting a healthy diet) also consumption of high caloric diet with insufficient physical activity which lead to overweight and ultimately to obesity.

This is may disagree with study in China as the whole study respondents with (46.2%), (31.4%) and (22.3%) having normal , overweight and obese, respectively in China (Hui-Mei Chen, et al 2012).

Otherwise the most Omani respondents(53.5%) type 2 diabetes mellitus  patients were overweight and obese i.e. BMI ≥25 kg/m 2 (Masoud Y, et al 2011). Whereas 61% of the Iranian study population were overweight and obese with the other 39% with normal BMI i.e.< 25 kg/m2 (Alireza Shahab, et al 2011).

(Figure 3) shows approximately (39%) of respondents with type II diabetes were illiterate with only(9%) have higher academic education, the remaining (52%) were literate comparing to (37%)were   illiterate ,while only(12%) with   University graduate in Omani diabetic patients (Masoud Y, et al 2011).  In Iranian study population only (35.1%) were literate, and(18.1%) having Twelve years and over academic education(Alireza Shahab, et al 2011).

Many of Iraqi population (especially the female) were not completed their education because of tradition, far distances of their schools, low intelligence, while the boys drop-out of their school due to hard financial worries so they went to work to get money for their families.    As 68(34%) of respondents with (1-5 years) of diabetes duration and only 18% with more than 15years duration of diabetes as presented in(Figure4).

Approximately 65% of respondents were with oral hypoglycemic agents(OHA), this is because that OHA more favorable with psychological effect , less expensive, and more easy to be taken than the Injectable type of management. Only 12 (6%) of study groups with diet only this may indicate the noncompliance of our society with diabetic diet. It was found  that increasing treatment intensity in patients with Type 2 diabetes from diet and

exercise alone, to oral medications, to insulin, is associated with worsening quality of life(Figure5).

This is similar to Iranian study groups show Diet alone(4.2%), and the majority (71.1%)with oral pills (Alireza Shahab, et al 2011),while Omani respondents present (18.0%) with diet only in contrast to (48.5%) with OHA(Masoud Y, et al 2011).

As 84(42%) of study population were in pre-hypertensive stage (Figure6) while only 10% have normal blood pressure i.e. <120 mmHg systolic and<80 mmHg diastolic blood pressure and 48% of the respondents already having hypertension (this was done by measuring blood pressure and  according to British Hypertension Society). This may agree with Iranian study which reveal that (28.94%) of study groups in association to diabetes whether this start before or after developing DM (Alireza Shahab, et al 2011).

Adult diabetics in comparison to non diabetic adults were nearly three times as likely to have hypertension, this is true in our current study ,this also because of  unhealthy eating habits in our society  with consumption of high caloric diet and sedentary lifestyle, and with other genetic attributing factor.

The result of a previous study showed that patients with DM experienced a good QoL in comparison to other chronic disease groups and even to healthy population and the majority of patients with Type II DM experience a high degree of wellbeing, satisfaction and enjoyment (Issa BA, Baiyewu O.2006).

In this study, two hundreds consecutive attendees of the Diabetes and Endocrine clinic met the inclusion criteria during the course of the study; 114 were females and 86 were males. For overall QoL, 88 (44%) had good score,77 (39%) had a moderate score and 35(18%) had poor score, (Figure7).Other studies reveal 41% had good score, 46% had fair score and 13% had poor score Type II diabetic patients in Mosul2011 (Wafaa A.A. , Mohammad Y. A.2011).Also 20.7% had good score 65.4% had fair score and 13.9% had poor score Type II diabetic patients in Nigeria 2006(Issa BA, Baiyewu O.2006).

The results show that patients with less than5 years of disease duration and HbA1c less than 8% reported significantly better overall DQoL(Masoud Y, et al 2011).

There is no statistically significant relation between the gender and QoL; where (69%) of study population with poor quality of life were female compared to(31%) male.[Table2] (P-value=0.128).

The exact explanation of such gender variations was not entirely clear, it may attributed to women consult medical practitioners more often than men, and suffer from more minor psychological complaints, and may be women are less active compared with men. A woman cannot receive needed health care because norms in her community prevent her from travelling alone to a clinic. WHO reports that 55% of diabetes deaths          occur in women(WHO2013).   And  may be due to the high prevalence of obesity in female patients in our locality, this result is similar to other studies (ALshehri A,et al 2008).

Rubin et al reported that men were more satisfied with their diabetes treatment regimen, and missed less work and fewer leisure activities as a result of diabetes, than women (Rubin RR, Peyrot M1999). In Dutch study (Redekop WK, et al 2002)(Cramer JA.2004), women had significantly lower QoL scores than men and this difference was explained with gender difference of obesity. In our study we have found that women are more obese than men as found in the Dutch study and our results support this explanation.

Also in another study carried out on The Iranian Diabetics' Quality of Life (IRDQOL) Questionnaire, Total QOL was higher in males than females and was significant (Alavi NM, et al 2007).

Age has been another parameter which has an effect on diabetic patients'quality of life shown in [Table2]. In our study it was seen that there is no significant  association between  age and QoL with(P-value=0.242)as the total of respondents 78(39%) were presented with (55-64) years age group,18(51%)  of patients with poor QoL were with55-64 years age group, in comparison to only 2(6%) of respondents with poor QoL were lie in the (35-44)years age group  ; this is similar to the result of a study in Saudi Arabia and this because Type II diabetes is disease of elderly(ALshehri A, et al 2008). This is due to such co morbidities of other chronic diseases of elderly like hypertension, dyslidipaemia, ischaemic heart diseases, and others may interfere with restriction of some types or component of the food . Also elderly persons may have poor dentition, loss of taste and smell, poor or loss of vision, poor psychological attitude, isolation, and dementia.

Brown (Brown GC, et al 2000), and Rubin  (Rubin RR, Peyrot M1999)from USA, have reported that age has no effect on diabetic patient's quality of life but Gulliford from Trinidad and Tobago (Gulliford, M. C., & Mahabir, D. 1999) , Redekop (Redekop WK,et al 2002)(Cramer JA.2004) from Netherlands, Klein (Klein BE, et al 1998) and Glasgow (Glasgow RE, et al 1997)from USA have reported that older age has had a negative effect on patients quality of life. Glasgow (Glasgow RE, et al 1997) found that, younger patients had significantly higher physical and social functioning scores and Klein(Klein BE, et al    1998) found that older patients had lower levels of physical functioning and physical role functioning scores.

