# Assessment of Knowledge, Attitude and Practice and Medication Adherence of Type-2 Diabetes Mellitus Patients: A Cross Sectional, Observational, Community Based Survey from Gujarat, India

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## ABSTRACT

Objectives: To assess knowledge, attitude and practice level and to measure medication adherence rate of type -2 Diabetes mellitus patients. **Materials and Methods:** A Cross Sectional, Observational, Community Based Survey Study. The study used a community-based survey, home to home visit in charotar, north Gujarat, Saurashtra and south Gujarat region. This study was carried out during November 2022 to May 2023, over a period of 7 months. **Results:** Total 139 Type-2 Diabetes mellitus subjects were enrolled in the study. Mean age (in years) of all study participants $N$=139 is 57.604±11. Mean value of glycosylated haemoglobin of $N$=139 participants were 8.298±2.110. Mean Body mass Index of male $N$=80 was 25.6±4.44. Mean Body mass Index of female $N$=59 was 26.15±3.89. From 139 participants, 46.04% have good knowledge, 30.21% have moderate knowledge and 23.74% have poor knowledge. Good, moderate and poor attitude level of participants were found 47.48%, 43.66% and 22.87% respectively. From 139 participants, 46.04% participants have Moderate and 53.95% participants have poor practice towards diabetes mellitus. The level of adherence from $N$=139 participants, we found 7.9% participants were low adherent, 46.76% participants were medium adherent, 26.6% participants were high adherent and 18.7% participants were highest adherent. **Conclusion:** The knowledge level of study participants regarding Type-2 Diabetes mellitus was quite satisfactory. Many of study participants showed positive attitude towards Type-2 Diabetes mellitus. Study showed, practice regarding Type-2 Diabetes mellitus were very low among the participants. Our study finding showed that medication adherence was low to medium. Ultimately counselling and educational intervention program is vitally important for enhancing knowledge, attitude and practice of disease and improving medication adherence for getting desired therapeutic outcome.

**Keywords:** Diabetes mellitus, Knowledge, Attitude, Practice, Medication adherence.

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## INTRODUCTION

Diabetes Mellitus (DM) is a serious, metabolic, chronic disease hence highly challenging public health problem of the 21st century across the globe. For all age-groups people across the globe, prevalence of diabetes was estimated to be 4.4% in 2030.[1] The prevalence rate of diabetes is higher in male than Female. There are two different types of DM, where greater than 90% are categorized under Type 2 DM (T2DM).[2,3] Obesity, unhealthy diet, very fewer physical activities, alcohol use and cigarette smoking are most common factors causing T2DM.[4,5]

At present, as per World Health Organisation (WHO) in India 77 million people are suffering with type-2 DM, age greater than 18 years and 25 million people are suspected of prediabetics.[6] Type-2 DM is also increasing Cardiovascular (CVS) risk fourfold and risk of CVS death increases twice. Type-2 DM increases future risk of limb amputation, neuropathy, loss of vision and loss of kidney function.[7,8]

Knowledge of diabetes, positive attitude and skill-based practice are effective social construct that changes behaviours and produces positive health outcomes. Present study shows KAP of type-2 DM patients through modified and validated version of KAP questionnaire.[9] Present study data helps to designing,

framing and successful execution of various educational interventional programme in state.

As per World Health Organisation (WHO) guideline adherence is depends on, behaviour pattern of individual, dietary habit, taking medication on time and executing life style changes as per recommendation from the health care provider.[10] It has been found that most of DM patients were being non adherent to medications,[11] results in to therapeutic failure, which enhances morbidity and later mortality rate.

Diabetes is progressive disease; for reducing diabetes progress life style modification, dietary habits, physical exercise and meditation are very best approaches for pre diabetics and recently diagnosed group of population. To control Type2 DM epidemic, educational intervention must be done in an appropriate, socially, economically and culturally suitable manner but till date very less data is available from Gujarat state to support this fact.

This research paper shows profile of Type-2 DM group of people, their knowledge, attitude and practice levels and medication adherence rate form Gujarat, India.

## MATERIALS AND METHODS

### Study Design and Site

Study design was observational, prospective and home-based community survey of Type-2 DM patients. The study used a community-based survey, home to home visit in charotar, north Gujarat, Saurashtra and south Gujarat region.

### Study Period

This study was carried out during November 2022 to May 2023, over a period of 7 months.

### Sample Size

As this study was community-based survey, total 139 patients were interviewed and after their consent, their all information and data were taken in a well-designed, validated data collection forms.

### Data Collection Tools

#### Patients Data Collection From

This sheet contains all demographic details of the patients. It has various parameters like the Name of patient, Height, Weight, BMI, Age, Chief complains, Diagnosis, Associated comorbidities like heart disease, kidney Disease, History of Lipid Profile, Blood Pressure, Duration of Disease, Medication history, History of diabetes, Allergic History, Adverse Drug Reaction History, Compliance History of treatment, History of Addiction, Lab investigation like Random Blood Sugar (RBS), Fasting Blood Sugar (FBS), Postprandial Blood Sugar (PPBS) Glucose Tolerance Test (GTT), Haemoglobin A1c (HbA$_{1c}$), Lipid profile, LDL,

Cholesterol, Triglyceride, Blood Pressure Creatinine, Urea, Eye check-up, ECG, Nervous system check-up for loss of sensation and Diet and life style history.

## Knowledge, Attitude and Practice Questionnaire (KAP)

The KAP questionnaire is a 3 parameter and 30 item scale that captures 3 dimensions of disease and behaviour of patient. It includes Participant information, Diabetic knowledge, Diabetic attitude, Diabetic practice. Purpose of this tool to find out patient's knowledge of the disease and their attitude and practice of disease. This questionnaire has a consistent, generalisable factor structure and good reliability and validity.

