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Diabetes Reversal by Plant-Based Diet

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Abstract

Introduction: Diabetes causes a never-ending medicine and or insulin treatment for the diseased. Also, the patients are bound to follow a particular diet, with eliminating most of the sugary foods; that further deteriorates the quality of life. This gave way to the study, focused on diabetes cure without medicines and on rich fruits and vegetable diet. The clinical trial on 55 diabetes patients with a team of 6 medical associates was practiced for 3-days at Zorba, The Buddha, 10 – Tropical Drive, Ghitorni, New Delhi from 29th April to 1st May, 2016. The goal was to establish and observe the effects of plant-based diet on the sugar levels of the diabetes patients. These included both insulin-dependent and independent, diabetes type-1 and type-2 patients. The 3-days Residential Treatment Tour involved 55 subjects with different age groups and demographic profiles. The study considered participants from different countries to find out the global impact of the treatment.

Objective: The burden of the disease diabetes is rising globally. The aim of the research is to find out that on discontinuing the medicines and being on a particular plant-based diet, can high blood glucose levels in diabetes patients be normalized.

Methodology: Clinical trials were performed on diabetes patients for 3-days continuously. The sample size of the study was n=55 patients. Medicines were eliminated from the first day of the trial. Thereafter, following 3-days, the participants were kept on a prescribed plant-based diet. Both fasting and post-prandial readings were measured each day along with the weights of the participants. The subjects with varying diabetes history, age groups, type of diabetes, insulin dependency and demographic profiles were part of the trial.

Findings of the study: The study reported controlled* blood glucose levels for 84% of patients and partially-controlled* levels for 16% of patients. Those with controlled* levels could attain a healthy blood glucose range without medicines and or insulin, along with the prescribed diet in 3-days. Those with partially controlled* levels could attain a healthy blood glucose range with less than 50% of insulin than prescribed earlier. Among diabetes type-2 patients the study reported 100% results with all the patients maintaining a healthy blood glucose level. While among diabetes type-1 patients, 57% reported controlled* blood glucose levels through the diet and zero-medications. Whereas, 43% reported healthy blood sugar levels through the diet and insulin reduction. In addition of the insulin-dependent group, 59% could completely drop their insulin requirements and 41% could reduce the requirement to at least 50%. The weight reduction for 55 patients in 3-days was reported as 1.14 kgs of average weight loss per individual. Also, the patients had symptomatic relief from general fatigue and weaknesses. The plant-based diet proved to be beneficial with regards to energy and nutritional fulfillments.

Future scope: Diabetes treatment has both health and economic burden on society. With reference to the present research, a new approach for the treatment of this considered life-style metabolic disability can be shaped. The plant-based diet has been found effective to cure and control diabetes, eliminating the medicine or insulin requirements. Further research on the subject matter can present a medicine-free-food-science based treatment for the disease. At the same time, this unique treatment approach will eliminate the risks of medicine side-effects. On the basis of this research, diabetes education can be developed for better understanding of the disease and better living for the diseased population.

Keywords Plant-based diet; Diabetes; Diabetes type I and type II; Insulin dependent; Blood glucose levels

Introduction

In the latest Clinical Practice Recommendations provided by the American Diabetes Association-ADA, Medical Nutrition Therapy is highly recommended for Diabetes care. However, they could not define a dietary pattern or establish a specific nutrition therapy for delay or prevention of the risk of diabetes. They further suggested increased intake of whole grains, fruits, vegetables and legumes, reducing refined and sugary foods [1]. In addition, intensive life-style changes were reported to be 58% effective after 3 years by the ADA [1].

The Medical Nutrition Therapy for diabetes paved its way through many randomized trials, meta-analysis and observational studies [2]. Improved glycemic and metabolic control were evident with reduction in A1c and blood glucose levels in diabetes patients. The results reported favored both type 1 and 2 population and worked irrespective of disease duration [2]. Moreover, it was also established that life-style interventions work better than metformin in reducing the incidence of

type 2 diabetes [3]. The research in hand presents a defined model of managing diabetes with plant-based diet protocol eliminating the need for medications. The study will provide a strong foundation with extensive future scope for research due to its practical implications.

