

Diabetes Reversal by Plant-Based Diet

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 (American Diabetes Association, 2015). In addition, intensive life-style changes were reported to be 58% effective after 3 years by the ADA (American Diabetes Association, 2015).

The Medical Nutrition Therapy for diabetes paved its way through many randomized trials, meta-analysis and observational studies (Pastors et al., 2003). 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 (Pastors et al., 2003). Moreover, it was also established that life-style interventions work better than metformin in reducing the incidence of type 2 diabetes (Knowler et al., 2002). 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.

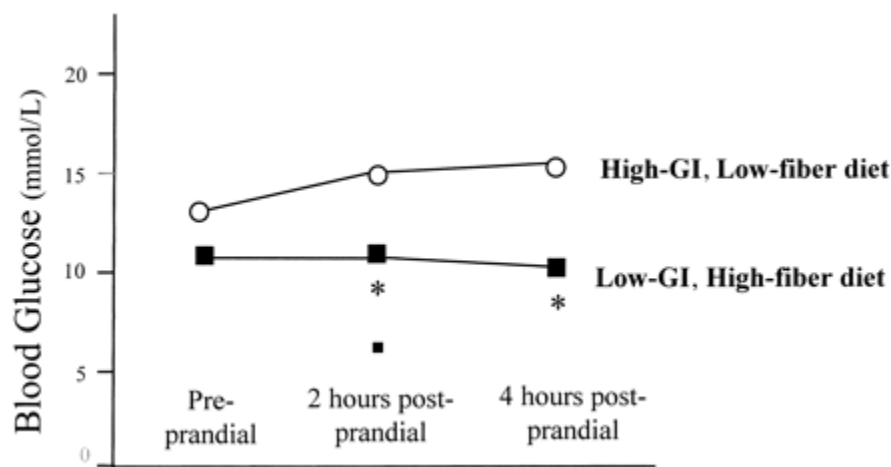


Figure 1: A 24 weeks analysis on post-prandial blood glucose concentrations obtained in type 1 diabetes patients with low GI-high fiber diet or high GI-low fiber diet (n=63).

Source: Riccardi, G., Rivellese, A. A., & Giacco, R. (2008). Role of glycemic index and glycemic load in the healthy state, in prediabetes, and in diabetes. *American Journal of Clinical Nutrition*. Available at: <http://ajcn.nutrition.org/content/87/1/269S.full.pdf+html>

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 (Riccardi et al.,

2008). The study supported low GI and high fiber-rich diet to manage post-prandial blood glucose levels in pre-diabetes and diabetes (Riccardi et al., 2008).

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 (Mann et al., 2004). 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 hemoglobin, C-reactive proteins, lipids and plasma glucose on type 2 diabetes patients gave positive results (Wolever et al., 2008). 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 (Wolever et al., 2008).

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 (Hankin et al., 2001). 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 (Odegaard et al., 2011). 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 (Odegaard et al., 2011).

Meat consumption and incidence of type 2 diabetes has been elucidated in a cohort study of 4,366 Dutch participants (Van Woudenberg et al., 2012). 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) (Hofmann et al., 2002) (Sandu et al., 2005). It is expected that the pro-inflammatory properties in AGEs may attribute towards the induced risk of type 2 diabetes (Uribarri et al., 2005). Moreover, presence of

saturated fatty acids in meat can even contribute to the risk of type 2 diabetes (Feskens & Kromhout, 1990).

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 (Campbell & Li, 2005). 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 (Campbell & Li, 2005).

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 (Gerstein, 1994). Higher anti-casein antibodies were also observed in children with type 1 diabetes (Savilahti et al., 1988).

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 (Dahl-Jorgensen K et al., 1991) (see figure 2).