## Variables and measurements

We developed a basic Knowledge, Attitude and Practice (KAP) test questionnaire form. Our prepared test was aimed to collect fundamental information of the patients in three dimensions of disease knowledge, attitude of patients towards the disease and how they practice in their routine life. We mostly focused on qualitative and quantitative components in our updated and modified questionnaire. This modified KAP tool was verified and validated by a team of investigators made up of Diabetologist, Medical doctor, Pharmacologist, Pharmacist, health economist and language expert. We did preliminary study in community survey covering almost ($N$=30) patients. Based on our preliminary study we revised the final version of questionnaire that would be friendly and easy for our study participants to understand and answer. Total score of KAP questionnaire mapped 30 points. 10 points for each dimension was designed. For Knowledge and Practice component, score was developed as follow: for each "Yes" to a question, a score of "1" was given while for each "No", a score of "0" was given. So, least score of knowledge component was "0" and maximum score was "10" given. For Attitude component, score was developed as follow: Attitude questions were designed based on Linkert scale. This scale was made up of strongly agree, Agree, Neither, Disagree and strongly disagree. For each strongly agree and Agree answer score was given "1" and for each Disagree and strongly disagree answer score was given "0". So, least score for attitude questions were "0" and maximum score was "10" assigned. We graded diabetes knowledge, Attitude and Practice according to the following criteria. Score: $\geq$8=Good, 6-7=Moderate and $\leq$5=Poor. A percentage score was calculated from frequency of right answered individuals. It was derived by dividing everyone with right answered by total individual multiply by 100. For example, knowledge Q-1, frequency of right answered were 132, then % frequency (score) was calculated 132/139100=94.96%. For better understand the perceptiveness of diabetes, all participants were asked an open-ended question to describe what they know about disease, what is their attitude towards disease and how effectively they follow their knowledge and attitude in their real-life practice. All answer of

their perceptiveness was used in data analysis i.e. Associated Co-Morbidities, Diet, Life style, BMI, Exercise, Smoking etc.

## Sample size calculation

### Sample size calculation and plan of statistical analysis

Prevalence of diabetics is reported 8.5% (i.e., 0.085) in National Family Health Survey (NFHS-5). Considering this prevalence that is 8.5% and allowable Margin of Error (MOE) of 3% (i.e., 0.03) sample size calculated. Hence estimated prevalence is $p \pm$ MoE, where $p$ is proportion.

The estimated prevalence is of 8.5$\pm$3% with 95% confidence.

Using normal approximation for binomial distribution, $p$ follows normal distribution with mean $p$ and standard deviation $\sqrt{\frac{p(1-p)}{n}}$.

We know that,

$$MoE = Z_{\{critical\}} * SD$$

$$MoE = Z_{\{critical\}} * \sqrt{\frac{p(1-p)}{n}}$$

(We have MoE=3%, $p$=0.085, Z_critical value is tabulated value. Z_critical=1.96 for 95% confidence level).

$$0.03 = 1.96 * \sqrt{\frac{0.085(1-0.085)}{n}}$$

$$n = \frac{1.96^2 * 0.085 * (1-0.085)}{0.03^2}$$

$$n = \frac{3.8416 * 0.077775}{0.0009}$$

$$n = 331.9783$$

$$n \cong 332$$

Considering 3% allowable error on either side, confidence level at 95%, minimal sample size required is 332.

## Morisky Medication-Taking Adherence Scale-MMAS (4-item) Questionnaire

Our study aimed to find out adherence rate of study participants. This study only focused on quantitative component of adherence of Type-2 DM patients. This tool is used from publish version of Morisky Medication Adherence Scale-4. Adherence to medication is a crucial part of patient care and reaching clinical goals. The outcome will be ranked in a scale of 0-4, 0 being non adherent and 4 being adherent.

All data collection tools are converted in to Guajarati language so patients can understand and able to give appropriate answer.

## Source of Data

- Direct patient face to face interview.
- Patient's data files, prescription, hospital files.

- Patient counselling.
- Collection of laboratory reports.
- Demographic detail form.
- Informed consent form.

## Study Criteria

### Patients Inclusion Criteria

- Male and Female Type-2 DM patient age >18 years.
- Who wants to participate in study?
- Patients who signed informed consent form.

## Exclusion Criteria

- Pregnant women.
- Type-1 DM and paediatric patients.
- Patients who were not willing to give consent to participate.

STROBE Flow chart of current observational study, Strengthening the Reporting of Observational Studies in Epidemiology.

A total 139 patients were enrolled in the study. Their demographic details and all lab values were collected in self-designed and validated demographic form. We did face to face personal interview with all enrolled patients to fill the three data collection questionnaire form.

## Statistical Analysis

All the study data transferred in to Microsoft excel 2019. Data were analysed using Minitab statistical software version 17.1 for windows. All the quantitative variables expressed using Mean (Standard Deviation (SD)), Median and interquartile range. All categorical variables were presented using frequencies and percentages. Student's t test was used for testing difference between mean values of two continuous variables. Also, the correlation between variables was tested using Pearson's and spearman's correlation. Probability values ($p$-Values) less than 0.05 was considered significant.

## RESULTS

Total 139 Type-2DM subjects were enrolled in the study.