Review of Literature

The correlation between life-style orientations and diseases has been profound. The present research is rooted within the vast literature present in support of association between diabetes and diet. Some of the related studies have been listed below.

Glycemic control and diabetes

In the study presented by Riccardi et al. on glycemic control in diabetes, they could establish a deep relationship between pre-diabetes and type 1 and 2 diabetes with high glycemic load. Figure 1 shows the effects of high/low glycemic index (GI) on blood glucose levels in type 1 Diabetes patients, similar results were seen in type 2 diabetes patients.

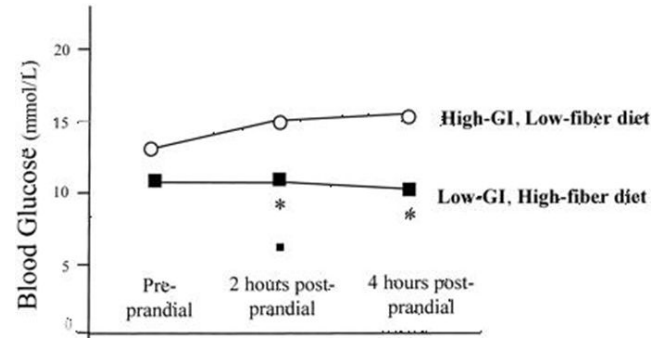

Figure 1: A 24 weeks analysis on post-prandial blood glucose concentrations obtained in type 1 diabetes patients with low GI-high fiber diet or high GI-low fiber diet (n=63).

The glycemic load is explained as glycemic index (GI) of a particular food multiplied by the amount of carbohydrate contained in an average portion of the food consumed [4]. The study supported low GI and high fiber-rich diet to manage post-prandial blood glucose levels in pre-diabetes and diabetes [4].

Studies also reported that glycemic index can be used as an effective marker along with fiber-content and nutritional value to classify carbohydrate rich foods and their preferences in routine diet [5]. This presented relevance in case of diabetes control and prevention. In addition, a comparative study for glycemic index or the quantity of carbohydrates on glycated hemoglobulin, C-reactive proteins, lipids and plasma glucose on type 2 diabetes patients gave positive results [6]. The outcomes of the 1-year controlled trial on 162 type 2 patients managed by sole diet gave the mean C-reactive protein being 30% low in low-GI diet in a comparison to high GI diet. The study reported sustainable reductions in post-prandial glucose level and C-reactive proteins and referred the diet management system to aid in type 2 diabetes management [6].

Animal protein and diabetes

The Singapore Chinese Health Study (SCHS) investigated association between dietary patterns and risk of type 2 diabetes in Chinese men and women in Singapore [7]. The study examined 43,176 individuals aged 47-74 years and diabetes free. The study performed Cox regression for diet pattern scores and risk of type 2 diabetes in individuals [8]. Their dietary patterns showed positive relation between meat-rich foods and risk of type 2 diabetes. Whereas fruits, vegetables and soy-rich foods inversely affected risk of type 2 diabetes [8]. Meat consumption and incidence of type 2 diabetes has been elucidated in a cohort study of 4,366 Dutch participants [9]. This study delivered the effects of processed meat on insulin resistivity and incidence of type 2 diabetes. The heating up of meat leads to the formation of AGEs (Advanced glycation end products) [10,11]. It is expected that the pro-inflammatory properties in AGEs may attribute towards the induced risk of type 2 diabetes [12]. Moreover, presence of saturated fatty acids in meat can even contribute to the risk of type 2 diabetes [13].

Cow's milk consumption and diabetes

Campbell's China Study 2005, a guide to nutrition and health reported that milk protein casein is not fit for human consumption. The proteins in cow's milk have been found to be responsible for auto-immune diseases especially type 1 diabetes; mostly in children with genetic susceptibility [14]. This was explained as, may be in most of us; the body's immune cells are unable to distinguish between the protein fragment of cow's milk and the β-cells of the body. Consequently, the immune cells attack the β-cells of the body resulting in diabetes or other autoimmune diseases [14].

