



## Impact of Truweight Diabetic Program on the Weight Loss and the Reduction of HbA1C among Type 2 Diabetic Clients

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Received: July 30, 2019; Published: August 19, 2019

### Abstract

**Background and Objectives:** Obesity is a serious problem associated with the risk of developing diabetes. Association between diabetes and obesity has always been known to vary as per different ethnicities. Type 2 diabetes results mostly from the body's ineffective use of insulin and with a healthy diet, maintaining normal body weight, and physical activity along with medications prescribed by a physician can prevent, delay as well as reverse Type 2 diabetes. The specific objectives of the present study were to assess the impact of truweight program on diabetic parameters and to observe the correlation between diabetic parameters and BMI in type 2 diabetic subjects enrolled in Truweight program.

**Materials and Methods:** The present study was a nine months clinical observation of diabetic clients enrolled in the Truweight program. The study participants (N=50) comprised of 27 males and 23 females with a BMI > 25kg/m<sup>2</sup>, between the age group of 20 to 65 years and were selected using purposive sampling technique. Initial weight, BMI, HbA1c values were collected using standard procedures and regular blood sugar readings were taken. Diet plan with addition of nutrient dense foods with functional ingredients were provided and the diet plan was designed to fulfill the nutritional requirements of the clients. Paired t-test, correlation coefficient were used for statistical analysis.

**Result:** In the present study, there was significant reduction in the BMI (32.59 ± 4.72 to 29.78 ± 4.04) and HbA1c level (8.47 ± 1.90 to 6.44 ± 1.02) among subjects. Dietary intake of all the macronutrients (carbohydrates, protein, fat and fibre) were positively correlated with weight loss. There was a significant reduction in HbA1c level as weight loss increased.

**Conclusion:** Truweight healthcare program aimed at losing weight and reducing the BMI had a positive effect on the HbA1C levels of the type 2 diabetic subjects. The present study showed that with decrease in the BMI by 2.81 ± 1.50 kg/m<sup>2</sup> results in the reduction of Hba1c level by about 2.02 ± 1.66 in a span of 9 months. Lifestyle based interventions are effective for the HbA1C levels among type 2 diabetes subjects with obesity.

**Keywords:** HbA1c; Glycaemic Control; Obesity; Type 2 Diabetes; Weight Loss; T2D; Truweight

### Introduction

The association between diabetes and obesity is well known among Indian populations who are unfortunately, becoming the diabetes capital of the world. Type 2 diabetes (T2D) or non insulin dependent diabetes mellitus has become increasingly prevalent, and this is seen mostly among obese people [1]. A one kg/m<sup>2</sup> increase in body mass index (BMI) increases the risk of developing T2D by 8.4 per cent [2]. Study by Jensen, *et al.* [3] reported that, losing weight helps in reducing insulin resistance and thereby improving the glycaemic control. A systematic review done by Gummesson, *et al.* [4] reported a linear association between weight loss and HbA1c reduction and pointed an estimated mean HbA1c reduction

of 0.1 percentage for each one kg reduction of body weight for their study population. Therefore, among overweight and obese T2D individuals, sustained weight loss is one of the goals in the management of type 2 diabetes (T2D). The American Diabetes Association guidelines suggests that weight loss of approximately 5 per cent in overweight or obese diabetic patients may help manage blood glucose and further reduce the need for glucose-lowering medications [5]. According to Wing, *et al.* [6], weight loss by non-surgical means can be very challenging in patients with T2D. Obesity is one of the major risk factors for diabetes, yet there has been little research focusing on this risk factor across India [7]. In the light of the above observations the broad objective of the study was to investigate the

effectiveness of truweight health program reducing BMI and glycosylated hemoglobin among clients with T2DM.

### Methodology

The present study was a clinical observation of obese type 2 diabetic clients enrolled in the Truweight weight management program for nine months. Truweight is a research and nutrition based healthcare company that helps people to deal with obesity and obesity related disorders. The enrolled clients will be provided with periodic diet counselling, a kit of superfoods containing functional ingredients and they have to use the mobile application to track the food intake and their lifestyles.

### Research design

The study was a Clinical observation of 50 type 2 diabetic obese clients out of which 27 were males and 23 were females. The duration of the study was for nine months.

