REDUCTION IN DRUGS DOSAGE: AN INSIGHT FROM THREE DAYS APP BASED DIETARY INTERVENTION

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Introduction

Diabetes is a common life-style disorder characterized by hyperglycemia, impairment in insulin metabolism, increased urination, increased thirst and unexplained weight loss[1]. According to International Diabetes Federation (IDF) estimated prevalence for diabetes in India was 72,946,400 cases in year 2017[2]. Majorly diabetes is of two types, type 1 diabetes and type 2 diabetes. Type 2 diabetes forms major fraction of all the diabetes i.e. 90-95% while type 1 constitutes 5-10%. In type 2 diabetes impaired receptors don't respond to insulin while type 1 diabetes is an autoimmune disorder where there is a lack of insulin due to the destruction of beta cells[1]. Furthermore, diabetes has been associated with many complications leading to poor quality of life which is shown by higher values of Hb1Ac [3]. It has been shown that insulin requirement can be decreased once a constant glycemic control is achieved[4,5]. Diet plays an important role in controlling blood sugar level. In two separate studies low carbohydrate diet successfully decreased or sometime even eliminated the need for medicine[6,7]. On the contrary, high fat diet results in the impairment of glucose level by altering binding of insulin at its receptors. The type of fatty acid changes phospholipids composition thereby changing membrane fluidity and insulin signaling[8]. In a study done in India, 55 diabetic patients were put on dietary intervention for three days. Diet mainly consists of fruits and vegetables. All the patients showed reduction in medicinal requirement with a few no longer needing a medicine[9]. Furthermore, reversal of diabetic nephropathy through ketogenic diet has been shown in mice model. Albumin/creatinine ratio, the indicator of nephropathy, as well as expression of stress-induced genes, was completely reversed by 2 months maintenance on a ketogenic diet. This diet showed the cytoprotective effect on high or low glucose induced toxicity[10].

Methods

Enrollment of patients

Fifty three diabetic patients were enrolled in the study for 3 continuous days using *Diabetes 72app* [11] from all over India and few from other countries as well. These patients were connected to 6 member medical analyst team with the help of this app. The subjects with varying diabetes history, age groups, type of diabetes, insulin dependency and demographic profiles were part of the trial. Each participant was asked to fill a detailed DAM (Daily Diet and Medication form) which describes patient's clinical history and medication along with consent.

Clinical history of patients

Patient's age ranged from 5-66 yrs. Out of 53, 11 were diabetic type 1 and 42 were diabetic type 2 patients. Shortest duration of illness was 28 days while 22 years was recorded longest duration of illness. Of these, 9 were taking medication for blood pressure. Four were on thyroid medication. Some of them reported gastric problems and one patient was having high cholesterol.

Rationale for stopping the medicines

Patients were advised to stop all diabetic medications for those whose sugar levels were below 250 mg/dl post prandial from the first day of the trial. This cut off is based on the calculation after consulting various studies [12]. Patients were also advised to stop cholesterol, intestine and bone disease related medicines. Based on the above mentioned calculation patients were categorized in to controlled (without medication) and partially controlled group (with medication)
Average blood sugar was calculated as follows:

$$\text{Average Blood sugar} = \frac{\text{Fasting Blood Sugar} + \text{Blood sugar before sleep}^*}{2}$$

*blood sugar should be taken 2 hours after dinner.
Controlled blood sugar level defines a state where patients maintain normal i.e. blood glucose range of ≤ 250mg/dl without medicines and or insulin requirement, along with the prescribed diet in three days.
Partially controlled sugar level defines a state where patients maintain normal i.e. blood glucose range of ≤ 250mg/dl with less than 50% insulin intervention than prescribed earlier. Methodology of insulin reduction is depicted in Figure 1

Dietary Intervention

Diet consists of fruits, vegetables, soaked nuts and sprouts as described earlier[9]. Sunshine is also an integral part of the prescribed diet. Packed and refined food, nutritional supplements, non-steroidal anti-inflammatory drugs (NSAIDs), animal, dairy products and dinner at late hours are strictly denied.