An overview of medical literature on early cow's milk exposure and type 1 diabetes reported an increase of risk factors by approximately 1.5 times [15]. Higher anti-casein antibodies were also observed in children with type 1 diabetes [16]. In a popular study, a linear model was obtained on analyzing age-standardized prevalence of diabetes among children of 0-14 years of age in 12 countries. The countries were Finland, Sweden, Norway, Great Britain, Denmark, United States, New Zealand, Netherlands, Canada, France, Israel, and Japan (see figure 2) [17].

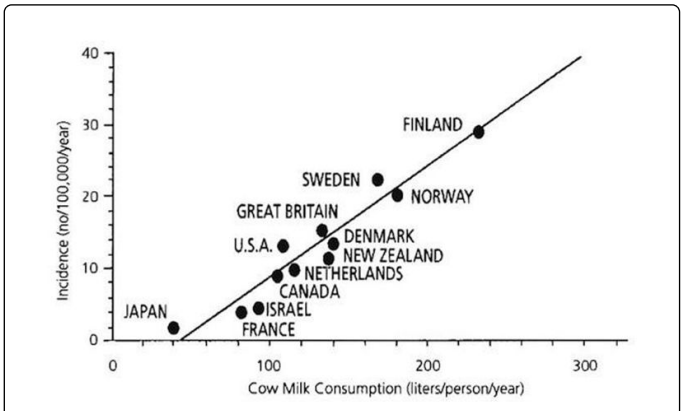

Figure 2: Association of Cow's milk Consumption and incidence of type 1 diabetes in different Countries.

Among them, Finland had the highest incidence of insulin-dependent type 1 diabetes, which was 35 times higher than Japan. Finland has the world's highest cow's milk and milk products consumption and subsequently highest prevalence of diabetes [18]. The research concluded that cow's milk may be responsible for development of insulin-dependent type 1 diabetes.

Plant-based diet and diabetes

In support of plant-based diet, a cohort study involved 3,704 participants with 653 diabetes patients from European Prospective Investigation [19]. The study examined the association between intake of fruits, vegetables and fruits and vegetables in combination along with their variety and quantity and risk of type 2 diabetes [19]. The research analyzed 11-year incidence of type 2 diabetes, and reported 21% lower risk of diabetes with greater fruits and vegetables intake in diet (Cooper et al., 2012). A research based on epidemiological and clinical trials found that nuts can improve post-prandial glycemia and reduce the risk of diabetes [20]. Many studies have reported the relation between nut consumption and metabolic syndrome (MetS). Metabolic Syndrome is a group of cardio-metabolic risk factors, which comprise of type 2 diabetes, high fasting plasma glucose, hyperglycemia, hyper-triglycerides, low HDL cholesterol and abdominal obesity [21].

Metabolic syndrome raises the risk of diabetes by 5 times and that of cardiovascular diseases for diabetes population by 2 to 5 times [22]. Nuts have been found to play an important role in adjusting the components of MetS by influencing inflammation, oxidative stress, and endothelial function. This in process influences the insulin sensitivity and reduces chances of diabetes, hypertension and obesity [20].

Also, three cohort studies could establish a reduced risk of type 2 diabetes by 27%, 20% and 33% respectively by nut intake in regular diet in women in the Nurses' Health Study (NHS, in the NHS and NHS II cohorts) [23, 24] and women in the Shanghai Women's Health Study [25]. A significant research published in the Current Atherosclerosis Reports-2010 demonstrated that, the time of cooking is directly proportional to the increase in glycemic index (GI), resulting in lot of burden on the blood sugar making a person more prone to diabetes [26]. In the same research it was proved that the simple whole grain consumption in its natural state helps the diabetic patient to get a more stable and acceptable blood sugar. However, the refining followed by cooking of the grains rapidly shifts the grains from the low GI range to high GI range [26].