## Socio-demographic Characteristics of Participants

Socio-demographic characteristics of all the study participants are shown in Table 1. Mean (SD) age of all study participants $N$=139 is 57.604$\pm$11.613. $N$=54 participants follow in age group 51-60 years shown in Figure 1. from all the study subjects $N$=80 (57.55%) was male and $N$=59 (42.45%) was female. $N$=137 (98.56%) study participants married. $N$=137 (98.56%) was following Hinduism

**Identification**
• Eligible Patient (N=332)

**Not included n=193**
• lack of motivation to fill the questionnaire form (n=97)
• Not willing to provide written informed consent (n=96)

**Inclusion**
• Included in the study (n=139)
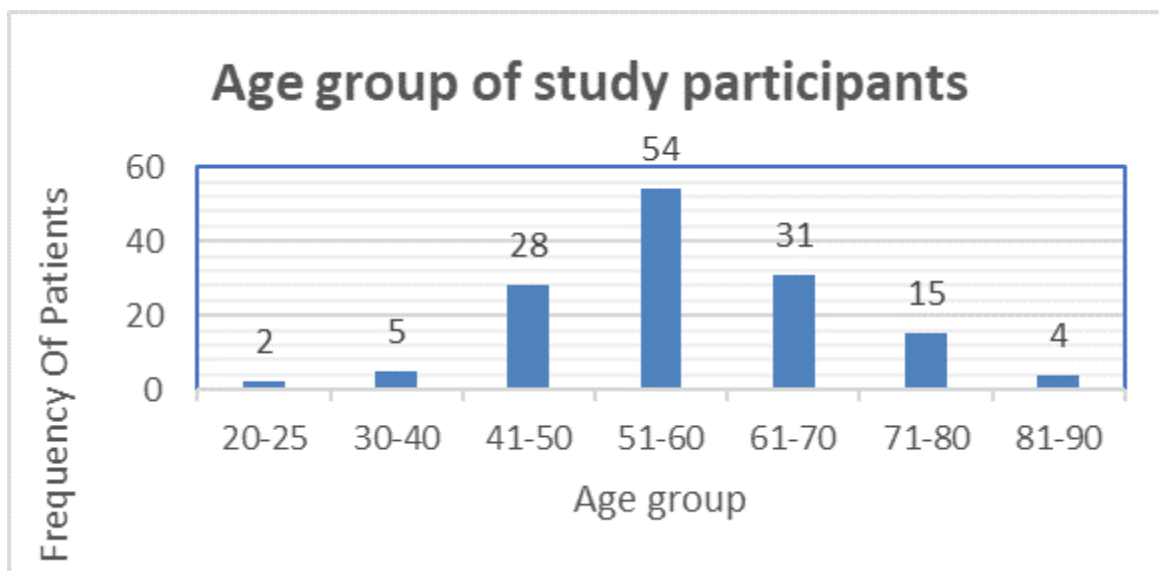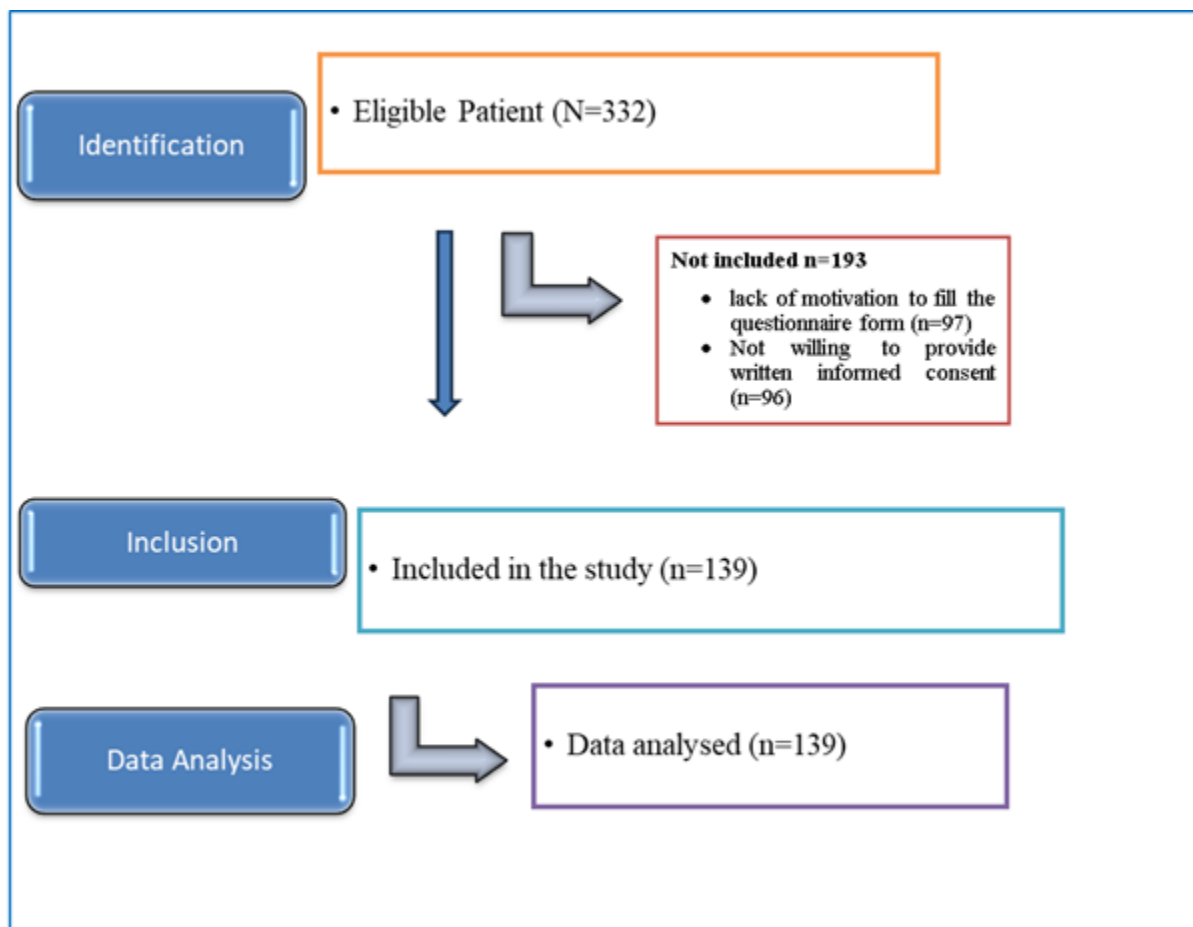
**Data Analysis**
• Data analysed (n=139)