Results & Discussion

Out of all 53 enrolled patients, 42 were type 2 patients and 11 were type 1. These patients were further classified as 34 males and 8 females in type 2 while in case of type 1 there were 9 males and 2 females were enrolled which is shown by Figure 2. Age wise distribution of patients is depicted in Figure 3. Patient's clinical history is given in table 1. An overview of patient enrollment to outcome has been summarized in Figure 4
Variation in blood sugar level:
Fasting and post prandial blood sugar level were monitored for each patient regularly for three days. Mean±SD of blood glucose was 160±87, 176±85 and 160±76 mg/dl for first, second and third day respectively. Diabetic medication including insulin and tablets were tapered gradually once consistent glycemic control was achieved (Figure 5). Third day reading represents normal blood glucose with reduced or no medication.
Blood pressure and weight
The average weight reduction in 3 days was reported as 1.68 kgs per individual. Blood pressure profile of all cases was close to standard i.e below 150/90mm Hg.
Insulin requirement:
More than 50% patients were insulin dependent (Figure 6). These include type 2 and type 1 patient. 100% of patients showed drastic reduction in insulin dosage.
Dependency on medication:
At the end of three days of intervention 100 percent of patients were free from diabetic medication excluding those (12) who were taking reduced amount of insulin. Almost all patients showed reduction in insulin requirement (Figure 7). Twenty eight patients out of 53 were those who were not taking any kind of medicines except few (24) who were recommended to continue some essential medicine for thyroid and blood pressure or

reduced quantity of insulin. Percent reduction in total insulin units and percent reduction in patient number dependent on medication are shown by Figure 8 and 9 respectively.

Analysis of type 2 patients:

42 type 2 patients were enrolled. Out of 42, 12 were insulin dependent cases. All the cases showed reduction in dosage; however one patient showed 100 percent reduction in insulin. This patient were having thyroid and blood pressure problem along with diabetes. Not only diabetic medicines but his blood pressure medicines were also eliminated. Out of all (9) BP patients' only one patient continued BP medication, rests were free from medication.

Analysis of type 1 patients

Type 1 patients are characterized by the inability to produce insulin. 11 people were identified as type 1. Each patient showed significant reduction in insulin dosage. Out of 11, 3 patients were those who were recently diagnosed with type 1 so they did not start insulin therapy. Two out of 11 showed complete reversal.

Conclusion

Diabetes is grouped under non communicable diseases. Growing cases of diabetes is majorly attributed to dietary habits and sedentary life-style. Bad eating habits can result in obesity which puts individual at high risk for diabetes[12]. Current study provides insight in to achieving consistent glycemic control through diet which can eventually lead to tapering of medicines. Medicines tapered were mainly diabetic and blood pressure drugs. All patients showed reduction in insulin dosage while 52 percent patients were free from any kind of medication. Keeping in mind the importance of diet, different stakeholders of diabetes care should actively involve themselves in educating people about the importance of diet which can help in disease management, and results in better quality of life[13].