### Truweight health program

Truweight health program comprises of three principal functionalities which includes, a customized meal plans and Superfoods, Personal Nutritionist and Doctors; tech based scientific analysis and constant mentoring. A kit of nutrient dense functional foods which are natural were provided every month, diet plans were provided by qualified nutritionist every 15 days once and the mobile app which helps to follow a healthy diet and lifestyle by logging as well as recording weight, sugar levels and foods consumed. Diet plan with addition of a kit containing ready to eat or prepare foods with added functional ingredients was provided to the patients. The Superfood kit provides about 20 per cent of the daily diet and the rest 80 percent was prepared by the clients. Appropriate quantities were provided based on the client's weight and weekly counselling was provided by the nutritionist. The clients were asked to follow the diet plan as per the diet guidelines and were asked to log the food they have eaten for the day and need to click the finish my day daily. HbA1c of the clients were taken during enrolment and after nine months of the program and every 4th or 5th day, they were asked to update the weight. The clients were asked to do 30 mins physical activity and be active throughout. The clinical observation has been done on diabetes patients related to diet and physical activity. During the follow up call by the in house Ayurveda physicians regarding the dosage of medicines were checked.

### Study period

Based on their HbA1c criteria, the clients were selected using purposive sampling technique. The study was carried out for a period of nine months. Pre HbA1c levels were collected in the initial days of the program and the final was recorded on completing nine months of the program

### Selection of subjects

The location for the present study was Truweight Wellness Center. Based on the following inclusion and exclusion criteria, the data was collected from the clients.

### Inclusion criteria

- Age between 20 - 64 yrs
- BMI between 25 to 40 kg/m<sup>2</sup>
- Type 2 diabetic males and females with oral drugs or insulin up to 30 units
- HbA1C > 7% and <10%
- Willing to follow the truweight diet program, logging the foods, lab reports and updating weight in the truweight mobile app as instructed.

### Exclusion criteria were

- Age < 19 years and > 65 years
- BMI < 24.9 kg/m<sup>2</sup>
- Individuals with HbA1c < 6.9% and > 10.1%
- Diabetic individuals with chronic ailments taking insulin > 30 units
- People who did not volunteer to participate in the study and not willing to use mobile app

### Conduct of the study

The subjects of the study were enrolled online; under the Truweight health programme. T2D obese clients enrolled for the weight loss and diabetic management formed the study sample. After enrolment, they were given consultation through phone. Super foods from Truweight were given monthly once and nutritionist connects with the clients over the phone every week. They were taking their diabetic oral doses which were asked to continue. The Ayurveda in house physicians used to monitor the regular sugar updates and medicine dosages once in 7 days.

### Collection of data

#### Assessment of the socio-economic status of the subjects

Information regarding socio-economic characters such as age, educational status, occupation, family size, monthly income, medical history etc was elicited using general questionnaire designed which was pre-tested and updated in the mobile app.

#### Assessment of the Nutritional Status of the subjects

The nutritional status of the subjects was assessed from anthropometric measurements, biochemical estimation, clinical profile and diet recall.

#### Anthropometric measurements

Standardized techniques were used for measuring the height and weight of the clients. Height of the subjects was measured using stature meter and weight using digital weighing balance. The height and weight of all subjects were recorded following the methods of Jellifee [8]. The body Mass Index was calculated using the formula: BMI= weight in kg / height in m<sup>2</sup>.

#### Biochemical estimation

The HbA1c levels of the selected clients were got recorded in the mobile app during enrolment and after nine months of the program.

**Dietary assessment**

Assessment of the dietary pattern of the subjects were carried out on the basis the diet logs they update in the mobile app. Major nutrients like carbohydrate, fats, proteins and fibre were calculated by the standard formula.