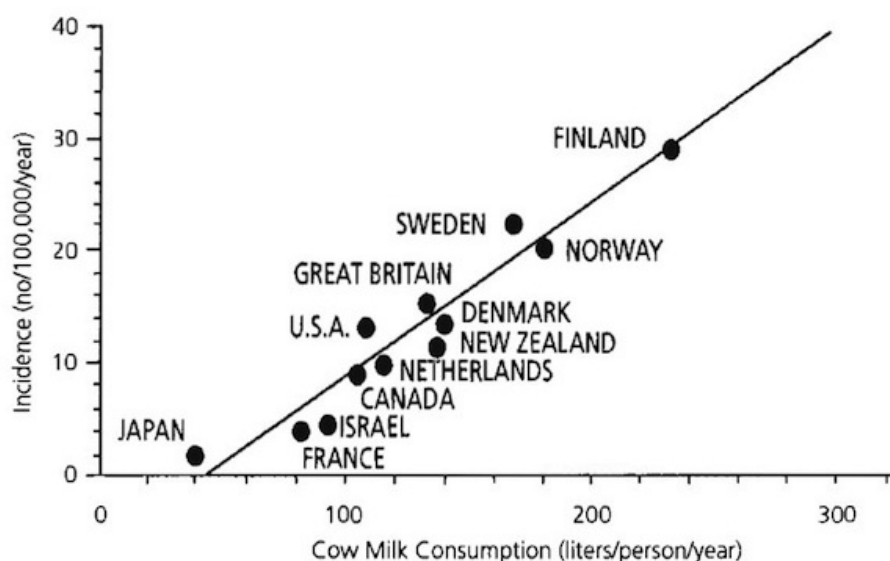


Figure 2: Association of Cow's milk Consumption and incidence of type 1 diabetes in different Countries

Source: Campbell, T. C., & Li, T. M. C. (2005). T. colin campbell, phd and thomas. Available at: <http://www.socakajak-klub.si/mma/The+China+Study.pdf/20111116065942/>

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 (LaPorte et al., 1985). 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 (Cooper et al., 2012). 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 (Cooper et al., 2012). 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 (Salas-Salvado et al., 2014). 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 (KG Alberti et al., 2009).

Metabolic syndrome raises the risk of diabetes by 5 times and that of cardiovascular diseases for diabetes population by 2 to 5 times (Kendall et al., 2010). 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 (Salas-Salvado et al., 2014).

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) (Jiang et al., 2014) (Pan et al., 2013) and women in the Shanghai Women's Health Study (Villegas et al., 2008).

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 (Murray et al., 2010). 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 (Murray et al., 2010).

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.

➤ **Controlled and Partially Controlled Blood Glucose Levels**

Patients who could maintain a healthy reading by the end of 3-days of plant-based diet treatment along with eliminating the requirement for medications were considered as subjects with controlled blood glucose levels.

Those who could maintain a healthy blood glucose level with less than 50% of insulin requirement as was compulsory before, were categorized as subjects with partially controlled levels.

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.

Sugar Levels						
			Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Controlled		46	83.6	83.6	83.6
	Partially Controlled		9	16.4	16.4	100.0
	Total		55	100.0	100.0	

Frequency Table-1

- Frequency Table 1 – Controlled and Partially Controlled Blood Glucose Levels in 55 Diabetes Patients

1. Correlation Table 1 – Sugar levels and Type 1 or 2 Diabetes in 55 Diabetes Patients

Sugar Levels * Diabetes Type Cross-tabulation

Count

		Diabetes Type		
		Type 1	Type 2	Total
Sugar Levels	Controlled	12	34	46
	Partially	9	0	9
	Controlled			
Total		21	34	55

Correlation Table-1

Results: In the 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% attained partially controlled readings. Among type 2 diabetes patients, 100% gave controlled sugar readings through the process.

2. Correlation Table 2 – Sugar levels and Insulin Dependency in 55 Diabetes Patients

Sugar Levels * Insulin Dependency Cross-tabulation

Count

		Insulin Dependency		
		Insulin-Dependent	Insulin-Independent	Total
Sugar Levels	Controlled	13	33	46
	Partially	9	0	9
	Controlled			
Total		22	33	55

Correlation Table-2

Results: 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.