It has been investigated whether education has had an effect on QoL of diabetic patients. In current study, higher education level had a positive effect on QoL of patients ,with great significant association between quality of life and educational level (P-value =0.001), [Table2] as none of poor QoL have high academic level and only 4(11%) of respondents with poor QoL have secondary educational level and the majority of patients with poor QoL were illiterate 23(66%) with 8(23%) have primary educational level ,while 68(41%) of respondents with not poor QoL

(either good or moderate) have secondary and higher educational level. Escape from school, low intelligence, and high economic burden were may be the reasons for the lower literacy level in our society. Patient education empowers self-management of diabetes and has become a cornerstone of quality oriented diabetic care.

Randomized controlled study assessing learning, problem solving ability, and QoL in people with type 2 diabetes stated that better education of patients with type 2 diabetes can facilitate the patient's acquirement of specific knowledge and conscious behaviors that leads to knowledge, problem solving ability, and better QoL. Good psychosocial support is associated with more favorable clinical outcomes(Isao S, et al 2006).

Significant difference was noted between those with university level education and those without education (vitality and emotional health). This is consistent with other studies (Li L, et al 2003).

Patients of the similar study in Oman , with 6 years of education, have significantly better QoL compared with other patients who do not have the same level of education(Masoud Y,et al 2011).The 18.3% No formal education while only 9.2% with university education level were in Malaysia (Cheah WL, Lee PY, et al, 2012).

Our study reveal significant association between quality of life and residence (P-value of 0.002),as (60%) of respondents with poor quality of life were came from urban area present in [Table2] , from the total (75%) of study group ,this is may be because the Diabetic and Endocrine clinic lie in the center of Hilla city and the most of attendees came from the same area, this is because it is easy to visit the clinic for checkup and receiving treatment, and may be the people living in the urban had more awareness of the diabetes as a disease and its complications which need frequent follow-up . The prevalence of diabetes was estimated at 11% in the rural and 14% in the urban population of the West- Bank (Abdul-Rahim HF, et al 2001).

Most of the patients were married in our study 172(86%) of total study population; [Table 2] 29(83%) with poor quality of life were married and only 6(17%) were widowed. This may indicate a good social network support in the Iraqi community. This can be attributed to the close and mutual relationship of the Iraqi community, its cultural characteristics and traditions toward family ties and supportive attitudes. Social support has a positive influence on physical and psychological well-being of patients, which is reflected in better QoL.

The study which was conducted by Trief et al had shown that, quality of marriage is associated with adaptation to diabetes and other aspects of QoL for insulin treated adults with diabetes (Trief PM,et al 2001). Iranian study show the married were (89.6 %) of study group, while the single (10.4%)(Alireza Shahab, et al 2011). Another Omani study show(74.5%) married, with(25.5%)either divorced or widowed(Masoud Y, et al 2011).

However, the effects of socio-economic differences may be weaker in developed countries than in conditions of poverty in developing countries. The negative impact of socio-economic conditions on QoL among diabetic patients can be even stronger in our country.

There was great significant statistical association between quality of life and occupation in our study,(P-value= 0.002)[Table 2], (71%) of respondents with poor quality of life were unemployed, while 94(57%)from 165 of respondents with not poor quality of life(either good or moderate) were employed (either private or governmental) .

In general population, a strong association has been demonstrated between socioeconomic status and quality of life(Franciosi M,et al 2001).

As the unemployed may have lower income, this may explain the lower physical functioning, as other studies have found that older patients have lower physical functioning ,and those with lower incomes have lower scores in all components of quality of life.

Regarding to duration of illness, poor QoL is related to high mean of duration of illness; this is likely due to the appearance of complications with time. We have found that there has been no meaningful association between diabetes duration and QoL as shown in [Table3]. P-value (0.226) ;26(74%) of study population with poor quality of life had duration of diabetic illness15 years or less .A study in Saudi Arabia showed that the duration of illness had no significant effect on QoL (ALshehri A,et al 2008),also this presented in our study as only 9(26%) of study population with poor quality of life with 15years and more illness duration ,in contrast to the total study population 163(82%) with less than 15 years diabetic duration,while Swedish bases population study which reported that the duration of disease significantly correlate with QoL, and notice that subject with duration more than 5 years had better QoL (Wang Shi L,et al 2001). This may be due to good control and adaptation of the patients with diabetic life style. Another study in Kuwait(Awadalla AW,et al 2006) showed that the duration of illness had a significant impact only on the environmental domain.

Hypertension and diabetes are both end results of the metabolic syndrome. They may therefore, develop one after the other in the same individual(Cheung BM. 2010).

Our recent study demonstrated no statically significant association (P-value=0.134), (60%) of patients with poor quality of life have hypertension, in corresponding to 89(54%) of patients with not poor quality of life(either good or moderate) not having hypertension [Table3]. Although 103(52%) of respondents not having hypertension.

Hypertension in Type2 diabetics in Iranian study group reveal (28.94%) (Alireza Shahab, et al 2011). Another (68.3%) of study group with hypertension in Malaysia (Cheah WL, Lee PY,et al 2012).

The association relation between glucose and risk of hypertension and cardiovascular events,  an increase in fasting glucose of 0.2 mmol/L should confer about a 5% increase in the risk of stroke, which is less than the differences reported in the recent trials. Moreover, recent overviews of prospective observational studies indicate that although the risk of coronary heart disease is linearly and modestly increased above a fasting glucose value of 5 mmol/L, the risk of stroke is substantially raised only at fasting glucose values well above 7 mmol/L (Sarwar N,et al 2010).

The progressive nature of type 2 DM and the real risk for developing chronic complications particularly the presence of two or more complications, is associated with worsened quality of life.