**Statistical analysis of the data**

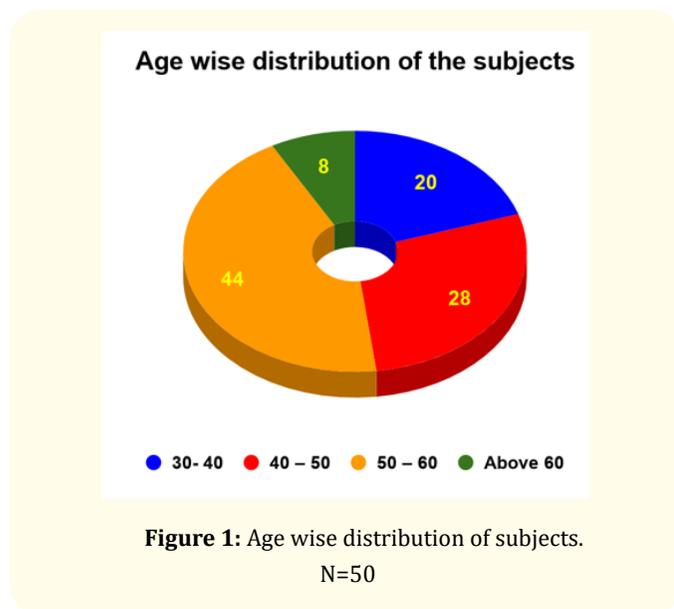
For the present study, the data analysis was carried out using SPSS 2.0 for Windows. Those participants who updated the sugar levels, weight as well as diet logs were considered for the study. The weight and height of the clients were converted into respective BMI and analyzed for the study. The data was analysed by calculating mean, standard deviation. Paired “t” test was used to test the significance before and after the program. Pearson Correlation was used to analyze the association between HbA1c and different parameters.  $p > 0.01$  was set for significance.

**Results**

The observation study was carried out the T2D overweight and obese clients enrolled in the Truweight weight loss program for 6 months. The results are presented here.

**Age wise distribution of the subjects**

Figure 1 shows the age wise distribution of T2D subjects selected for the study.



The subjects selected were in the range of 20 to 64 years. The mean age of the selected T2D subjects were 49 + 8.85 years. In present study, around 44 per cent of the T2D subjects were in the age group of 50 - 60 years, 28 per cent were in the age group of 41 - 50 years, 20 per cent were in the age group of 30 - 40 years 8 per cent were above 60 years. The mean age of the selected T2D subjects were 49 yrs and SD was 8.85.

**Gender wise distribution of the subjects**

Figure 2 shows the gender wise distribution of T2D subjects selected for the study.

Around 54 per cent of the males and 46 per cent of the females formed the samples for the present study.

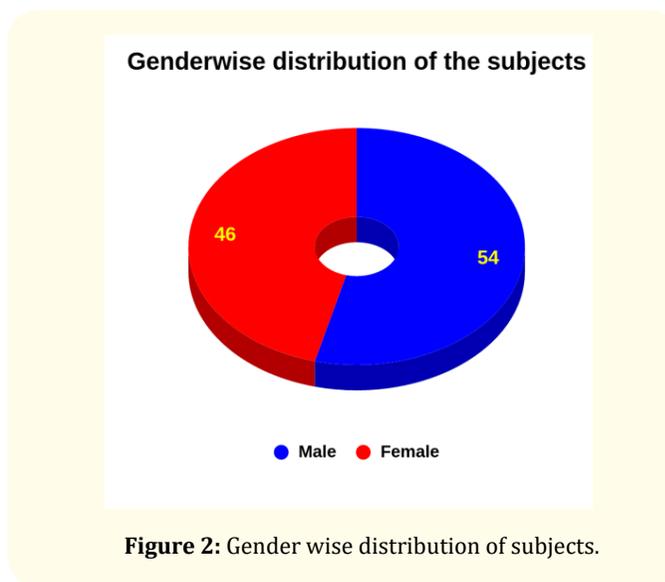


Figure 2: Gender wise distribution of subjects.

**Comparison of initial and final weight, total weight loss and mean levels of initial and final BMI's among subjects**

The initial weight of the T2D subjects selected in the present study was 89 + 13.83 kg and final weights were 81 + 12.47 kg. There was a significant reduction in the weight of the subjects after following the program. The total weight loss per cent in nine months' time was 9 + 4.26 kg for the T2D subjects selected. The reduction in weight loss affected BMI of the T2D subjects selected.

Table 1 shows the Comparison of mean levels of initial and Final BMI's among T2D subjects.

BMI	Number	Mean	SD	Significance of Paired t value
Initial	50	32.59	4.72	13.2275**
Final	50	29.78	4.40	

Table 1: Comparison of mean levels of initial and Final BMI's among subjects.  
\*\* Significant at 1% level

Table 1 depicts the comparison of mean levels of initial and Final BMI's of T2D subjects. Truweight program resulted with significant decrease in the mean values of weight and BMI in nine months. It was shown that there was significant reduction in BMI levels among subjects at 1% level of significance in a span of 9 months.