**Figure 1:** Age Group of Study Participants.

while $N=2$ (1.44%) was Islamic. $N=42$ (31.0%) of the subjects has degree and higher level of education. $N=1$(15.11%) subjects were illiterate. among the all $N=139.32$ (23.02%) subjects were doing job, 50 (35.97%) subjects were housewife's and 32 (23.02%) subjects were retired, $N=13$ (9.36%) subjects were employed, $N=8$ (5.76%) were Farmer. $N=9$ (6.48%) subjects were Non-worker,

$N=6$ (4.32%) Subjects were Businessman, $N=2$ (1.44%) Subjects were diver and $N=8$ (5.76%) was followed other professions.

## HbA$_{1c}$ (%) Profile of Study Participants

Glycosylated haemoglobin % (HbA$_{1c}$ (%)) mean (SD) value of $N=139$ participants were 8.298±2.110 shown in Table 2. From

**Table 1: Socio-demographic Characteristics of Type 2 Diabetic Subjects from Gujarat, India.**

| Characteristics | N=139 | % |
|---|---|---|
| Age (years) | (mean±SD) | |
| | 57.604±11.613 | 100 |
| sex | | |
| Men | 80 | 57.55 |
| Women | 59 | 42.45 |
| Marital status | | |
| Married | 137 | 98.56 |
| Never Married | 02 | 1.44 |
| Religion | | |
| Hinduism | 137 | 98.56 |
| Islam | 02 | 1.44 |
| Education | | |
| Degree and above | 42 | 31.00 |
| Diploma courses | 7 | 5.04 |
| High school (class 8-10) | 32 | 23.02 |
| Middle school (class 5-7) | 27 | 19.43 |
| Primary school (Class 1-4) | 10 | 7.2 |
| Illiterate | 21 | 15.11 |
| Occupation Level | | |
| Job | 32 | 23.02 |
| Housewife | 50 | 35.97 |
| Retired | 32 | 23.02 |
| Employed | 13 | 9.36 |
| Farmer | 8 | 5.76 |
| Non-worker | 9 | 6.48 |
| Businessman | 6 | 4.32 |
| Driver | 2 | 1.44 |
| Labourer | 2 | 1.44 |
| Others | 8 | 5.76 |

**Table 2: Profile of HbA$_{1c}$ (%) of Type 2 Diabetic Participants from Gujarat, India.**

| Characteristics | No. (N=139) | % |
|---|---|---|
| Glycosylated haemoglobin (%) (HbA$_{1c}$) (Mean±SD) | 8.298±2.110 | |
| Glycaemic status (%) | | |
| ≤7 (good control) | 36 | 26 |
| 7-8 (optimal control) | 34 | 24.46 |
| 8-9 (sub-optimal control) | 34 | 24.46 |
| >9 (uncontrolled) | 35 | 25.17 |
| Family history of diabetes | Present | |
| | 98 | 70.50 |

SD=Standard Deviation.

in healthy weight range (between 18.5 and 24.9). only N=13 (16.51%) male were obese (BMI≥30). N=24 (32.98%) male were found overweight range. Mean (SD) of female (N=59) BMI was 26.15±3.89. N=23 (38.91%) female were found in healthy weight range. Only N=8 (13.52%) was found obese. Mostly N=27 (45.68%) was found overweight.

Mean (SD) of Random Blood Sugar (RBS) of male was 232.49±79.59. N=52 (65%) of male shows RBS≥200 mg. Mean (SD) of RBS of female was 226.4±85.2. N=37 (62.59 %) females have RBS≥200 mg. Mean (SD) of Fasting Blood sugar (FBS) of male was 203.8±93.9. N=64 (80%) of male has FBS≥126 mg/dL. Mean (SD) of Fasting Blood sugar (FBS) in female was 165.90±64.54. N=37 (62.58%) female has FBS≥126 mg/dL.

Mean (SD) of total cholesterol of male was 164.99±41.39 and female was 185.1±38.17. this shows total cholesterol of most of male and female participants were normal (Less than 200 mg/dL). Mean (SD) of LDL of male was 132.55±38.33 and female was 122.86±37.69. most of male participants N=34 (42.5%) has borderline high LDL (130 to 159 mg/dL). While in female N=23 (38.93%) has optimal LDL (100 to 129 mg/dl).

Mean (SD) of triglycerides of male was 172.4±71.5 and female was 165.3±57. This shows all participants have Borderline high level of triglycerides (150 to 199 mg/dL). Mean (SD) of creatinine of male was 1.1691±0.5889 and female was 0.8488±0.2359. This shows most of all participants have normal level of creatinine (0.7 to 1.3 mg/dL). Only N=10 (12.5%) of males has higher creatinine level (>0.7 to 1.3 mg/dL).

N=58 (72.5%) of male and N=40 (67.79%) female have hypertension. N=10 (12.5%) of male and N=9 (15.25%) of female has diabetic peripheral neuropathy. Very few patients have diabetic nephropathy (N=2, 2.5% in male and N=2, 3.38% in female). N=66 (82.5%) of male and N=54 (91.52%) of female were taking balanced diet. More than 50% of male and female were doing physical exercise. Very few, N=15 (18.75%) male were smoking and N=22 (27.5%) of male were taking alcohol.

that N=36 (26%) participants show good glycaemic control (HbA$_{1c}$≤7%). N=34 (24.46%) participants show sub optimal control (HbA$_{1c}$ 8-9%) while N=35 (25.17%) participants show uncontrolled glycaemic levels (HbA$_{1c}$>9%). This study shows from N=139 participants, N=98 (70.50%) participants have family history of diabetes.