Research design

The 3-days Residential Treatment Tour was conducted at Zorba, The Buddha, 10 – Tropical Drive, Ghitorni, New Delhi from 29th April to 1st May, 2016 with 55 diabetes patients and 6 Medical Analysts. The Residential Treatment Tour was publicized among masses both online and through seminars. The procedure required form-filling of DAM form-Diet and Medicine information by the patients. By the time of the beginning of the tour, 60 patients could furnish all details along with completion of the desired formalities of the tour. However, 5 of them had to leave because of personal reasons. Therefore, our sample-size was reduced to 55 patients. The procedure was planned to keep the 55 subjects on 3-days plant-based raw fruits and vegetables diet. The medicines were discontinued at the start of the plan. Meals were provided as per the diet plan with appropriate quantities based on the patient's weight. Regular blood-sugar readings - fasting and post-prandial were taken and individuals' log-sheets were further maintained. The diet plan was all different for 3-days and was especially designed to fulfill the nutritional requirements of the patients.

Table 1, gives the scheduler depicting the events for Day 1, Day 2 and Day 3. All the patients were provided the scheduler before the start of the reversal tour. The planner was followed strictly, and observations on blood glucose readings, fluctuations and related parameters were precisely documented.

DAY 1		DAY 2		DAY 3	
Time	**Activity**	**Time**	**Activity**	**Time**	**Activity**
7:20 AM	Reporting Time	7:20 AM	Reporting Time	7:20 AM	Reporting Time
7:30 AM	Blood Sugar Test	7:30 AM	Blood Sugar Test	7:30 AM	Blood Sugar Test
7:40 AM	Coconut water + Tulsi Leaves + ginger Take 15 minutes to sip it	7:40 AM	Coconut water + Tulsi Leaves + ginger Take 15 minutes to sip it	7:40 AM	Coconut water + Tulsi Leaves + ginger Take 15 minutes to sip it
8:00 AM	Pranayam and Light Exercise(optional)	8:00 AM	Pranayam and Light Exercise(optional)	8:00 AM	Pranayam and Light Exercise(optional)
8:30 AM	Breakfast	8:30 AM	Breakfast	8:30 AM	Breakfast
9:30 AM	Diabetes Management Training 1	9:30 AM	Diabetes Management Training 5	9:30 AM	Diabetes Management Training 8
11:30 AM	Sugar readings (Only insulin dependent patients)	11:30 AM	Sugar readings (Only insulin dependent patients)	10:30 AM	Sugar readings (Only insulin dependent patients)
11:45 AM		10:45 AM	Snacks + Tiffin Insulin Management Training	11:45 AM	Snacks + Tiffin
12:00	Question-Answers	12:00		12:00 noon	Diabetes Management Training (Maintenance Diet)
12:30 PM	Diabetes Management Training 2	12:30 PM	Diabetes Management Training 6	2:00 PM	Lunch

2:00 PM	Lunch	2:00 PM	Lunch	2:30 PM	Submit Log Sheet through mail
3:30 PM	Diabetes Management Training 3	3:30 PM	Queries	3:00 PM	Maintenance Diet through Whatsapp
5:00 PM	Blood Sugar (PP)	5:00 PM	Blood Sugar (PP)	3:30 PM	End of Tour
5:05 PM	Snacks + Tiffin	5:05 PM	Snacks + Tiffin		
5;15 pm	Question/Answers	5;15pm	Question/Answers		
5:30 PM	Question/Answers	5:30 PM	Question/Answers		
6:00 PM	Walk/free-time/dinner preparation	6:00 PM	Walk/free-time/dinner preparation		
7:00 PM	Dinner	7:00 PM	Dinner		
8:00 PM	Diabetes Management Training 4	8:00 PM	Diabetes Management Training 7		
9:45 PM	Blood Sugar Test	9:45 PM	Blood Sugar Test		

Table 1: Gives the day-wise scheduler followed during the reversal tour.

The ingredients that formed the plant-based diet have been listed in Table 2, along with the quantities per individual for 3-days of reversal tour.