**Comparison of mean levels of initial and Final HbA1c among subjects**

Reduction in glycated haemoglobin (HbA1c) is accepted as a well-validated surrogate for glycaemic control and long-term micro vascular complications, and has become the standard outcome measure in many trial designs for a variety of diabetes therapies [9,10]. Table 2 shows the Comparison of mean levels of initial and Final HbA1c among subjects.

HbA1c	Number	Mean	SD	Significance of Paired t value
Initial	50	8.47	1.90	8.5881**
Final	50	6.44	1.02	

**Table 2:** Comparison of mean levels of initial and Final HbA1c among subjects.

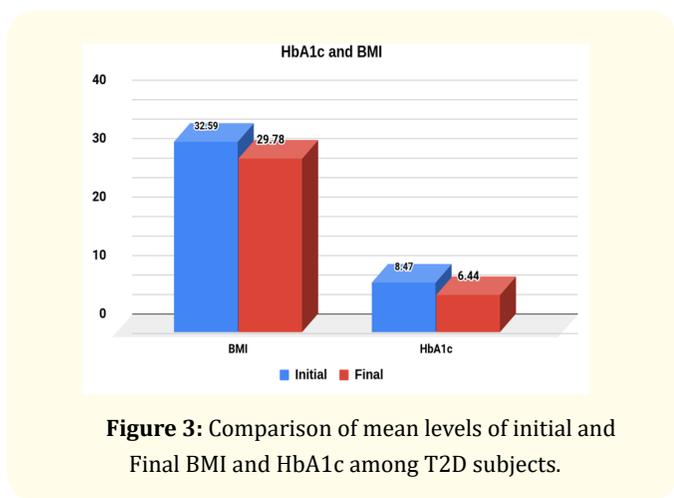
\*\* Significant at 1% level

The above table depicts the comparison between mean levels of initial and final HbA1c among the T2D subjects. The Initial HbA1c was 8.47 + 1.90 and the final was 6.44 + 1.02. It was seen that, there was a significant reduction in HbA1C levels of the subjects due to the Truweight intervention in nine months. This difference was statistically significant with p value less than 0.01.

**Comparison of mean levels of initial and Final BMI and HbA1c among the T2D subjects**

From 2010 onwards, as per the guidelines of Expert Committees of the American Diabetes Association (ADA), the International Diabetes Federation (IDF), and the European Association for the Study of Diabetes (EASD) HbA1C test was recommended to diagnose diabetes, with a threshold of ≥6.5%. It will give an understanding of the long-term glycemic control in subjects with type 2 diabetes. Figure 3 shows the Comparison of mean levels of initial and Final HbA1c among the T2D subjects.

As per Figure 3, there was a significant reduction in weight and HbA1c levels of the selected subjects. Through Truweight program, among obese and overweight diabetic subjects can significantly reduce the Hba1c, which is a standard diabetic marker for a 3 months glucose control.



**Figure 3:** Comparison of mean levels of initial and Final BMI and HbA1c among T2D subjects.

**Impact of total weight loss on HbA1c level in T2D subjects**

Earlier studies showed that weight loss has a significant role in reducing the HbA1C levels. Table 3 shows association between Total Weight loss on HbA1c level in T2D subjects in the present study.

The above table depicts the impact of weight loss on HbA1c level among subjects. A linear regression analysis to study the influence of total weight loss on the level of Hba1c was carried out on a sample of 50 subjects who underwent Truweight programme. The analysis showed that there was a reduction in HbA1c level as the total weight loss increased among the subjects. However, the analysis shows insignificant impact of total weight loss on Hba1c level.

Variable	Coefficient	Standard error	t value	Model F value	R <sup>2</sup>
Intercept	6.7968	0.3104	21.8938**	1.6130 <sup>NS</sup>	0.0325
Total weight loss (Kg)	- 0.0447	0.0352	- 1.2700 <sup>NS</sup>		

**Table 3:** Impact of Total Weight loss on HbA1c level in T2D subjects.

\*\* Significant at 1% level NS Not significant

**Correlation between Macronutrient (carbs, protein, fat and fiber) intake and Weight loss in T2D subjects**

A correlation analysis between macronutrients intake and weight loss in type 2 DM subjects was carried out. Table 4 shows the Correlation between Macronutrient (carbs, protein, fat and fiber) intake and Weight loss in T2D subjects.