## Risk Factor and Clinical/Lab Investigation

Risk factor and lab investigation of all study participants shown in Table 3 and Mean (SD) values of all quantitative variables shown in Table 4. Mean (SD) of BMI (Body Mass Index) values of male N=80 was 25.6±4.44. N=42 (50.07%) of male were

**Table 3:** Profile of clinical, Lab Investigation, Associated Co-Morbidities and Other Parameters of Type 2 Diabetic Study Subjects from Gujarat, India.

| BMI and Lab Characteristics and associated comorbidities | Male (*N*=80) | % | Female (*N*=59) | % |
|---|---|---|---|---|
| **BMI** | | | | |
| Below 18.5-You're in the underweight range | 1 | 1.27 | 1 | 1.69 |
| Between 18.5 and 24.9-You're in the healthy weight range | 42 | 50.07 | 23 | 38.91 |
| Between 25 and 29.9-You're in the overweight range | 24 | 32.98 | 27 | 45.68 |
| 30 or over-You're in the obese range | 13 | 16.51 | 8 | 13.52 |
| **Random blood sugar mg/dL** | | | | |
| Normal: less than 140 mg/dL | 11 | 13.75 | 10 | 16.92 |
| Prediabetes: 140-199 mg/dL | 17 | 21.25 | 12 | 20.32 |
| Diabetes: 200 mg/dL or above | 52 | 65 | 37 | 62.59 |
| **Fasting Blood sugar (FBS) mg/dL** | | | | |
| Normal: less than 100 mg/dL | 6 | 7.5 | 6 | 10.14 |
| Prediabetes: 100-125 mg/dL | 10 | 12.5 | 16 | 27.07 |
| Diabetes: 126 mg/dL or above | 64 | 80 | 37 | 62.58 |
| **Total Cholesterol mg/dL** | | | | |
| Normal: Less than 200 mg/dL | 65 | 81.25 | 36 | 60.9 |
| Borderline high: 200 to 239 mg/dL | 11 | 13.75 | 19 | 32.2 |
| High: At or above 240 mg/dL | 4 | 5 | 4 | 6.76 |
| **LDL mg/dl** | | | | |
| Optimal: Less than 100 mg/dL | 10 | 12.5 | 13 | 22.03 |
| Near optimal: 100 to 129 mg/dL | 28 | 35 | 23 | 38.93 |
| Borderline high: 130 to 159 mg/dL | 34 | 42.5 | 14 | 23.72 |
| High: 160 to 189 mg/dL | 5 | 6.25 | 6 | 10.16 |
| Very high: 190 mg/dL and higher | 3 | 3.75 | 3 | 5.08 |
| **Triglycerides mg/dL** | | | | |
| Normal: Less than 150 mg/dL | 33 | 41.25 | 26 | 43.99 |
| Borderline high: 150 to 199 mg/dL | 30 | 37.5 | 16 | 27.06 |
| High: 200 to 499 mg/dL | 17 | 21.25 | 17 | 28.76 |
| Very high: Above 500 mg/dL | 0 | 0 | 0 | 0 |
| **Creatinine mg/dL** | | | | |
| <0.7 to 1.3 mg/dL | 7 | 8.75 | 13 | 20.67 |
| 0.7 to 1.3 mg/dL | 63 | 78.75 | 45 | 77.57 |
| >0.7 to 1.3 mg/dL | 10 | 12.5 | 1 | 1.76 |
| **Urea mg/dL** | | | | |
| <6 to 24 mg/dL | 6 | 7.5 | 1 | 1.69 |
| 6 to 24 mg/dL | 64 | 80 | 52 | 88.05 |
| >6 to 24 mg/dL | 10 | 12.5 | 6 | 10.14 |
| **Associated co-morbidities** | | | | |
| Hypertension | 58 | 72.5 | 40 | 67.79 |
| Diabetic peripheral neuropathy | 10 | 12.5 | 9 | 15.25 |
| Proteinuria | 10 | 12.5 | 8 | 13.55 |
| Diabetic nephropathy | 2 | 2.5 | 2 | 3.38 |

| BMI and Lab Characteristics and associated comorbidities | Male (*N*=80) | % | Female (*N*=59) | % |
|---|---|---|---|---|
| **BMI** | | | | |
| **Diet and lifestyle** | | | | |
| **Balanced diet** | | | | 9 |
| YES | 66 | 82.5 | 54 | 1.52 |
| No | 14 | 17.5 | 5 | 8.47 |
| **Exercise-** | | | | |
| YES | 43 | 53.75 | 36 | 61.01 |
| No | 37 | 46.25 | 23 | 38.98 |
| Smoking | 15 | 18.75 | 0 | 0 |
| Alcohol | 22 | 27.5 | 0 | 0 |

SD=Standard deviation.

## Knowledge of Study Participants Regarding Type-2DM

Most of all participants knew about diabetes [94.9% (132)], types of diabetes [95.6% (133)], risk factor of diabetes [85.1% (119)], shown in Figure 2. Many of them knew symptoms of diabetes [79.13% (110)]. They also knew regular blood glucose test; regular prescription medicines intake and diet and exercise can reduce complications of diabetes [77.69% (108)]. Only [55.3% (77)] study participants know types of diabetic complications. Very few participants knew acute complications [40.28% (56)] and chronic complications [46.04% (64)] of diabetes. Still, many of them do not differentiate Type-I and Type-II diabetes [55.3% (77)].

## Attitude of Study Participants Regarding Type-2DM

Mostly all agreed [94.9% (132)] that blood sugar can be controlled by exercise, sports and medicines shown in Figure 3. They also agreed that diet can control blood sugar [94.24% (131)]. They feel glucose testing is necessary [93.52% (130)]. [91.36% (127)] agreed that diabetes can be well managed. Around [74.1% (103)] participants agreed that prevention of complication is important in diabetes. Few of them [65.46% (91)] agreed that complication due to diabetes are a very serious problem and [66.18% (92)] of them agreed on taking care of feet is necessary while treating diabetes.