In[Table 3] nearly all patients in our study with poor QoL were with diabetic complications (these include neuropathy, dyslipidaemia, nephropathy, retinopathy, diabetic foot ulcer) as 34(97%) and only 1(3%) free from complications,(with P-value=0.002) this is similar to high proportion of patients with complications (80.2% with one or more self-reported major complication: nephropathy, neuropathy, retinopathy or diabetic foot) in  Gaza 2006(Eljedi A,et al 2006). A similar pattern of findings was reported for the association between number and severity of complications and scores on QoL scales, with treatment satisfaction and disease impact scales consistently sensitive to severity of complications and less consistently responding to number of complications.

Trief and colleagues (Trief PM, et al 1998) reported that number of complications was a strong predictor of QoL diabetes impact and treatment satisfaction scores in a population of insulin-requiring patients. In addition, number of complications was associated with lower scores on the Nottingham Health Profile( Keinanen-Kiukaanniemi S, et al 1996), and increased number of complications was associated with lower scores on all scales of the QoL.

Others have found that the presence of neuropathy, cardiovascular disease or end-stage renal disease was associated with decreased scores on all scales of the QoL; and the presence of nephropathy was associated with greater health worries and reduced perceived health in patients with Type 2 diabetes (Klein BE,et al 1998).

This disagrees to (66%) of Omani respondents with no complications(Masoud Y, et al 2011). Also Iranian study which reveal (59.23%) of study population without any complication (Alireza Shahab, et al 2011).  While (58.7%) of respondents in Gaza without complication (Eljedi A,et al 2006).

It has been investigated whether smoking has had an effect on QoL of diabetic patients. Recent evidence suggests a strong association between cigarette smoking, insulin resistance and metabolic syndrome (Sherwood Forest Hospitals NHS Foundation Trust.2007).

There was no significant association between quality of life and smoking in our study (P-value 0.570),[Table3] show only4 (11%) of respondents with poor quality of life were currently smoking , and the other 31(89%) were nonsmoker , on the other hand the majority of respondents 171(85%) were not smoking .

Compared to non-smokers with diabetes, people with diabetes who smoke have twice the risk of premature death. Furthermore, the risk of complications associated with tobacco use and diabetes in combination is nearly 14 times higher than the risk of either smoking or diabetes  alone (Haire-Joshu D, et al 2005).

Few studies have evaluated smoking cessation treatment specifically for people with diabetes but the limited research available suggests that smokers with diabetes may be less successful in quitting than smokers without diabetes and those intensive strategies should be considered to optimise successful cessation.

A British prospective study of 7,735 men aged 40-59 years found that the benefit of giving up smoking was only apparent after 5 years of smoking cessation and risk reverted to that of    never-smokers only after 20 years(Sherwood Forest Hospitals NHS Foundation Trust 2007).

In Iranian study the non smoker presented  the majority of study population were (85.7%), and only (14.3%) were currently smoking(Alireza Shahab, et al 2011).

Approximately12(34%) of study population with poor QoL complicated by attending CCU with  Ischaemic Heart Diseases ,whereas 142(86%) of respondents with not poor QoL(either good or fair) were free from this macrovascular complications, with great significant association (P-value =0.004),while the total 165(82%) of respondents were free from this macrovascular complications these were demonstrated in [Table3]. This is due to a number of measures, including physical functioning, prolong duration of      diabetes with its micro and macrovascular comorbidity, associated hypertension, and obesity.  Advantage  of the diabetic patients in this study may result from the fact that all but one of the hypertensive patients were taking a variety of medications, including diuretics and beta blockers, which might significantly affect quality of life.

It has been amply documented that having one or more first-degree relatives with Type 2DM increases the odds of having the disease compared with someone without such relatives. Although  there was  no statistically significant association between quality of life and family history in our recent study (P-value =0.250) shown in [Table3] ;16(46%) of respondents with poor QoL  from the total 109(55%) of respondents and 93(56%) with not poor QoL (either fair or good) had  strong family history of the first relative by history.

In contrast to 19(54%) of respondents with poor QOL didn`t have this strong relationship in addition to 72(44%) of respondents with not poor QOL also. This is agree with Omani study whereas (56.0%)of study diabetics were with strong family history(Masoud Y, et al 2011). In Mosul 78% of study diabetics were of strong family

history(Wafaa A. A., Mohammad Y.A.,2012).

In contrast to other study like in Nigeria 91% didn`t have family history (Issa BA, Baiyewu O. 2006).

The estimations vary, but the odds usually range from two to six times more likely. Also, a long-term study reported that the cumulative prevalence of T2DM at age 80years is about 3.5 times higher (38% vs. 11%) for people with a first-degree relative with T2DM compared to people without any affected relative. The closer the relative, the greater the risk. It's estimated that people with one parent with diabetes have double the risk, while both parents increase the risk up to six times.

Where both parents have diabetes, the average age of diagnosis is 39, compared to 48 years of age for people where neither parent has the disease. Having a brother or sister with type 2 diabetes increases the risk more than four times. Mothers present a greater risk than fathers.

Research at the Diabetes Centre at Sydney's Royal Prince Alfred Hospital found that diabetes was twice as common when the mother had diabetes. The more relatives with the disease the greater the odds for other family members. For instance, three or more relatives increase the risk almost 15 times.

The average age of diagnosis when six relatives have diabetes was found to be 42 years,compared with 52 years of age when only one family member had it.

Our results do not support the findings of Forsyth and Goetsch; in their study, individuals with a family history of diabetes engaged in health-protective behaviors, specifically weight control behaviors, more often than individuals without a family history of diabetes. In addition, our findings are in accord with the results of a United Kingdom study showing that first-degree relatives of people with type 2 diabetes consumed diets higher in fat and cholesterol, increasing their risk of developing diabetes (Adamson AJ,et al 2001)

Because family history was one of the strongest risks for diabetes in our study, individuals with family members who have diabetes should be a screening priority for diabetes. As stated previously, undiagnosed diabetes constitutes approximately 29.3% of total diabetes prevalence (Gregg EW,et al 2004).A current study demonstrated that the prevalence of diagnosed diabetes has increased, and the prevalence of undiagnosed diabetes has decreased for severely obese individuals (BMI 35), possibly because of a better awareness of BMI as a risk factor among health care providers and improved screening among these individuals. Similarly, the use of a family history screening tool could capture many more of these undiagnosed individuals who would benefit from early intervention(Gregg EW,et al 2004).