Correlation coefficient	CHO (g)	Protein (g)	Fat (g)	Fibre (g)
Total Weight loss (Kg)	0.2500 <sup>NS</sup>	0.2423 <sup>NS</sup>	0.1436 <sup>NS</sup>	0.4424**

**Table 4:** Correlation between Macronutrient (carbs, protein, fat and fiber) intake and Weight loss in T2D subjects.

\*\* Significant at 1% level NS Not significant

Above table depicts about the correlation between Macronutrients intake like carbohydrates, protein, fat and fibre and weight loss among T2D subjects. The analysis showed that fibre intake was positively correlated with total weight loss among subjects at 1% level of significance. Other macronutrients (carbohydrate, protein and fat) were positively correlated with total weight loss but not significant.

**Correlation between Macronutrient (carbs, protein, fat and fiber) intake and HbA1c in T2D subjects**

HbA1c give an understanding of the long-term glycemic control in subjects with type 2 diabetes. Diet has an important role in bringing down the HbA1c level among T2D subjects. Table 5 shows Correlation between Macronutrient (carbs, protein, fat and fiber) intake and HbA1c in T2D subjects.

Variables	Coefficients	Standard error	t value	Model F value	R <sup>2</sup>
Intercept	7.1699	1.0874	6.5931**	1.1326 <sup>NS</sup>	0.0914
CHO (g)	- 0.0029	0.0126	- 0.2325 <sup>NS</sup>		
Protein (g)	0.0253	0.0443	0.5717 <sup>NS</sup>		
Fat (g)	0.0285	0.0608	0.4687 <sup>NS</sup>		
Fibre (g)	- 0.0622	0.0424	- 1.4672 <sup>NS</sup>		

**Table 5:** Correlation between Macronutrient (carbs, protein, fat and fiber) intake and HbA1c in T2D subjects.

\*\* Significant at 1% level NS Not significant

From the above table, the impact of macronutrients on HbA1c level in subjects is presented. A multiple regression analysis was carried out to know the impact of Macro-nutrients on the HbA1c level among subjects. It was observed that none of the nutrients were significantly influencing the HbA1c, but however, it has revealed that CHO and Fibre had negative influence while Protein and Fat had positive influence on HbA1c level.

**Impact of per cent of reduction in BMI on reduction in HbA1c level among T2D subjects**

Reduction in BMI has a significant role in reducing the HbA1c level for diabetic individuals as per earlier studies. Table 6 shows the Impact of per cent of reduction in BMI on reduction in HbA1c level among T2D subjects.

Variable	Coefficient	Standard error	t value	Model F value	R <sup>2</sup>
Intercept	18.0795	4.5216	3.9984**	0.8167 <sup>NS</sup>	0.0167
% Reduction in BMI	0.4155	0.4597	0.9037 <sup>NS</sup>		

**Table 6:** Impact of per cent of reduction in BMI on reduction in HbA1c level among T2D subjects.

\*\* Significant at 1% level NS Not significant

As per Table 6, per cent reduction in BMI has positive impact on reduction in Hba1c level among T2D subjects

**Discussion**

The study presents data from the obese T2D subjects who has enrolled and followed Truweight healthcare program for losing weight as well as reducing diabetic parameters.

From the results, it was found that as age progress, the number of subjects was also increasing because type 2 diabetes mellitus is an age-related disorder. Also, an earlier study conducted by the ICMR-INDIAB demonstrated a significant association between age and diabetes and the prevalence of diabetes was high between ages 25 and 34 years [11] where as in the present study, it was high among 51-60yrs. This is against the present study. Previous study done by Bhati and Goyal [12] reported the similar findings.

The ICMR – INDIAB based study by Patel., *et al.* (2011), estimated that the diabetic patients in India to be as 62.4 million and it was also confirmed by the 5th edition of the Diabetes Atlas which gave a figure of 61.3 million people in India with diabetes in the age group of 20 – 79 years.

Reports indicate that males had higher prevalence of diabetes in the age group above 60 years while in females; it is between 51 and 60 years [13]. This gender difference in prevalence of diabetes may be due to lower insulin action in young women than men as observed in earlier studies. This is in line with the present study.