## Practice of Study Participants Regarding Type-2 DM

All the participants [100% (100)] were on oral medicine of diabetes. 80.57% (*N*=112) participants were taking care of their feet shown in Figure 4. Only 56.8% (79) and 52.5% (73) participants exercise regularly and monitor blood sugar by regular blood test respectively. Only 50.3% (70) of participants were concerned about regular meal on time and following diet. Most of study participants taking care of their feet with the help of different tools like shocks, proper shoes, massage etc.

## Association between knowledge, Attitude and Practice Scores Regarding type-2DM

The Pearson correlation test showed very weak positive significant association between knowledge and attitude score (r=0.1956, *p*=0.09) and attitude and practice (r=0.1818, *p*=0.080). This test showed correlation of knowledge and practice scores (r=0.033, *p*=0.425) of study participants.

## Association between Age, BMI, HbA$_{1c}$, Balance Diet and Exercise with KAP Score

Association between age, BMI, HbA$_{1c}$, balance diet and exercise was found through Pearson correlation test shown in Table 5. The Pearson correlation test showed lowest negative correlation of age between knowledge, attitude and practice scores (r=-0.065, *p*=0.102), (r=-0.083, *p*=0.085), (r=-0.051, *p*=0.117) respectively. This test also showed lowest negative correlation of BMI and knowledge (r=-0.045, *p*=0.102) and attitude scores (r=-0.158, *p*=0.008) but this test showed lowest positive correlation with BMI and practice score (r=0.095, *p*=0.258). This test showed lowest positive correlation only between HbA$_{1c}$ and practice score (r=0.093, *p*=0.256). Correlation showed in HbA$_{1c}$ and knowledge and attitude scores. The Pearson correlation test showed moderate positive correlation for balanced diet and practice score (r=0.416, *p*=0.545), also weak positive correlation between balanced diet and knowledge score (r=0.102, *p*=0.281) but correlation between balanced diet and attitude score (r=0.089, *p*=0.521). The Pearson correlation test showed weak positive correlation between exercise and practice score (r=0.168, *p*=0.326).

## Male (*N*=80) and Female (*N*=59) Participants Knowledge, Attitude and Practice Score

Mean (SD) of male knowledge score was 7.2±1.709 and female score was 7±1. 875 showed in Table 6. For male lowest knowledge score was 4 and highest knowledge score was 10 obtained. Study found *N*=29(23.75%) of male has highest knowledge score 8 out of 10. For Female lowest knowledge score was 3 and highest

**Table 4:** Characteristics of Study Population, Clinical and Laboratory Findings by Gender Among the Type 2 Diabetic Subjects from Gujarat, India.

|  | Male Mean±SD | IQR | Female Mean±SD | IQR | p-Value |
|---|---|---|---|---|---|
| Age | 57.36±12.01 | 14.75 | 57.93±11.15 | 15.00 | 0.774 |
| BMI | 25.6±4.44 | 5.80 | 26.15±3.89 | 4.40 | 0.446 |
| Fasting Blood sugar (FBS) | 203.8±93.9 | 117.5 | 165.90±64.54 | 93.00 | 0.005** |
| Random blood sugar (RBS) | 232.49±79.59 | 127.75 | 226.4±85.2 | 144.00 | 0.001** |
| HbA$_{1c}$ | 8.82±2.41 | -* | 7.9±1.69 | -* | 0.04* |
| LDL | 132.55±38.33 | 39.75 | 122.86±37.69 | 45.00 | 0.139 |
| Total Cholesterol | 164.99±41.39 | 47.00 | 185.1±38.17 | 47.00 | 0.004** |
| Triglycerides | 172.4±71.5 | 64.50 | 165.3±57 | 71.00 | 0.521 |
| Creatinine | 1.1691±0.5889 | -* | 0.8488±0.2359 | -* | 0.00** |
| Urea | 14.33±9.31 | 10.75 | 13.14±9.33 | 9.4 | 0.458 |

−* do not have original Value.*p value significant at 0.05 level.**p value significant at 0.01 level.



**Figures 2, 3, 4:** Knowledge, Attitude and Practice of Study Participants Regarding Type-2DM.

knowledge score was 10 obtained. Study showed N=13 (22.03%) and N=13 (22.03%) female have highest knowledge score 7 out of 10 and 8 out of 10 respectively. Mean (SD) of male attitude score was 8.262±1.589 and female attitude score was 8.119±1.672 showed in Table 6. Study found N=25 (31.25%) of male has highest attitude score 10 out of 10. Study showed N=16(27.12%) female have highest attitude score 10 out of 10. Mean (SD) of male practice was 5.05±1.113 and female was 5.39±1.051 showed in Table 6. Lowest score of practice was 3 and highest score was 7 out of 10 was obtained. N=27 (33.8%) of male and N=24 (40.7%) of female practice score was 6 out of 10.

## Adherence to Anti Diabetic Medications

Adherence to anti diabetic medication was calculated from Morisky Medication-Taking Adherence Scale-MMAS (4-item). Majority of all participants were on Oral Hypoglycaemic Agents (OHA). Mean (SD) of male MMAS score was 2.525±0.914 and female MMAS score was 2.593±0.79 presented in Table 7. 50% of male and 44.1% of female scored 2 on MMAS scale.

From total N=139 participants, N=11 (7.9%) was low adherent, N=65 (46.76%) was medium adherent. N=38 (26.6%) were high adherent and N=25 (18.7%) was highest adherent, presented in Table 8. This study showed almost N=63 (45.3%) participants showed high and highest adherence.