It was observed in the Hoorn Study that the waist-to-hip ratio (WHR) and not only body mass index (BMI) is an important independent predictor of incident diabetes in 50–75-y-olds (deVegt F,et al 2001).In the current study [Table4]; the total 172(86%) of respondents were pre-obese and obese with only 28(14%) having normal BMI . Approximately 30(86%) of study population with poor QOL 14(40%), 16(46%) were Overweight and Obese respectively according to BMI, only 5(14%).

In particular, the accumulation of visceral fat is assumed to play an important role in the etiology of diabetes by overexposing the liver to free fatty acids, resulting in insulin resistance and hyperinsulinemia . Both lipid profile and body fat have been shown to be the important predictors for metabolic disturbances including dyslipidaemia, hypertension, diabetes, cardiovascular diseases, hyperinsulinaemia etc. The New England Journal of Medicine, Diabetes Prevention Program Research Group found that lowering weight in the pre-diabetic stage, by only 7% can lessen the chances of getting Type II Diabetes by almost half! (Diabetes Prevention Program Research Group 2002).

Whereas high risk WHR(i.e. > 1 in men and > 0.8 in women) also indicate obesity, so our respondents reveal no significant association between poor QOL and not poor QOL(P-value= 0.361).[Table4] present 21(60%) of respondents with poor QOL and 85(52%) with not poor QOL were with high risk.

Both waist and hip circumference have important, but opposite, associations with the risk of diabetes after adjustment for age and BMI.A larger waist circumference is associated with a higher risk of diabetes, whereas a larger hip circumference is associated with a lower risk of diabetes, this clear in our society as eating large quantity of food, high fatty and sweet diet , and lack of physical activity(WHO2008).

Glycemic control in DM by determining glycolsylated hemoglobin (HbA1c) becomes an important measurement for preventing long term complications and provides a better QOL to diabetic patient. Current guidelines for diabetes mellitus recommend that patients maintain HbA1c of less than 7%(Standards of Medical Care in Diabetes 2012 ). Our current study also showed some correlations[Table4], when 28(80%) of respondents with poor quality of life had HbA1c $\geq$ 7%, and also 161(81%) of patients with not poor quality of life were with HbA1c $\geq$ 7% .But only 7(20%) of respondents with poor quality of life had HbA1c less than 7% with no meaningful statistical association between poor quality of life and not poor quality of life (P-value=0.934).

Only (28.5%) of the study group in Iran had HbA1c less than 7%, with the majority (71.5%) had HbA1c $\geq$ 7%. [160] And only (32.5%) of Omani diabetics study population were with HbA1c < 7% , the other (67.5%) had HbA1c $\geq$ 7%(Masoud Y, et al 2011).

Some authors suggest that there may be a curvilinear relationship between HbA1C and health related QOL, implying lowest QOL in patients with the highest HbA1c levels (>8.1%), highest in those with HbA1c levels

7.1-8% and intermediate in those with the lowest HbA1c levels(<7.0%) (16).While like Tumer and Trief studies we could not find the above association in the current study(Tumer P,et al 20040 (Trief PM,et al 2002).

Similar results were found in Dutch type 2 individuals, where higher HbA1c levels were negatively associated with QoL. In the same study they found that type2 patients with higher HbA1c levels were less satisfied with the treatment than other patients. Another study the assesses health-related QoL of subjects with type 2 diabetes in Turkey found similar results (Akinci F, et al 2008).

Maintaining a healthy diet is important for everyone, but it is especially important for people with diabetes. A type 2 diabetes diet and following the right meal plan can make all the difference to a person struggling to keep their blood sugar under control. Rather than a restrictive diet, a diabetes diet or Medical Nutrition Therapy (MNT) is a healthy-eating plan that's naturally rich in nutrients and low in fat and calories, with an emphasis on fruits, vegetables and whole grains. In fact, a diabetes diet is the best eating plan for most everyone. A good balance of the right foods, along with regular exercise and prescribed medications, can help diabetic patients feel better and stay healthier.

There was great significant association between quality of life and feeling that meals are delicious P-value <0.001 [Table5]; as 25(71%) of study population with poor quality of life had no feeling that meals are delicious, in contrast to 104(63%) of respondents with not poor quality of life(either moderate or good) had feeling that meals are delicious . Although eating healthy foods doesn't mean sacrificing taste; 18(51%) of study population with poor quality on of life not satisfied after meals and not able to enjoy meal , comparing to 103(62%) ,and 106(64%) of respondents with not poor quality of life were satisfied after meals and they were able to enjoy meal. A good meal plan should fit in with diabetic schedule and eating habits.The right meal plan will help them improve their blood glucose, blood pressure, and cholesterol numbers and also help keep their weight track.

Total of 120(60%) of study group feeling fullness after meals, there was no meaningful statistical association between the two groups (either poor or not poor quality of life with P-value =0.058, this is presented in [Table5].As(54%) of respondents with poor quality of life not feeling fullness after meals,(P-value=0.058) in reverse to(63%) of respondents with not poor quality of life were have feeling fullness after meals. This may confirm to especial diet preparation, or modification of food component to meet the diabetic diet plane. Adiabetes meal plan is a guide that tells them how much and what kinds of food they can choose to eat at meals and snack times.

Because of the effects of obesity on insulin resistance, weight loss is an important therapeutic objective for overweight or obese individuals with pre- diabetes or diabetes.

Consistently eating at the same times every day is important for some people, especially those who take long-acting insulin and oral medications that decrease blood sugar levels (sulfonylureas or meglitinides).