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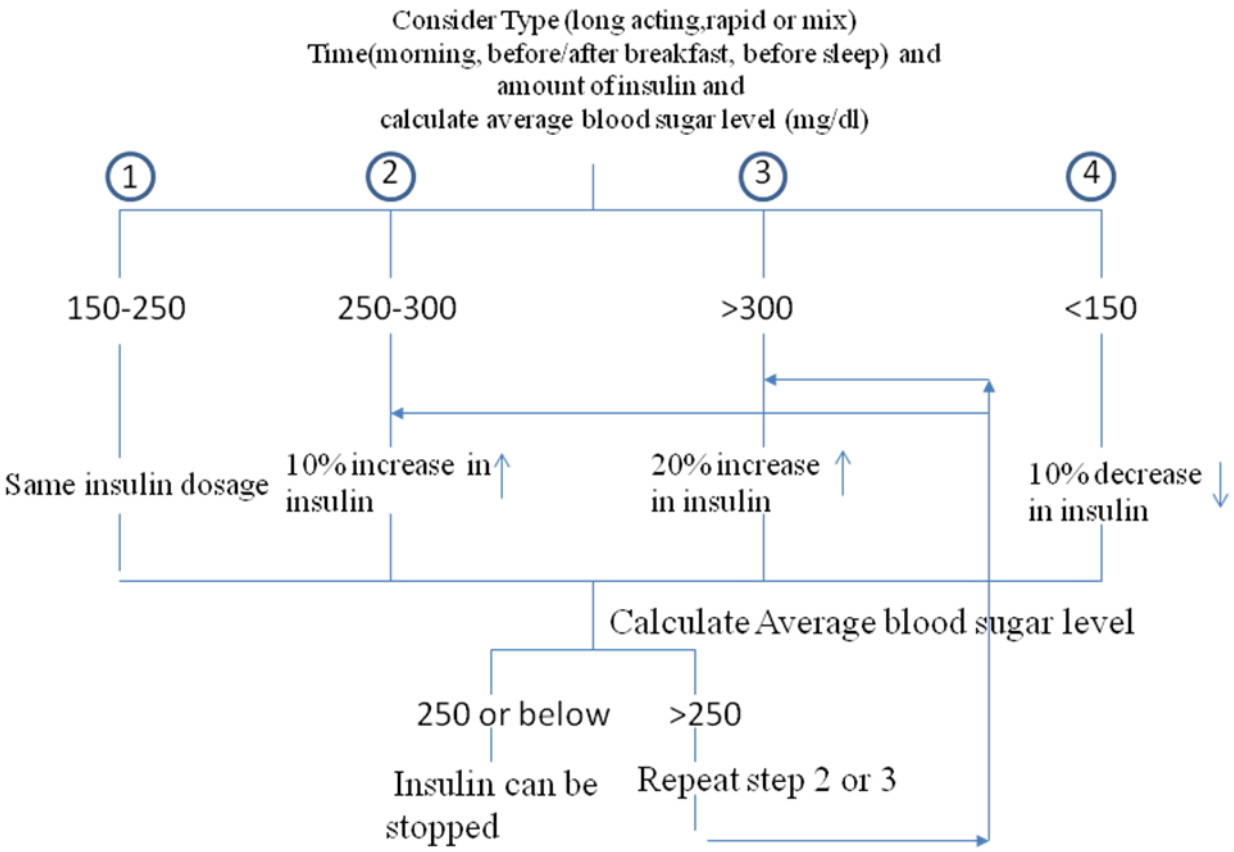


figure 1
methodology of insulin reduction

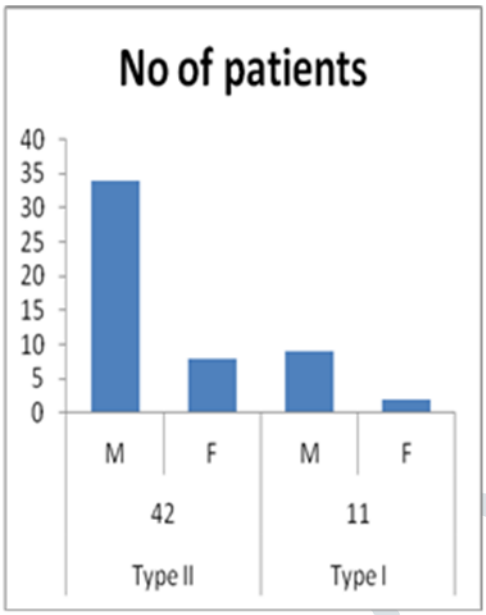
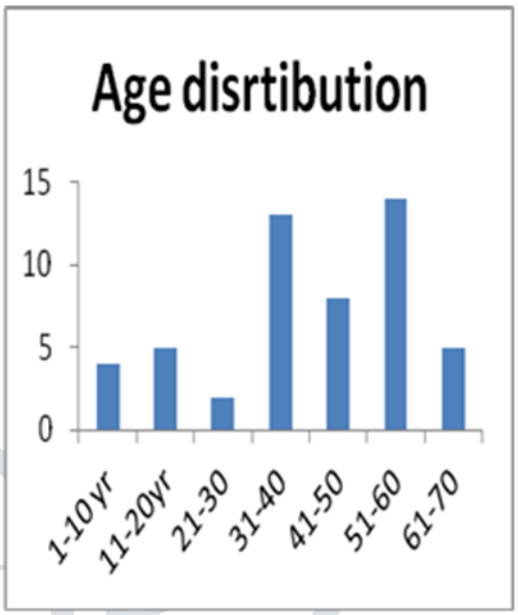