**Table 5: Association between Age, BMI, HbA$_1$c, Balance Diet and Exercise with KAP Score.**

| Variables | Knowledge | Attitude | Practice | Total Score |
|---|---|---|---|---|
| Age | r=-0.065 | r=-0.083 | r=-0.051 | r=-0.110 |
| | p=0.102 | p=0.085 | p=0.117 | p=0.058 |
| | | | | |
| BMI | r=-0.045 | r=-0.158 | r=0.095 | r=-0.071 |
| | p=0.123 | p=0.008 | p=0.258 | p=0.097 |
| | | | | |
| Hemoglobin A1c(HbA$_{1c}$) % | r=-0.038 | r=-0.040 | r=0.093 | r=-0.021 |
| | p=0.129 | p=0.127 | p=0.256 | p=0.146 |
| | | | | |
| Balanced diet | r=0.120 | r=0.089 | r=0.416 | |
| | p=0.281 | p=0.251 | p=0.545 | |
| | | | | |
| Exercise | r=-0.075 | r=-0.080 | r=0.168 | |
| | p=0.093 | p=0.087 | p=0.326 | |

**Table 6: Male and Female Participant Knowledge, Attitude and Practice Score.**

| | | Knowledge / 10 | | Attitude /10 | | Practice/10 | | Total score/30 | |
|---|---|---|---|---|---|---|---|---|---|
| Characteristics | N | Mean±SD | p-value | Mean±SD | p-value | Mean±SD | p-value | Mean±SD | p-value |
| **Sex** | | | | | | | | | |
| Male | 80 | 7.2±1.709 | 0.52 | 8.262±1.589 | 0.61 | 5.05±1.113 | 0.068* | 20.512±3.002 | 0.942 |
| Female | 59 | 7±1.875 | | 8.119±1.672 | | 5.39±1.051 | | 20.475±3.008 | |

**Table 7: Mean (SD) of Male and Female MMAS Score.**

| Sample | N | Mean±StDev | SE Mean | p-Value |
|---|---|---|---|---|
| Male_MMAS Score | 80 | 2.525±0.914 | 0.1 | 0.639 |
| Female_MMAS Score | 59 | 2.593±0.79 | 0.1 | |

**Table 8: MMAS Score and Frequency of Participants (N=139).**

| MMAS Score | Frequency | % |
|---|---|---|
| 1 | 11 | 7.91 |
| 2 | 65 | 46.76 |
| 3 | 38 | 26.6 |
| 4 | 25 | 18.7 |

## DISCUSSION

The present observational, community-based survey study showed large number of demographic data. As per study carried out by Prajapati D, prevalence of diabetes in Gujarat was 9% in males and 10% in females. Study also showed positive corelation of sedentary lifestyle of most of population can increase higher risk in prevalence of Diabetes mellitus.[12] Mehta M, in Jamnagar, Gujarat in 2022 showed Type-2 DM is the most common in the middle age population of urban area.[13] Prevalence depends on risk factors having higher BMI, having comorbidity like hypertension and ischaemic heart disease.

Till date wide number of studies carried out in Gujarat and all studies showed that the alarming increase in the prevalence of overweight and obesity in urban and rural adolescents specially with the male gender suggesting for an urgent need for immediate and targeted preventive measures through life style interventions and awareness programs in the pre diabetic populations.[14-17] The present study found that Type-2 DM is a major health burden in Gujarat, which is consistent with findings of kumar.D.[18] The

important findings of study, $N$=36 (26%) of study participants showed good glycaemic control (HbA$_{1c}$ ≤7%). $N$=13 (16.5%) and $N$=8(13.5%) of male and female were obese. $N$=21(15.1%) of study participants were illiterate. This finding was expected because it was community-based survey mostly covered villages area of Gujarat. This study showed 26% of the participants had good glycaemic control which is similar with other findings like, AI Muskari F, *et al.* found that 38% of type-2 DM subjects had good glycaemic control[19] and 31% of study subject showed good glycaemic control.[20,21] Still this present community-based survey showed fair control on HbA$_{1c}$ levels. This study showed ($N$=98) 70.50% of study participants had a family history of diabetes which is related with hypertension and sedentary working. This study showed total cholesterol levels were normal (less than 200 mg/dL) in $N$=65 (81.25%) of male and $N$=36 (60.9%) of female, but LDL levels and triglycerides levels were borderline high. This is corelated with hypertension, most of study participants (70%) had hypertension. Hildrum *et al.* finding were similar to present study like total cholesterol, LDL, Tri Glycerides (TGs) had significantly higher prevalence in comparatively older groups (age group- 51-60 years).[22] Our study showed only 12.5% of male and 15.25% of female have diabetic peripheral neuropathy which is corelated with finding of Solanki JD *et al.*,[23] showed 38% prevalence of diabetic peripheral neuropathy amongst the population in Gujarat. Although balanced diet and physical exercise is the crucial part of management of Type-2 DM. our study showed that 82.5% of male and 91.52% of female followed balanced diet, that is good indication and 53.75% of male and 61.01% of female followed routine exercise. Patient compliance can be increased by self-awareness and self-regulation of diet, exercise, regular blood glucose monitoring and adherence to medication.[24]

Our study found good knowledge of Type-2 DM in male and female participants. Shah VN showed that poor KAP and inadequate of time allotted by doctors to patients.[25] In our study though diabetes knowledge were good but still few participants were not aware about knowledge of DM which is like previous studies.[26,27] Lower knowledge scores associated with illiterate and had middle school education levels of study participants. Our study knowledge score is like sadek R *et al.*,[28] as their study participants have good knowledge of DM. Upadhyay *et al.* observed lower knowledge scores[29] than the present study. We found favourable attitude of our study participants for DM. Kumar M,[30] showed that with counselling knowledge, Practice and Attitude of chronic patients are improving. Yasobant S,[31] showed suitable designed community-based intervention programs can changed knowledge and practice levels about diabetes management. Priyanka RCK,[32] showed a positive knowledge and attitude of diabetes patients which is similar with our findings. Our findings show very low practice score. Though they showed good knowledge, favourable attitude but they were not having

practice of it. Most of participants were not doing regular blood test. They do not concern about regular meal on time and doing exercise. Ghannadi S[33] showed similar low practice score which was related to lower education. Kennedy C.A *et al.*[34] showed that education of self-management of disease had positive outcomes on practice scores in their survey. Our study showed lowest positive correlation between HbA$_{1c}$ and practice score, but correlation showed in HbA$_{1c}$ and knowledge and attitude score. Mohammadi. S *et al.*,[35] showed significant association between KAP score and glycaemic control.