[Table6] demonstrated that there was significant association between quality of life and history to eat meals at regular hours, with (P-value =0.001) , approximately 20 (57%) of study population with poor quality of life had history to eat meals at regular hours , in contrast to 15(43%) of study population with poor quality of life had history not to eat meals at regular hours. Whereas 157(79%) of total study population were eat meals at regular hours and If a meal is skipped or delayed while on these regimens, they are at risk for developing low blood glucose. People who use intensive insulin therapy (those on multiple daily injections) and people who take other types of oral diabetes medications (eg, insulin sensitizers such as metformin) have more flexibility around meal timing. With these regimens, skipping or delaying a meal does not usually increase the risk of low blood sugar. They should have regular meals at regular times each day. Have a breakfast, a lunch or tea type meal and a dinner. Meanwhile there was no statistically significant association between both categories in the history to keeping energy intake constant [Table6] (P-value=0.131); as 26(74%) of respondents with poor quality of life did not have the history to keeping energy intake constant, from the total 166(83%) of respondents didn`t have this history , this is also to prevent either low or high blood sugar . There is no one perfect food so including a variety of different foods and watching portion sizes is key to a healthy diet. Also, make sure our choices from each food group provide the highest quality nutrients they can find. In other words, pick foods rich in vitamins, minerals and fiber over those that are processed(MEDIS study. 2010)

According to American Diabetes Association(Standards of Medical Care in Diabetes 2012) diabetic patients have necessity to Make a menu each day in order to include whole diet components. The best mix of carbohydrate, protein, and fat may be adjusted to meet the metabolic goals and individual preferences of the person with diabetes.

[Table6] show the great significant statistical association between the poor and not poor quality of life in type 2 diabetic as(P-value= 0.029) ; as that total of 154(77%) of respondents did not have the history to make menus, with 22(63%) of study group with poor quality of life did not have the history to make menus, and only 13(37%) of study group with poor quality of life did have the history to make menus, this may attribute to faulty knowledge about the diabetic diet as it may restrict whole favorite food items, or it must buy the only highly expensive type of food, as the majority of the study group with poor quality of life 66% were illiterate and did not have the right knowledge , and some patients can't afford to follow a diabetes diet.

As the recession deepens and the unemployment rate hovers at 10%. This is true in our study as 25 (71%) of respondents with poor QOL had economic burden of diet therapy P-value of (0.001), in contrast to 114(69%) didn`t have this burden , this may attribute to unemployment or some patients were retired with low monthly income . It is not surprising that individuals with diabetes have financial issues because those with diagnosed diabetes, on average, have medical expenditures that are approximately 2.3 times higher than those without diabetes. Although some individuals with diabetes may not disclose financial anxieties to their clinicians, health care professionals should be aware that the inability to pay for food as some diabetic food costs too much, medications, and other aspects of diabetes care can pose a barrier to optimal self-management.

People with diabetes can eat the same foods the family enjoys. There was no meaningful association between QOL and not being able to eat favorite food, the 19 (54%) of respondents with poor QOL not being able to eat favorite food, and even respondents with not poor QOL117(71%) not being able to eat favorite foods.[Table6]

Another parameter in the burden of diabetic diet[Table6]; there was great association between QOL and history not being able to eat same foods as other family members. (P-value of 0.005).The total respondents 156(78%) not being able to eat same foods as other family members.21(60%) of respondents with poor QOL were not being able to eat same foods as other family members. Everyone benefits from healthy eating so the whole family can take part in healthy eating. It takes some planning but they can fit their favorite foods into their meal plan and still manage their blood glucose, blood pressure and cholesterol. Snacks play a very important role in the daily life of a person with diabetes, particularly those with insulin-requiring type II diabetes (Close EJ,et al 1993).For these people, between-meal and bedtime snacks are essential to keep blood glucose levels as close to normal as possible and to help prevent low blood sugar (hypoglycemia).

There was significant association between quality of life and history to cook the diabetic diet, [Table6] show19(54%) of respondents with poor QOL from total 136(68%) of respondents have history to cook the diabetic diet.

And there is little doubt that diabetes can be a very tough illness with which to live. The impact of long-term complications can be severe, leading to major changes in a patient's ability to function in daily life. There was significant association between quality of life and feeling that the health condition is good. Approximately 30(86%) of study population with poor quality of life had no feeling that the health condition is good, in contrast to 127(77%) of study population with not poor quality of life had the feeling that the health condition is good, with(P-value=0.001), this is shown in [Table7]. This may determined subjectively by patients` knowledge, and attitude toward the benefits that have been perceived from the diet therapy.

Also significant association between quality of life and glycemic control,(P-value= 0.004). [Table7] demonstrated that 28(80%) of study population with poor quality of life had feeling that the glycemic control status is not good, whereas 88(53%) of study population with not poor quality of life had feeling that the glycemic control status is good. Dietary compliance is a major factor in achieving glycemic control in type 2 diabetes . One study, found that fewer than 40 percent of patients with diabetes ate within 20 percent of their prescribed diet Noncompliance rates among patients with diabetes in another study were 62 percent for diet (Hernández-Ronquillo L, et al 2003). This may associated with psychological fear; as the diabetic patients may suffer from frequent painful checking of blood glucose.

Also there was significant statistical association between quality of life and learning to lead a regular life; P-value of 0.001[Table7]. 22(63%) of study population with poor quality of life have not learned to lead a regular life, whereas 133(81%) of study population with not poor quality of life have learned to lead a regular life, this is because the majority of diabetic study group 132(66%) had have perceive the merits of the diet therapy.

Family bond another parameter to be discuss [Table7]. Meanwhile there were no significant statistical association between quality of life in type 2 diabetic and feeling that the family bond has become closer ;as the majority of the respondents in this study 190(95%) were with closer family bond regardless the poor or not poor QOL. This is may due to the ongoing threat of complications can be worrisome, depressing, and the social relationships may be severely affected. So the great social support by the family and caregiver to the diabetics to minimize and relieve negative emotional feelings, and these including meal cooking.

There was significant statistical association between quality of life in type 2 diabetic and feeling that worsening of diabetes has been successfully kept under check. (P-value = 0.001)[Table7]. Only 16(46%) of study population with poor quality of life feeling that worsening of diabetes has been successfully kept under check ,otherwise 130(79%) of respondents with not poor quality of life feeling that worsening of diabetes has been successfully kept under check. Awareness of diabetic patients, and development of nutritional education among patients with chronic diseases especially in such diseases need some sort of restriction of food items may develop such feeling. Glycaemic control have a major role in prevent complication and worsening of diabetes, and this is done by following strict diet therapy.