3. Correlation Table 3 – Sugar levels and Disease Duration in 55 Diabetes Patients

Sugar Levels * Disease Duration Cross-tabulation

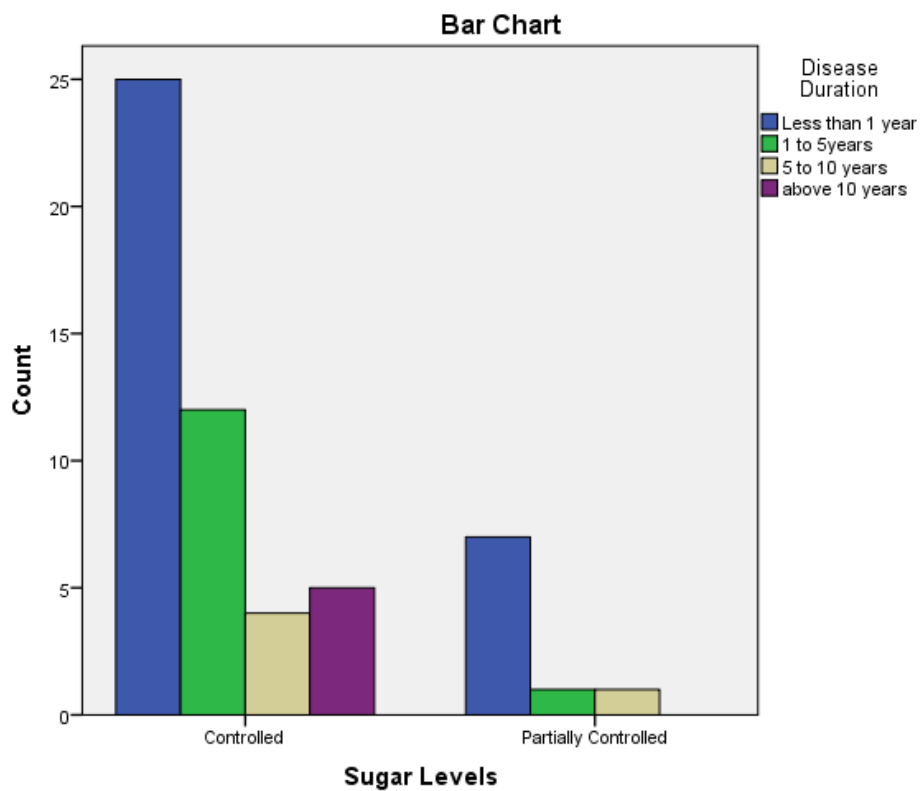
Count

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

Correlation Table - 3

Results: 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.

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



Bar Chart-1

Interpretation: 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.

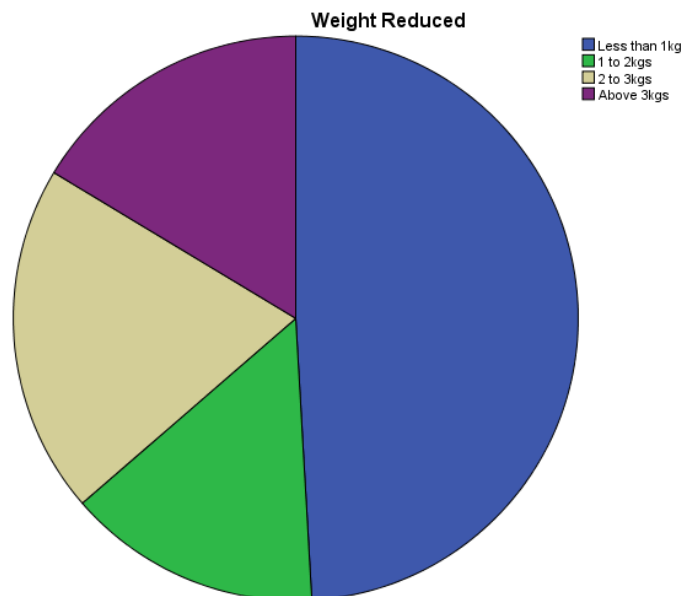
- Frequency Table 2 – Weight Reduction in 55 Diabetes Patients