figure 2



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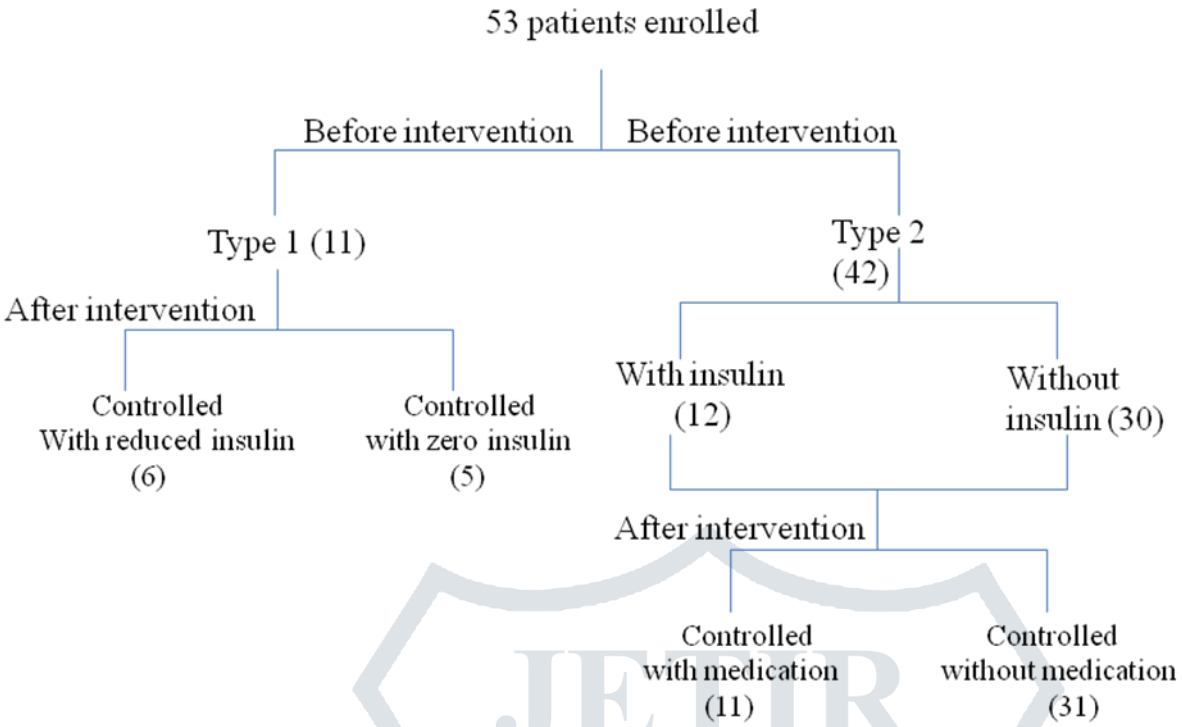