Finally , the burden and difficulty felt in adhering to diet restrictions, as well as the conflict between having to carry out social roles and the necessity to sustain self management behavior were the determinants to better quality of life in Type II Diabetes Mellitus.

## 5. Conclusion

monocausal theories could not explain the effects of diabetes on QoL. Lower education level, unemployment, presence of diabetic complications and ischaemic heart diseases were found to have a negative impact on the quality of life among diabetic patients. While neither age, gender, family history, nor hypertension, diabetic duration, glycaemic control, and obesity did not.

According to diet satisfaction there was statistical significant association between quality of life and feeling that meals are delicious, , history to make menus, economic burden of diet therapy, not being able to eat same foods as other family members, history to cook the diabetic diet, feeling that the health condition is good, feeling that the glycemic control status is good, and feeling that worsening of diabetes has been successfully kept under check , meanwhile there were no significant association between quality of life and feeling satisfied after meals, able to enjoy meals, history to keep the energy intake constant, not being able to eat favorite foods, and feeling that the family bond has become closer.

Consistently eating at the same times every day is important for some people, especially those who take long-acting insulin and oral medications that decrease blood sugar levels.

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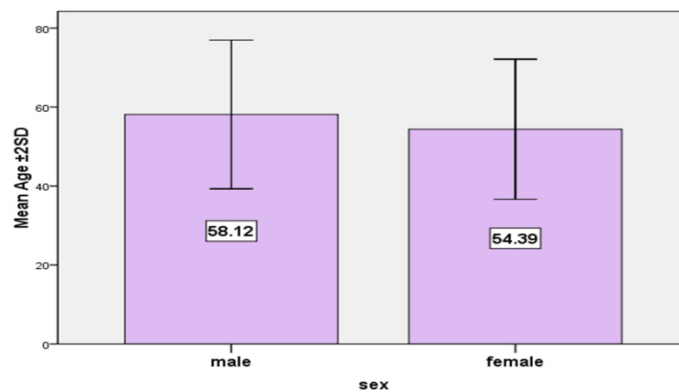Figure 1. Figure 1: Mean difference of age of study population by sex

## Table 1: Mean ± SD of study variables of all study population

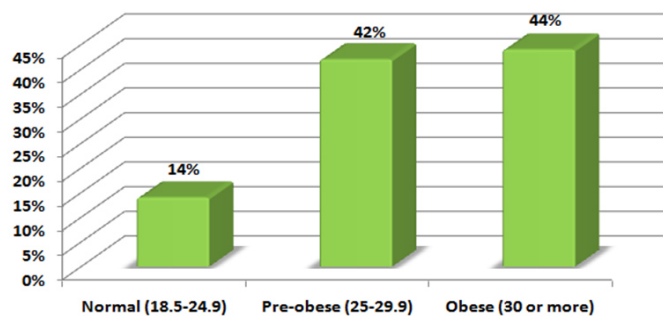| Variable | Mean ±SD |
| --- | --- |
| Age ( years) | 55.99 ± 9.27 |
| Height (cm) | 163.66 ± 7.91 |
| Weight (Kg) | 79.78 ± 14.78 |
| BMI (Kg/m²) | 29.68 ± 4.97 |



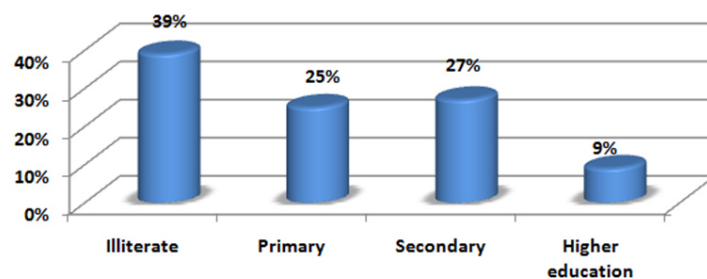Figure 2 : Distribution of study population by BMI



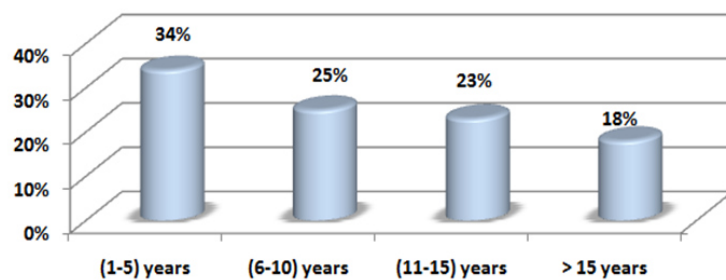Figure 3 : Distribution of study population by educational level

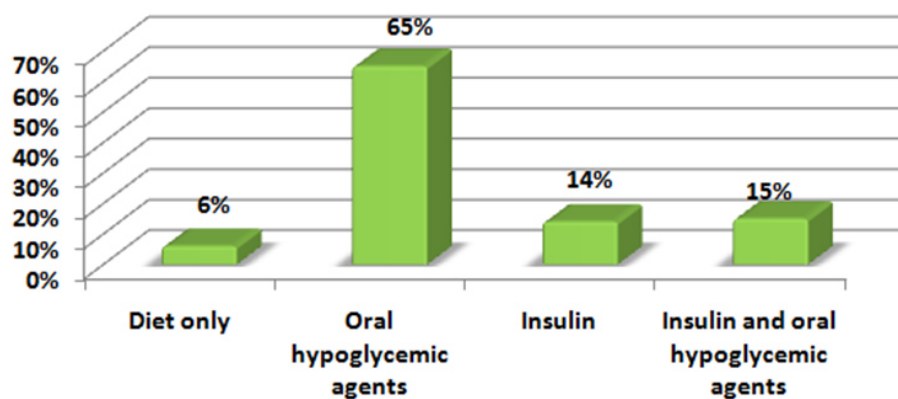Figure 4 : Distribution of study population by diabetes duration