Green Drinking Coconut Water	5
Fresh Coconuts	3
Basil Leaves	100
Ginger(Adrak)	20 gm
Pomegranate	500 gm
Banana	8 in number
Papaya	500 gm
Oranges	500 gm
Apple	400 gm
Almonds	100 gm
Raisins	100 gm
Cashews	50 gm
Walnut	25 gm
Raw Sesame Seeds (White)	50 gm
Fig	6 (dried or fresh)
Raw Peanuts	300 gm
Dates	100 gm (without sugar coating)
Whole Moong Dal Sprouted	100 gm
Cucumber	1.5 kg
Tomato	1 kg
Beetroot	500 gm
Red or green Cauliflower	300 gm
French Beans (soft and tender)	250 gm
Onion	250 gm (optional)
Yellow/Red/ Green Pumpkin	400 gm
Bottle Gourd	250 gm
Red Bell Pepper	250 gm
Yellow Bell Pepper	250 gm
Capsicum	250 gm
Cabbage	250 gm
Spinach	1 kg
Green Chili	30 gm
Carrot	500 gm
Broccoli	250 gm
Mint Leaves	250 gm
Fresh Green Coriander	250 gm
Lemon	250 gm
Garlic	25 gm
Bay Leaves	6
Fresh and Tender Curry Leaves	400 gm
Fresh Beetle Leaves	1
Jaggery (Gur)	50 gm
Black Pepper Powder	10 gm
Cinnamon Powder	10 gm
Roasted Cumin Seeds	15 gm
Green Cardamom Powder	10 gm
Yellow Lentil	50 gm
Black Chick Peas	80gm

White Chick Grams	50 gm

Table 2: Gives the list of ingredients per participant for 3-days of reversal tour.

Establishment of Blood Glucose Threshold

For the research trial, the diagnostic criteria for blood glucose levels in 55 diabetes patients was taken to be 250 mg/dl post-prandial sugar level. The study was structured taking two important variables as -

1.Controlled Blood Glucose Level*

2.Partially Controlled Blood Glucose Level*

*Controlled Blood Glucose Levels: The controlled levels denoted the blood glucose range of ≤ 250 mg/dl without medicines and or insulin requirement, along with the prescribed diet in 3-days. In this group of people, the diet alone balanced the glucose levels, leading to zero requirement of medicine or insulin.

*Partially Controlled Blood Glucose Levels: The partially controlled levels denoted the blood glucose range of ≤ 250 mg/dl with less than 50% of insulin intervention than prescribed earlier.

Sugar Levels					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Controlled	46	83.6	83.6	83.6
	Partially Controlled	9	16.4	16.4	100
	Total	55	100	100	

Table 3: Controlled and Partially Controlled Blood Glucose Levels in 55 Diabetes Patients.

In this group, the diet could help maintain the blood glucose readings with minimum and much reduced insulin dosage. For example, a 30 yrs male with 20U of insulin for the day, required only 3U of insulin under the diet therapy.

This cut-off limit has been well established in the book Last-Days of Diabetes [27]. Chowdhury (2016). For Doctors & Care Givers. The section 'Calculation' of the book brings out the core understanding of the world-wide establishment of blood glucose reference range as 250 mg/dl, Available at: https://www.biswaroop.com/9312286540.pdf

Findings of the study

The study reported 46 patients with controlled sugar levels and 9 with partially-controlled sugar levels. The valid percentages obtained were 84% and 16% under controlled and partially controlled groups respectively shown in Frequency Table and Correlation Table below (Table 3).

In this trial 21 patients were type 1 diabetic and 34 patients were type 2 diabetic. Among type 1 patients 57% could attain controlled blood glucose readings and 43% attainted partially controlled readings. Among type 2 diabetes patients, 100% gave controlled sugar readings through the process shown in correlation table below (Table 4).

Sugar Levels * Diabetes Type Cross-tabulation				
Count		**Diabetes Type**		
		Type 1	**Type 2**	**Total**
Sugar Levels	**Controlled**	12	34	46
	Partially Controlled	9	0	9
Total		21	34	55

Table 4: Sugar levels and Type 1 or 2 diabetes in 55 diabetes patients.

Sugar Levels * Insulin Dependency Cross-tabulation				
Count		**Insulin Dependency**		
		Insulin Dependency	**Insulin-Independent**	**Total**
Sugar Levels	**Controlled**	13	33	46
	Partially Controlled	9	0	9
Total		22	33	55

Table 5: Sugar levels and insulin dependency in 55 diabetes patients.

The trial had 40% insulin-dependent cases, of these 59% could completely drop their insulin requirement to zero and 41% could reduce the levels by at least 50% of the earlier requirement shown in correlation table above (Table 5).