The finding of the study showed there was lower medication adherence in the participants. These results pointing out the issues of non-adherence amongst Type-2 DM Patients. Many research and reviews has addressed issues of poor medication adherence in diabetes patients. Ahmad NS[36] showed poor adherence to medication in Type-2 DM patients in primary health clinics in Malaysia. Present study showed overall 50% of medication adherence of participants. Rajgadhi H[37] said that good medication adherence not only enhances glycaemic control but also retards the long-term complications of Type-2 DM. Study showed medium to low adherence in patients. De Galan BE *et al.*[38] showed importance of regular follow up of diabetic patients with health care provider reduces long term complications. Poor adherence to treatment occurs due to poor attitude and practice towards disease and poor health literacy of population. Adepu SP[39] showed that structured educational pharmaceutical care activities had shown marked improvement in medication adherence behaviour, supporting the interventional educational role of the clinical pharmacist. Joshi J,[40] showed there is need to develop structured diabetes self-care education programs with involvement of doctor, pharmacist and place emphasis on self-management education to patients and care givers especially low socioeconomic class and having lower education. Educational pharmaceutical care program intervention is required in community for better KAP in early stage of disease before it affects chronically.

## CONCLUSION

This study has measured the knowledge, Attitude and Practice level of Type-2 DM as well as demographic details, Lab values of various diagnostic parameters and medication adherence amongst the study participants. KAP regarding DM mostly depends on the socioeconomical state, cultural belief, mental level of patients and action performed by them time to time manner. Our study finding showed that medication adherence was low to medium. This was mainly due to lesser adherence with prescribed drug therapy and very poor practice of self-regulatory behaviours. Ultimately counselling and educational intervention with follow up is vitally important for enhancing KAP of disease and improving medication adherence for getting desired therapeutic outcome.

## Limitation of study

This study is basically community-based survey, so it is not possible to determine exact cause and effect relationship. This study was carried out in villages of charotar region of Gujarat, north part of Gujarat and Saurashtra region of Gujarat. So, for generalize conclusion study needs to carry out as many as possible in all the part of Gujarat state. Another limitation is, we did not find out reason of non-adherence due to various social, lifestyle, economic parameters. In future we will perform in self-care measurement levels and Adherence in Chronic Disease scale (ACDS). In future, study should be done with application of experimental design for finding out exact causality assessment of variables and outcomes.

## Recommendation of Study

Enhancing awareness by educational programs, personal counselling and giving visual aids (books, leaflets, Pictorial material of disease in small diaries form) in local language.

Enhancing awareness in diet, exercise, life style modification.

Improving attitude of disease and practice of disease with regular bold test, BP monitoring, foot checking.

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## CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

## ABBREVIATIONS

**DM:** Diabetes mellitus; **SD:** Standard Deviation; **T2DM:** Type 2 Diabetes mellitus; **NCD:** Noncommunicable diseases; **WHO:** World Health Organisation; **CVS:** Cardiovascular system; **KAP:** Knowledge, Attitude and Practice; **RBS:** Random blood sugar; **FBS:** Fasting Blood sugar; **PPBS:** Postprandial blood sugar; **GTT:** Glucose Tolerance Test; **HbA$_{1c}$:** Haemoglobin A1c; **LDL:** Low-density lipoprotein; **ECG:** Electro cardiogram; **MMAS:** Morisky Medication Adherence Scale; **IEC:** Institutional Ethics Committee; **p values:** Probability values; **BMI:** Body mass Index; **OHA:** Oral hypoglycaemic agents.

## ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study performed in accordance with the ethical standards of Institutional Ethics Committee and with the declaration of Helsinki as per the ethical standards. The ethical approval of this study was obtained from institutional ethics committee (IEC-2), Bhaikaka university, Karmsad, Anand, Gujarat (approval no: IEC/BU/2023/EX.16/93/2023). The details of study aim and purpose were explained to the patients and written informed consent was obtained from all patients. All the patient's information was kept confidential and secure.

## AUTHORSHIP CONTRIBUTION STATEMENT

RP and HP developed study concept and study design. RP responsible for data collection. RP and HP were responsible for statistical Analysis and data Interpretation. RP drafted the manuscript. HP revised the final prepared draft. All authors prepared and approved Final version of manuscript to be published.

## SUMMARY

The current study was the prospective, observational, cross-sectional study carried out in Gujarat with the aim to find out knowledge, attitude and practice level of Type-2 Diabetes mellitus and, we aimed to find out rate of adherence of that patient with the treatment by providing them structured questionnaire and assessing their feedbacks. This study helps to find out current position of KAP of Type-2 DM and adherence of rate of treatment. this study disclosed attitude and knowledge level is comparatively high than the practice level. This study imparts half of study participants showed medium adherence towards treatment. That is why interventional structured educational pharmaceutical care program with follow up is vitally needed for enhancing KAP of disease and improving medication adherence for getting desired therapeutic outcome and reducing national health burden of NCDs.

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