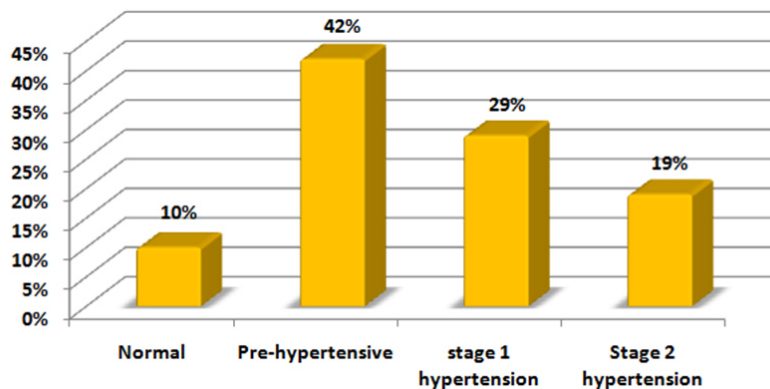Figure 5 : Distribution of study population by diabetes treatment



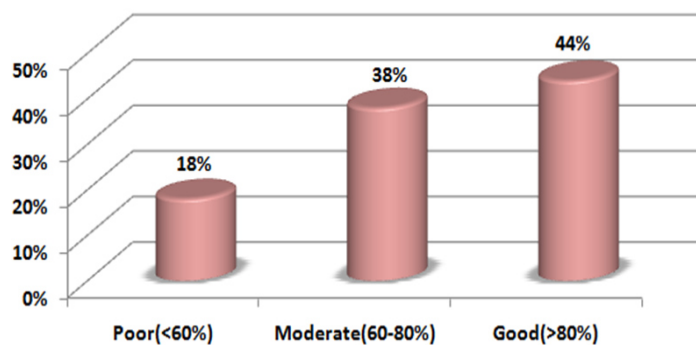Figure 6 : Distribution of study population by blood pressure



Figure 7 : Distribution of study population by quality of life

**Table (2): The association of quality of life (poor quality and not poor) by socio-demographic variables**

| Variable | Poor quality | Not poor quality | Total | $\chi^2$ | df | P-value |
|---|---|---|---|---|---|---|
| **Age** | | | | | | |
| (35-44) years | 2 (6%) | 25 (15%) | 27 (14%) | | | |
| (45-54) years | 10 (28%) | 46 (28%) | 56 (28%) | 4.182 | 3 | 0.242 |
| (55-64) years | 18 (51%) | 60 (36%) | 78 (39%) | | | |
| (≥65) years | 5 (14%) | 34 (21%) | 39 (19%) | | | |
| **Gender** | | | | | | |
| Male | 11 (31%) | 75 (45%) | 86 (43%) | 2.318 | 1 | 0.128 |
| Female | 24 (69%) | 90 (55%) | 114 (57%) | | | |
| **Educational level** | | | | | | |
| Illiterate | 23 (66%) | 55 (33%) | 78 (39%) | | | |
| Primary | 8 (23%) | 42 (26%) | 50 (25%) | | | |
| Secondary | 4 (11%) | 50 (30%) | 54 (27%) | 15.46 | 3 | 0.001** |
| Higher education | 0 (0%) | 18 (11%) | 18 (9%) | | | |
| **Occupation** | | | | | | |
| Unemployed | 25 (71%) | 71 (43%) | 96 (48%) | 9.33 | 1 | 0.002** |
| Employee | 10 (29%) | 94 (57%) | 104 (52%) | | | |
| **Residence** | | | | | | |
| Urban | 21 (60%) | 128 (78%) | 149 (75%) | 4.69 | 1 | 0.03* |
| Rural | 14 (40%) | 37 (22%) | 51 (25%) | | | |
| **Marital status** | | | | | | |
| Married | 29 (83%) | 143 (87%) | 172 (86%) | | | |
| Widow, single and divorce | 6 (17%) | 22 (13%) | 28 (14%) | | | 0.592 [a] |

*p value ≤ 0.05 was significant
**p value ≤ 0.01 was significant , a : Fisher – exact test .

**Table(3): The association of quality of life (poor quality and not poor) by medical history**

| Variable | Poor quality | Not poor quality | Total | $\chi^2$ | df | P-value |
|---|---|---|---|---|---|---|
| **Hypertension** | | | | | | |
| Present | 21 (60%) | 76 (46%) | 97 (48%) | 2.246 | 1 | 0.134 |
| Absent | 14 (40%) | 89 (54%) | 103 (52%) | | | |
| **Diabetic complication** | | | | | | |
| Present | 34 (97%) | 120 (73%) | 154 (77%) | 9.719 | 1 | 0.002** |
| Absent | 1 (3%) | 45 (27%) | 46 (23%) | | | |
| **Duration of diabetes** | | | | | | |
| (>15) years | 9 (26%) | 28 (17%) | 37 (18%) | 1.464 | 1 | 0.226 |
| (15 or less) years | 26 (74%) | 137 (83%) | 163 (82%) | | | |
| **Ischemic heart diseases** | | | | | | |
| Present | 12 (34%) | 23 (14%) | 35 (18%) | 8.279 | 1 | 0.004** |
| Absent | 23 (66%) | 142 (86%) | 165 (82%) | | | |
| **Smoking habit** | | | | | | |
| Present | 4 (11%) | 25 (15%) | 29 (15%) | 0.323 | 1 | 0.570 |
| Absent | 31 (89%) | 140 (85%) | 171 (85%) | | | |
| **Dyslipidemia** | | | | | | |
| Present | 5 (14%) | 30 (18%) | 35 (17%) | 0.304 | 1 | 0.582 |
| Absent | 30 (86%) | 135 (82%) | 165 (83%) | | | |
| **Family history** | | | | | | |
| Present | 16 (46%) | 93 (56%) | 109 (55%) | 1.321 | 1 | 0.250 |
| Absent | 19 (54%) | 72 (44%) | 91 (45%) | | | |