Sugar Levels * Disease Duration Cross-tabulation						
Count		**Disease Duration**				
		Less than 1 year	1 to 5 years	5 to 10 years	Above 10 years	Total
	Controlled	25	12	4	5	46
	Partially Controlled	7	1	1	0	9
Total		32	13	5	5	55

Table 6: Sugar levels and disease duration in 55 diabetes patients

An important observation is that 100% results were obtained with patients with above 10 years of disease history, as all the 5 subjects maintained controlled sugar levels. For those newly diagnosed or less than 1 year of disease history, 78% could attain controlled blood glucose readings (Table 6).

Below is Bar Chart-1 of two variables the attained sugar levels and disease duration in 55 Diabetes Patients (Figure 3).

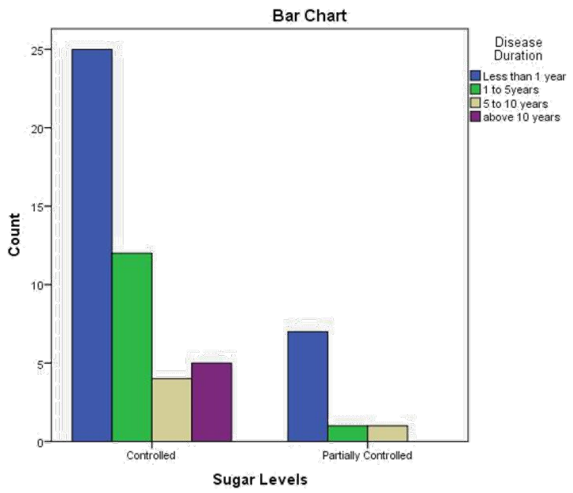

Figure 3: Bar Chart showing variables for the attained sugar levels and disease duration.

Maximum number of patients were with a disease history of <1 year, 78% of these reported controlled readings, following them were patients within 1-5 years of disease history, who gave 92% controlled results, and 80% controlled results for the group with 5-10 years of disease history shown in frequency table above (Table 6).

Weight Reduction					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 1 kg	27	49.1	49.1	49.1
	1 to 2 kgs	8	14.5	14.5	63.6
	2 to 3 kgs	11	20	20	83.6
	Above 3 kgs	9	16.4	16.4	100
	Total	55	100	100	

Table 7: Weight reduction in 55 diabetes patients.

The findings of the study gave 1.14 kilos of average weight loss per individual of total 55 cases. Among these, 9 subjects could reduce more than 3kilos of weight in 3-days of plant- based diet treatment along with good control over blood glucose levels. Almost half of the cases could reduce <1 kilos of weight during the trial.

Below is the pie-chart with valid-percentages of weight reduced among 55 subjects (Figure 4).

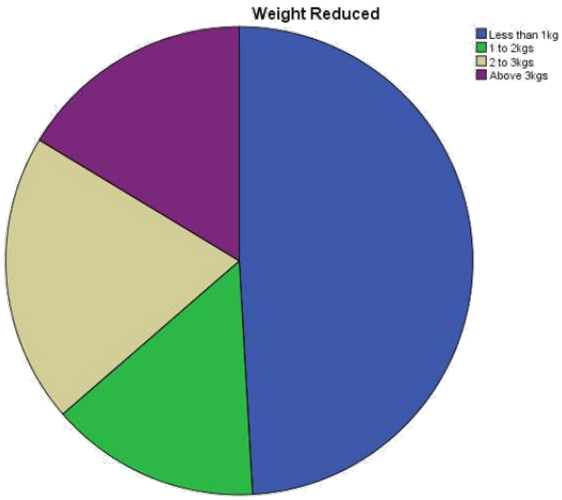

Figure 4: Pie-chart with valid-percentages of weight reduced among 55 subjects.

Of the total 55 subjects, 16% reduced ≥ 3 kilos of weight, following them were 20% of patients with 2-3 kgs of weight reduction and 14% could reduce 1-2 kilos of weight during 3-days. Whereas, 49% reported <1 kilo of weight reduction (Table 7).