figure 4
overview: from enrollment to outcome

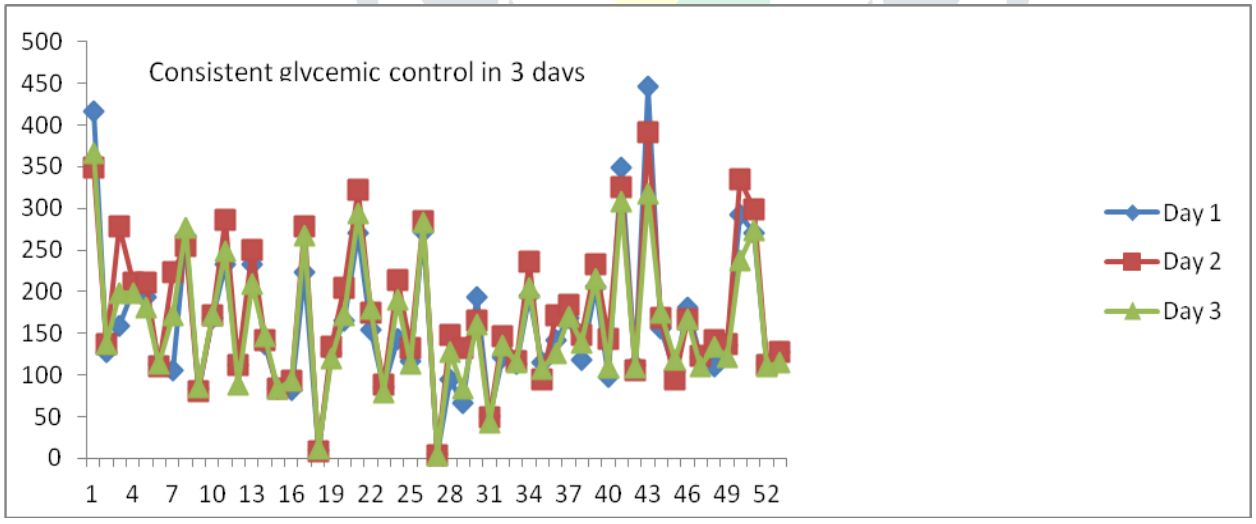
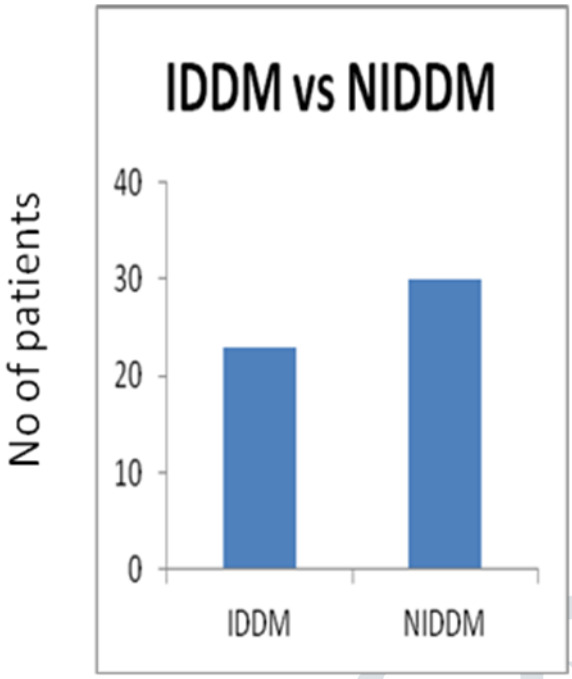


figure 5



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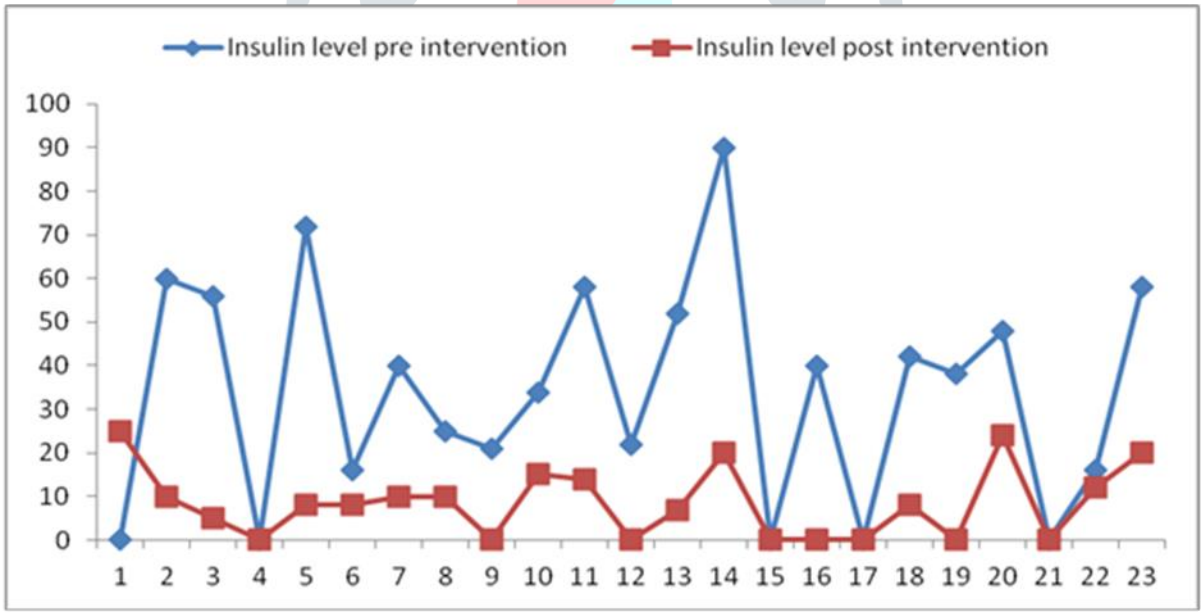