*p value ≤ 0.05 was significant
**p value ≤ 0.01 was significant

**Table 4 shows the association of quality of life (poor quality and not poor) by body mass index, waist to hip ratio and hemoglobin A1c**

| Variable | Poor quality | Not poor quality | Total | $\chi^2$ | df | P-value |
|---|---|---|---|---|---|---|
| **Obesity** | | | | | | |
| Normal | 5 (14%) | 23 (14%) | 28 (14%) | | | |
| Pre-obese | 14 (40%) | 70 (42%) | 84 (42%) | 0.071 | 2 | 0.965 |
| Obese | 16 (46%) | 72 (44%) | 88 (44%) | | | |
| **WHR** | | | | | | |
| High risk (>1 in male and >0.85 in female) | 21 (60%) | 85 (52%) | 106 (53%) | 0.835 | 1 | 0.361 |
| Low and moderate risk | 14 (40%) | 80 (48%) | 94 (47%) | | | |
| **HBA1c** | | | | | | |
| (7 and more) | 28 (80%) | 133 (81%) | 161 (81%) | 0.007 | 1 | 0.934 |
| (>5 and<7) | 7 (20%) | 32 (19%) | 39 (19%) | | | |

*p value $\leq 0.05$ was significant
**p value $\leq 0.01$ was significant

**Table (5): The association of quality of life (poor quality and not poor) by satisfaction with diet**

| Variable | Poor quality | Not poor quality | Total | $\chi^2$ | df | P-value |
|---|---|---|---|---|---|---|
| **Feeling that meals are delicious** | | | | | | |
| Yes | 10 (29%) | 104 (63%) | 114 (57%) | 13.98 | 1 | <0.001** |
| NO | 25 (71%) | 61 (37%) | 86 (43%) | | | |
| **Feeling satisfied after meals** | | | | | | |
| Yes | 17 (49%) | 103 (62%) | 120 (60%) | 0.309 | 1 | 0.129 |
| NO | 18 (51%) | 62 (38%) | 80 (40%) | | | |
| **Able to enjoy meals** | | | | | | |
| Yes | 17 (49%) | 106 (64%) | 123 (62%) | 2.995 | 1 | 0.084 |
| NO | 18 (51%) | 59 (36%) | 77 (38%) | | | |
| **Having a feeling of fullness after meals** | | | | | | |
| Yes | 16 (46%) | 104 (63%) | 120 (60%) | 3.608 | 1 | 0.058 |
| NO | 19 (54%) | 61 (37%) | 80 (40%) | | | |

*p value $\leq 0.05$ was significant
**p value $\leq 0.01$ was significant

**Table (6): The association of quality of life (poor quality and not poor) by burden of diet therapy**

| Variable | Poor quality | Not poor quality | Total | $\chi^2$ | df | P-value |
|---|---|---|---|---|---|---|
| **Necessity to eat meals at regular hours** | | | | | | |
| Yes | 20 (57%) | 137 (83%) | 157 (79%) | 11.465 | 1 | 0.001** |
| NO | 15 (43%) | 28 (17%) | 43 (21%) | | | |
| **Necessity to keep the energy intake constant** | | | | | | |
| Yes | 26 (74%) | 140 (85%) | 166 (83%) | 2.283 | 1 | 0.131 |
| NO | 9 (26%) | 25 (15%) | 34 (17%) | | | |
| **Necessity to make menus** | | | | | | |
| Yes | 22 (63%) | 132 (80%) | 154 (77%) | 4.79 | 1 | 0.029* |
| NO | 13 (37%) | 33 (20%) | 46 (23%) | | | |
| **Not being able to eat favorite foods** | | | | | | |
| Yes | 19 (54%) | 117 (71%) | 136 (68%) | 3.66 | 1 | 0.056 |
| NO | 16 (46%) | 48 (29%) | 64 (32%) | | | |
| **Not being able to eat same foods as other in gathering** | | | | | | |
| Yes | 23 (66%) | 131 (79%) | 154 (77%) | 3.051 | 1 | 0.081 |
| NO | 12 (34%) | 34 (21%) | 46 (23%) | | | |
| **Economic burden of diet therapy** | | | | | | |
| Yes | 25 (71%) | 51 (31%) | 76 (38%) | 20.12 | 1 | <0.001** |
| NO | 10 (29%) | 114 (69%) | 124 (62%) | | | |
| **Not being able to eat same foods as other family members** | | | | | | |
| Yes | 21 (60%) | 135 (82%) | 156 (78%) | 8.01 | 1 | 0.005** |
| NO | 14 (40%) | 30 (18%) | 44 (22%) | | | |
| **Necessity to cook or have someone cook the diabetic diet** | | | | | | |
| Yes | 19 (54%) | 117 (71%) | 136 (68%) | 18.32 | 1 | <0.001** |
| NO | 16 (46%) | 48 (29%) | 64 (32%) | | | |

*p value ≤ 0.05 was significant
**p value ≤ 0.01 was significant

**Table (7): The association of quality of life (poor quality and not poor) by perceived merits of diet therapy**

| Variable | Poor quality | Not poor quality | Total | $\chi^2$ | df | P-value |
|---|---|---|---|---|---|---|
| **Feeling that the health condition is good** | | | | | | |
| Yes | 5 (14%) | 127 (77%) | 132 (66%) | 50.56 | 1 | <0.001** |
| NO | 30 (86%) | 38 (23%) | 68 (34%) | | | |
| **Feeling that the glycemic control status is good** | | | | | | |
| Yes | 7 (20%) | 77 (47%) | 84 (42%) | 8.429 | 1 | 0.004** |
| NO | 28 (80%) | 88 (53%) | 116 (58%) | | | |
| **Having learned to lead a regular life** | | | | | | |
| Yes | 13 (37%) | 133 (81%) | 146 (73%) | 27.67 | 1 | <0.001** |
| NO | 22 (63%) | 32 (19%) | 54 (27%) | | | |
| **Feeling that the family bond has become closer** | | | | | | |
| Yes | 31 (89%) | 159 (96%) | 190 (95%) | | | 0.076[a] |
| NO | 4 (11%) | 6 (4%) | 10 (5%) | | | |
| **Feeling that worsening of diabetes has been successfully kept under check** | | | | | | |
| Yes | 16 (46%) | 130 (79%) | 146 (73%) | 16.02 | 1 | <0.001** |
| NO | 19 (54%) | 35 (21%) | 54 (27%) | | | |

*p value ≤ 0.05 was significant
**p value ≤ 0.01 was significant
a. Fisher-exact test