Sugar Levels * Patient Age Cross-tabulation								
		Patient Age						
		Less than 20	20-30	30-40	40-50	50-60	Above 60	Total
Sugar Levels	Controlled	4	1	11	9	9	12	46
	Partially Controlled	6	1	1	1	0	0	9
Total		10	2	12	10	9	12	55

Table 8: Sugar levels and age groups in 55 diabetes patients.

Among patients with different age-groups, all of those ≥ 50 years of age could attain controlled sugar levels. Those below 20 years of age showed 40% controlled and 60% partially controlled sugar levels. This could be related to the little difficulty faced by young children to consume raw-food in those 3-days and report effective results. Below is the bar-chart plot between two variables-attained sugar levels and age groups in 55 diabetes patients (Figure 5).

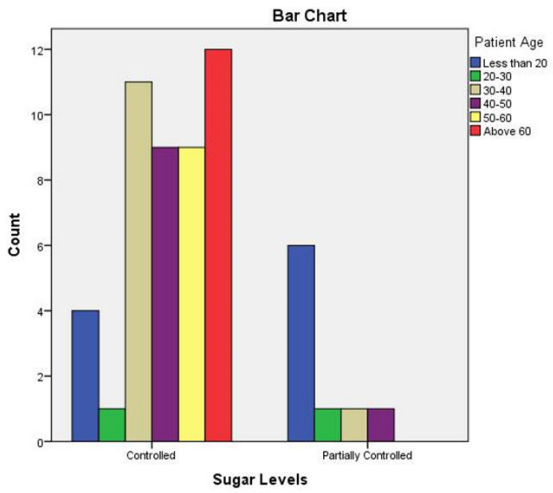

Figure 5: Bar chart showing the count and sugar level of the patients of different age group.

The Bar Chart-2 clearly shows the maximum subjects ≥ 60 years of age under controlled group following them are the subjects in 30-40 age group, the 40-50 and 50-60 age groups had equally effective outcomes (Table 8).

Sugar Levels * Patient Gender Cross-tabulation				
Count		Patient Gender		
		M ale	Female	Total
Sugar Levels	Controlled	34	12	46
	Partially Controlled	7	2	9
Total		41	14	55

Table 9: Sugar levels and gender in 55 diabetes patients.

Results: Of 55 cases, 41 were males and 14 were females. Among them, 83% of males and 86% females could attain controlled blood glucose readings by the end of 3-days diet treatment. The outcomes clearly support the diet protocol to be equally effective in both the genders.

Conclusion

There had been extensive research on changes in life-style and diet to cure diabetes, but rare could establish a practical approach. Also, most research work is based on one particular type of foods or parameter in terms of diabetes or cardiovascular diseases. Besides this, it is important to relate the nutritional fulfillment through diet in terms of healthy carbohydrates, proteins, fats, vitamins, minerals and anti-oxidants. Furthermore, consideration of body's metabolism through the functional and metabolic pathways can only provide the actual effect of the food in the body. The plant-based diet protocol has the similar design and works to aid the effective mechanisms in body. Eliminating the toxic components in food, the diet covers all the nutritional requirements.

The plant-based diet in the form of raw fruits and vegetables has the ability to reduce blood glucose levels both fasting and post-prandial. The diet is suitable for diabetic individuals. The diet has shown effect in case of both type 1 and type 2 diabetes patients. The diet process could reduce the insulin dependency for most of the patients by at least 50%. Disease duration was not a hindrance, as similar effects were seen in subjects with above 10 years of disease history and with newly diagnosed diabetes patients. The diet proved to be beneficial irrespective of variable age groups and demographic profiles. Besides, weight reduction by plant-based diet with quality nutrition makes the diet suitable for diseases associated with obesity or high fatty acids and related metabolic and cardiovascular diseases.

Post tour follow-ups

The necessary follow-ups were practiced post 3-days of Residential Tour. Most of the patients who maintained the diet protocol in their routine gave affirmative response. For most of them their medications completely dropped. Few of them could even maintain a healthy life-style with no-medicines even for common fevers. The remaining, who were still on medicines have been reducing them slowly with the diet-protocol. Follow-ups and advices are still carried over when required.

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