As per the ICMR [14] recommendations, following a diet containing carbohydrates (55–60 per cent) comprising of cereals, mixed whole grains and millets, whole pulses, salads; proteins (10 to 15 per cent) from vegetable sources, low fat milk and milk products, fish and lean meat; fats (20 to 25 per cent) comprising less than seven per cent of saturated fats and the major proportion from MUFA and polyunsaturated fatty acids (PUFA) as well as consumption of moderate amounts of whole fruits and fiber-rich foods. The diet of Truweight program follows small and frequent meals. The clients were asked to follow 6 meal patterns (3 regular meals and 3 snacks). The regular home based diets were modified- simple carbohydrate foods were replaced with complex carbohydrates, sprouted pulses, 3 servings of vegetables as salads or vegetable soup or a vegetable juice along with pulps (not strained) and one serving of fruit (whole fruit) were incorporated. Daily the subjects were asked to take two teaspoon fenugreek seeds, a gram of cinnamon and 5 gm of fiber supplement. The recommended diet was similar in terms of intake of the nutrients as recommended by the ICMR.

As per the guidelines of American Diabetes Association [15], intake of whole fruit, vegetables, low fat dairy products and whole grains, has a beneficial effect on reversing the development of type-2 diabetes, which is in line with the findings of the present study.

Around 85 per cent of the diabetic patients are overweight or obese [16]. Earlier studies on weight loss and sugar levels reported

that, in the case of overweight and obese individuals with T2DM, even weight loss of approximately 5 per cent of the body weight, there will be an improvement in glycaemic control [17]. Longitudinal cohort studies conducted by Ridderstrale, *et al.* [18] reported that changes in BMI among patients with T2DM are significant predictors of changes in HbA1c and patients who lose weight are more likely to achieve target HbA1c values than those with stable weight or weight gain as per the studies of Feldstein, *et al.* [19]. The results of the present study also prove that reduction in weight has an impact on the glycaemic control among T2D subjects. Similar trend was observed in the study conducted by Velazquez- Lopez, *et al.* [20]. The study showed that high fibre in the diet reduces HbA1c which is in line with the present study.

The glycosylated hemoglobin test (HbA1C) is considered as an excellent index of long term diabetes control. Blood sugar levels tends to fluctuate daily or sometimes within hours, the HbA1C test forms different as it gives a true index of the average blood glucose control over the past three months. Earlier study conducted by Mudraganam and Fatima [21] on Impact of Diet on Glycemic Control in Overweight or Obese Niddm Subjects reported a reduction of the mean HbA1C of 8.1% to 6.05% after 12 weeks' diet program. The effect of weight loss on blood sugar control was studied and proved by many earlier studies as the remission of diabetes.

Weight loss through diet and lifestyle modification is considered as the first-line therapy for T2D as per American Diabetes Association [22]. Present study followed the six meal diet pattern that had an impact of maintaining the blood sugar levels. Also, the dietary approach of small frequent meals would delay the rise in the glycemic loads which is very important for maintaining sugar levels in diabetic subjects. This would also result in minimum insulin requirement to control the glucose and moreover, it may cause the depletion of the glycogen stores, so adipose tissue begins to melt for meeting the energy requirements. In this way, it is beneficial for overweight or obese individuals to reduce their weight as supported by the past study done by Palmer, *et al.* 2009 [23,24].

### Summary and Conclusion

Proper nutrition, constant monitoring with scientific analysis from Truweight had led to significant decrease in the total weight loss, BMI and HbA1C levels through its 9 months study period among the T2D overweight and obese subjects. The diet program at Truweight made a significant impact on weight loss and glycaemic control in both male and female T2D individuals. Early diagnosis and better management can postpone chronic complications of diabetes and prolong healthy life. It is an important awareness creating approach in the selected population and in future may prove as an important tool for evidence based monitoring of lifestyle modification approaches for health promotion.

### Acknowledgements

The authors acknowledge the Management, Truweight Wellness Pvt., Ltd., for providing all the necessary facilities and the active participation of the clients for participating in the study. This study was selected and was presented in the oral presentations - clinical nutrition session in the 50th Annual International Conference the Nutrition Society of India, held on 16th to 17th, November, 2018 at National Institute of Nutrition, Hyderabad.

### Conflict of Interest

Nil.

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**Volume 3 Issue 9 September 2019**

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