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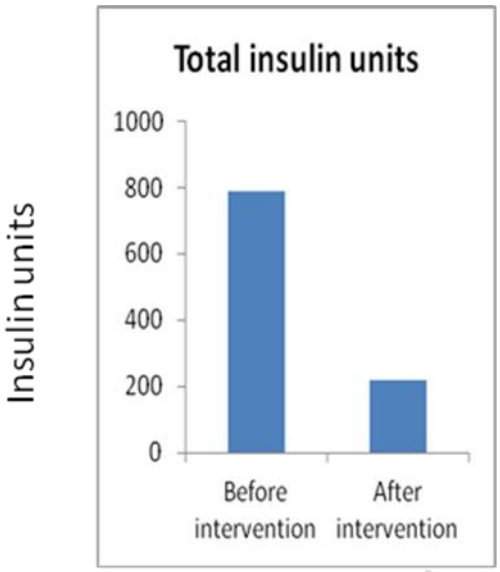

figure 8

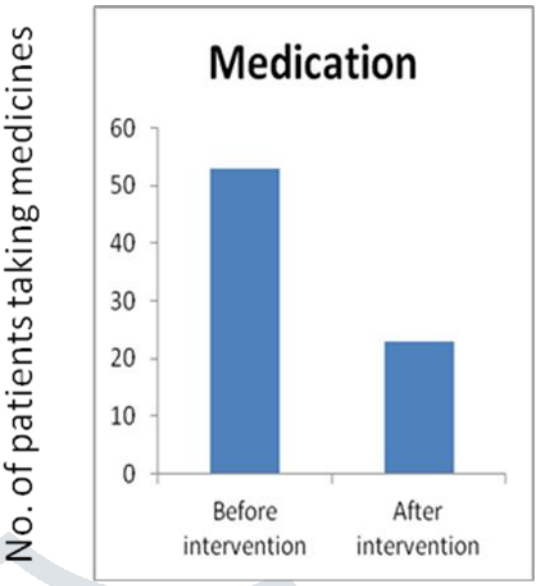

figure 9

Table showing reduction in medication after dietary intervention

Patient code	Allergy/Remark	Medication	
		Pre intervention	Post intervention
S1	Hypothyroid Mild Leg Pain GAD 3.7 C peptide 3.5	1- Sugar Knocker 2 Capsule (M&noon) Diabetes 2- Thronorm (25mcg)+ Thyrox(12.5mcg) (M) 3- VD Green 2 Capsule (M&E) Diabetes 4- Ayurvedic Medicine (M) 5- Homoeopathy 8 globules (M) Diabetes	25 +Thronorm (25mcg)+ Thyrox(12.5mcg) (M)
S2	Fructoseamine 297	1- Teneligliptin 20 mg+1000 mg Meformin (M&E) 2- Pioglitazone 15 mg (M) Diabetes 3- Gliclazide 80 mg (E) Diabetes 4- Methylcobalmin with Multivitamin (M) 5- Cetrizine	No medicine
S3	Chew tobacco, Report 2018 for abdomin and pelvis	1- **Lantus** 40U (M), 20U (N) 2- Glypten M Forte (M&N) 3- Cetapin XR (M) Diabetes 4- Telma CT (M) Diabetes 5- Met XL (N) Diabetes	10 U Lantus
S4	Fructoseamine 560, C-peptide 0.39	1- **Human Actrapid** 20U (M), 18U (noon), 18U (N) 2- Oxra 10 mg (M) Diabetes 3- Glycomet GP 0.5 (M&N) Diabetes	5U Lantus
S5	Weight loss, Sexual weakness	Ayurveda Medicine	No medicine
S6	GAD positive	1- Glucobay 25 (noon)	No medicine
S7		1- **Lantus** 36U (M), 36U (N) 2- Amaryl 2mg (M) Diabetes 3- Cetapin XR 1000 (N) Diabetes 4- Librax (M) (benzodiazepine and an anticholinergic/ spasmolytic used to treat stomach ulcers, irritable bowel syndrome) 5- Prelogic (N) peripheral neuropathy 6- stopped statin and lisinipril	Librax, Prelogic
S8	Acute Panceatitis attack- Dec 2017	1- **Human Mixtard** 6U (M) 2- **Lantus** 10U (noon)	8 U Lantus
S9	Fructoseamine 272	No Medication	No medicine
S10		No Medication	No medicine
S11	Pancreas infection	1-**Humalog Mixtard** 20U (M), 20U (N) 2- creon 10000 Pancreas supplement (M, noon, E, N)	10 U Lantus
S12		No Medication	No medicine
S13	**BP**, UTI, weakness, dizziness	1- Pantop DSR (acid reflux) (M) 2- Amaryl (M&N) Diabetes 3- **Tazloc CT40** (N) BP 4- Cipcal 500 (noon) Calcium 5- Rozavel10 (N) Cholesterol 6- **Insugen** 14-16U (M), 10U (N) 7- Uribid 100mg (M,noon&N) UTI	10 U Lantus
S14		1- **Lantus** 6U (N) 2- **Humalog** 5U (M), 5U (noon), 5U (E)	No medicine
S15	Hereditary Diabetes, Dslipidemia, Cholesterol, Tryglyceride, Fatty liver, 3 mm renal stone bilateral, prostate	1- Metformin BD 500 (N) 2- Tonact (N) Cholesterol 3- Carbophage SR 500 Diabetes	No medicine