Weight Reduction					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 1kg	27	49.1	49.1	49.1
	1 to 2kgs	8	14.5	14.5	63.6
	2 to 3kgs	11	20.0	20.0	83.6
	Above 3kgs	9	16.4	16.4	100.0
	Total	55	100.0	100.0	

Frequency Table-2

Results: 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.



Pie-Chart

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

4. Correlation Table 4 - Sugar levels and Age Groups in 55 Diabetes Patients

Sugar Levels * Patient Age Cross-tabulation

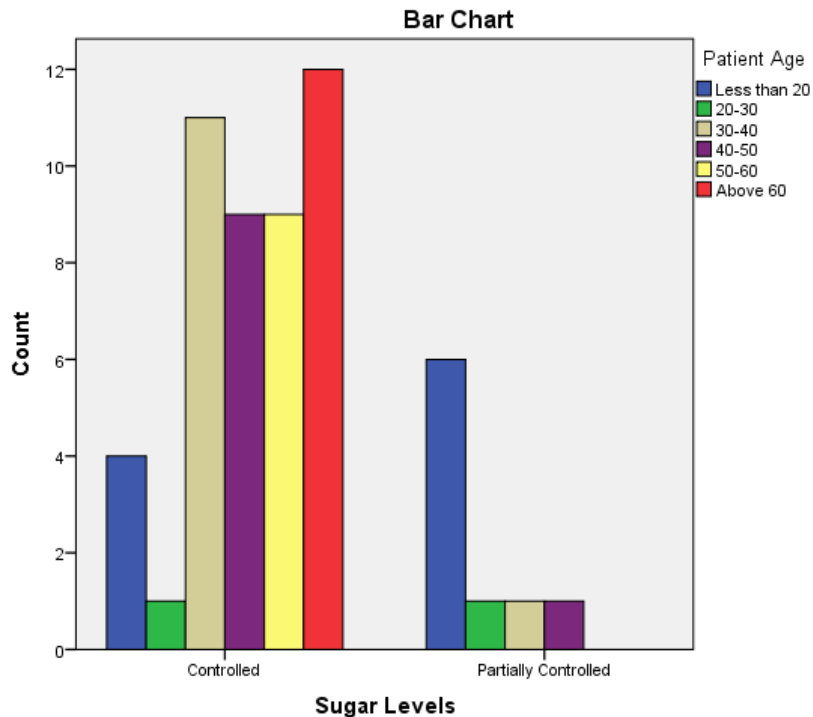
Count

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

Correlation Table - 4

Results: 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 weight reduced in 55 diabetes patients.



Bar Chart-2

Interpretation: 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.

5. Correlation Table 5 - Sugar levels and Gender in 55 Diabetes Patients

Sugar Levels * Patient Gender Cross-tabulation

Count

		Patient Gender		
		Male	Female	Total
Sugar Levels	Controlled	34	12	46
	Partially	7	2	9
	Controlled			

Total	41	14	55
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Correlation Table - 5

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.

➤ Reference - Blood Glucose Upper Limit

In the above report the threshold or diagnostic criteria for blood glucose levels in 55 diabetes patients was taken to be 250mg/dl post-prandial sugar level. This cut-off limit has been established in the book Last-Days of Diabetes (Chowdhury, 2016). Chowdhury, B. R. (2016). *For Doctors & Care Givers*. Available at: <https://www.biswaroop.com/9312286540.pdf>

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