S16	sneezing at change of season, 1 testis is under abdomen, breathlessness sometimes	1- Glimstar M2 (M) Diabetes 2- Dynaglipt (noon) Diabetes	No medicine
S17	Frozen shoulder, BP, CAD, ED	1- Metformin 500 (M&N) 2- **Wosulin** 18U (M), 16U (N) 3- **Ramipril 5mg** (M) ACE inhibitor for BP 4- **Metoprolol 50** (M&N) BP 5- Avas 20 (M) cholesterol and triglycerides 6- Clopidogrel 75 (M&N) Angina 7- Aspirin 150 (M) 8- Iron Cap (M)	15 U Wosulin , Avas, Clopidogrel, Asprin
S18		1- **Humalog** 6U (M), 12U (noon), 7U (E) 2- **Lantus** 33U (N)	14 U Lantus
S19	Thyroid, BP, Migraine, Leg cramp, Heart valve issue	1- Gluconorm SR (N) 2- Gluconorm G (M) 3- **Revelol AM 25/2.5** (M) BP 4- Thyronorm (M)	Thyronorm (M)
S20	Kidney stone 5mm	1- **Human Actrapid** 5U(M), 5U(noon), 5U(E) 2- **Lantus** 7U(N) 3- Berberis Vulgaris- homeopathy empty stomach 4- Osmium homeopathic (N) 5- Belladonna (noon) Bedwet	No medicine
S21	Cervicitis, Chocolate cyst	1- **Lantus** 20U (N) 2- **Actrapid** 8U (M), 12U (noon), 12U (E)	20 U Lantus
S22	GB stone 2006, GB removed, Blurred vision, Calf muscle pain	No Medication	No medicine
S23		Dynaglipt M (M)	No medicine
S24		1- Ondero met (M&N) Diabetes 2- Apriglim (noon) Diabetes	No medicine
S25		1- Glucomet (M) Diabetes 2- Istamet (E) Diabetes	No medicine
S26		1- **Biphasic Human** 30U (M), 30U (noon), 30U (N)	20 U Lantus
S27	High Cholesterol, Low Ferritin, Migraine headaches, chocolate cyst in RT overy (Adnexa) Gall baldder polys and bil. Breast and kidney cysts	1- Metformin 250 (N) Irregularly (had gestational diabetes in 2011 and had to take insulin during last trimester)	No medicine
S28		1- Glimpride (M&N) 2- Glucobay M50 (noon)	No medicine
S29	Thyroid TSH 6.34 µIU/ml, she's pregnant	Thyrox Thyroid (M)	Thyrox Thyroid (M)
S30	BP, Depression, Cholesterol	1- Amaryl 3mg (M&N) 2- Treviamet (M&N) 3- Xovat- Rosuvast (N) 4- **Xavor 25 BP** (M) 5- Ascard 75 (noon) 6- Rizek 20 (noon) 7- Seroxat 0.5 Depression	No medicine
S31		1- Amlodipine BP 2- Metformin	No medicine

S32	**BP,** Depression	1- Amaryl 2 (BBF & BFD) Diabetes 2- Istamet 50-1000 (M&N) Diabetes 3- **Olmezest 50** (M) BP 4- Evion 400 (M) Vit E 5- Centrum Silver (M) Vit Supplement 6- Volix 0.3mg (M&N) Diabetes 7- **Ecosprin AV 75** (N) blood thinner **Depression:** 8- Prothiaden 25mg (E) 9- Gabatin 100 ½ after tea (E) 10- Lesuride 25mg (E)	No medicine
S33		No medication	Thyrox 50 mg (M)
S34	Thyroid, BP	1- **Novomix 30** 20U (noon), 20U (N) 2- Thyrox 50 mg (M)	Thyrox 50 mg (M)
S35		Not taking insulin	No medicine
S36	Back pain, Burning feet, Fungal infection, itching in urine track	1- Gluconorm PG2 (BBF) 2- Januvia 50mg (M) 3- Gluconorm G2 Forte (N)	No medicine
S37		Ayurveda Medicine Organic India	No medicine
S38	Acidity	1- Azukon M (M&N) diabetes 2- Ziten M (M) diabetes 3- Veloz D (M) Acidity	No medicine
S39	weakness, dizziness, Retinopathy, ED	1- Xigduo 10/1000 Diabetes (M) 2- Glucophage (E) 3- **Victoza** 10U (M) 4- **Tresiba** 32U (N) 5- Rosuvastatin (N)	8 U Tresiba
S40	Asthma, **Stent implant Feb 2016**/ Dust, Brinjal	1- Janumet 50/500 (M&N) 2- Combitide125- 2puffs (M) 3- Montek10- 1tab (N) Asthma	Montek10- 1tab (N) Asthama
S41			10 U Homolog, Telesta (B.P.)
S42		No Medication	No medicine
S43	Alkaline phosphatase slightly high 160	1- **Huminsulin** 14U(M), 14U(noon), 10U(E) 2- **Lantus** 10U (N) Rainbow Plus- Diabetes	10 U Lantus
S44	Cholesterol	1- Duotrol (M&N) Diabetes 2- Lipaglyn (noon) hypertriglyceridemia in Type II diabetics 3- Gibtulio 25 Mg (M) Diabetes 4- Nurokind D3 (noon) Mecobalamin, a vitamin B12 coenzyme 5- Glucobay 50 (M&N) Diabetes	No medicine
S45	ED, slow urination	1- Amryl M (M) Diabetes 2- Janumet (N) Diabetes 3- Amryl (N) Diabetes 4- **Tezloc** (M) BP 5- Xigduo (M) Diabetes	Tezloc,
S46	Sinus, Acidity	No Medication	No medicine
S47		No Medication	No medicine
S48	Heart blockage, Skin allergy with black spot	1- Triglynaze (M&N) Diabetes 2- Patanjali Madhunashni (M&N) 3- Divya Hridamrit Vati (M&N) Heart Blockage Dec 2017	No medicine
S49		No Medication	No medicine

S50	Pancreatitis	1- **Novarapid** 4U (M), 6U (noon) 2- **Lantus** 6U (N)	12 Lantus
S51	Nerve pain & corn on foot	1- METFORMAX 1000mg—1before breakfast-1 bfr dinner 2- GLUCOBAY100 1bfr breakfast-1 bfr dinner 3- METOCARD ZK 23.75 mg—1 in a day (**heart conditions/BP)** 4- Vessel dueF 1 in a day (suppurative-necrotic forms of diabetic foot) 5- **Mixtard 30** 32U (BBF) 26U (BFD) 6- Sandoz 10 mg-1 in a day 7- Telmizek HCT 80 mg +12.5 mg-1 in a day **BP** 8- Milurit 100 mg- 1 in a day	20 u Telmizek
S52	Vitamin D Deficiency	D Rise 60k Once a month	No medicine
S53		1- Glycomet GP2 Forte (N)	No medicine

M = Morning, N=Night