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Consuming fruits with nuts and seeds proven to see a better post meal response for people with type 2 diabetes

CONSUMING FRUITS WITH NUTS AND SEEDS PROVEN TO SEE A BETTER POST MEAL RESPONSE FOR PEOPLE WITH TYPE 2 DIABETES

Introduction:

Diabetes, specifically type-2 diabetes, is one of the fastest growing public health problems in the world. India is home to the world's second largest adult diabetes population. Every sixth person with diabetes in the world is an Indian. The past three decades witnessed 150% increase in the number of people with diabetes in the country(1). A matter of immense concern is the progressive lowering of age at which type 2 diabetes is presenting, with its prevalence becoming apparent in the age group of 25–34 years. (1). Lifestyle management plays an important role in management of diabetes mellitus, especially nutritional therapy is fundamental for the effective management of diabetes and helps in achieving and maintaining optimal glycemic control and reducing the risk of long-term tissue damage(2). The amount and type of food consumed is a fundamental determinant of human health.(3) The American diabetes association recommends a dietary pattern that includes carbohydrates from fruits, vegetables, whole grains, legumes, and low-fat milk for healthy management of diabetes. In adults, a minimum of 130 g of carbohydrate per day is required to provide sufficient glucose as fuel for the brain. The effects of carbohydrate restriction below 130 g/day are not clear (1). Although fruit and vegetables are often considered together, fruit may not be viewed as being as healthy as fresh vegetables for individuals with diabetes, given its relatively high sugar content. This has led to frequent abstention from fruit consumption among individuals with diabetes in many parts of the world (4) including India. Fresh fruits provide significant amounts of fiber and water and are packed with vitamins, minerals, antioxidants and powerful plant compounds called phytochemicals. Fruits have carbohydrates in the form of simple sugars which raise the blood sugars. The sugar found in fruits is called as Fructose which is a simple sugar that makes upto 50% of sucrose (table sugar). Fructose is metabolized rapidly by the liver and hence when fruits are consumed in an empty stomach can cause sharp sugar spikes. Goodness of fruits cannot be negated due to this above feature. Fruits can still be a part of a healthy diabetes treatment plan by keeping a few things in mind. Individuals with diabetes, can still enjoy the benefits of fruits, except those that contain high levels of carbohydrates and sugars, which can affect an increase in the blood glucose level.(3). A large epidemiological study done on 0.5 million chinese adults for around 7 years showed, higher fresh fruit consumption was associated with significantly lower risk of diabetes among non diabetic individuals and, lower risks of death and development of major vascular complications were reported among diabetic individuals (4). Another study conducted on 63 newly diagnosed type 2 diabetic patients in Denmark concluded that an advice to restrict fruit intake as part of standard MNT in overweight adults with newly diagnosed type 2 diabetics does not improve glycemic control, body weight or waist circumference. (5). Although there are very few studies which positively co-relate the consumption of fruits and nuts with decrease in waist circumference, BMI and reduction in cardiometabolic risk factors (6), there are no studies which speak of benefits in reducing postprandial spikes which are noticed post consuming fruits. The aim of this study was to investigate the postprandial impact of fruits alone versus fruits consumed with nuts and seeds on blood sugar levels during Continuous Glucose Monitoring (CGM) period.



Sugar.fit is a comprehensive diabetes reversal and management program where a personalized evidence based approach is used to treat and help clients with type 2 diabetes and pre diabetes. Every sugarfitter is given a CGM (continuous glucose monitor) to understand trends in glucose values over 10 to 14 days. During this duration it is very important to log in details of food, physical activity, sleep and medication details to map across the readings and understand impacts these above parameters have on blood sugar readings. These parameters put together give a Metabolic Score or a number during this CGM period between 1-100, 100 being the best. Foods that cause a higher glucose spike, gives a lowest Food Score which further brings down the aggregated Metabolic score value.

Methodology:

This was a retrospective data collected and analysed from the food log entered by participants of SDRP (sugarfit’s diabetes reversal program). SDRP is a comprehensive diabetes reversal program where a personalized evidence based approach is used to treat and help individuals with type 2 and prediabetes. Each participant is given a CGM (continuous glucose monitor) to understand trends in glucose values over 10 to 14 days. During this duration it is very important to log in details of food, physical activity, sleep and medication details to map across the readings and understand impacts these above parameters have on blood sugar readings. These parameters put together give a Metabolic Score or a number during this CGM period between 1-100, 100 being the best. Foods that cause a higher glucose spike, gives a lowest ‘Food Score’ which further brings down the aggregated Metabolic score value. CGM also gives a value of average glucose for the day and ‘Time in Target or Range’ which is between 80-140 mg/dl. These two factors also impact the day’s metabolic score.

Log of six commonly consumed fruits (apple, banana, papaya, pomegranate, guava and kiwi) were picked. Criteria for selection was consumption of fruits with atleast 2 hours of gap from previous and next meal. This data was compared with fruits taken along with nuts or seeds within half an hour of consuming fruit. Log of commonly consumed nuts were considered (almonds, walnuts, groundnuts/peanuts, chia seeds and sunflower seeds).

The outcomes measured were first hour postprandial spike, second hour postprandial spike, highest spike value and the time taken to cause that spike both after fruit consumption and fruits consumed with nuts.

Table 1: Baseline characteristics of study participants

	Fruits (n=45)	Fruits with nuts (n=45)
Age in years	21-65	25-59
Sex	Male n=34 Female n=12	Male n=37 Female n=9
Hba1c in %	8.3	7.5
Fruit intake in grams	114.96±36.9	114.89±29.8
Nuts intake in grams	-	12.7



Study design: Total of 90 participants with 2 sets of groups were planned for this study. Group 1 was 45 individual participants who only logged fruit intake while Group 2 were the next set of 45 participants who logged fruit intake along with nuts or seeds. Populations of Group 1 were in the ages of 21 to 65 years where (n) of males and females were 34 and 12 respectively. Whereas, Group 2 had ages between 25 to 59 years with (n) of male being 37 and female being 9. The baseline Hba1c of Group 1 was 8.3% and that of Group 2 was 7.5%. Fruit intake log of Group 1 was an average of 114.96 ± 36.9 grams while the fruit intake log of Group 2 was an average of 114.89 ± 29.8 grams with an average of 12.7 grams of nuts.

Results:

Baseline characters (Table 1) shows there were no significant differences between the group for any of the baseline variables. Group 1 with only fruit intake saw an average spike of 20 mg/dl in the first hours compared to Group 2 with fruits and nuts where the spike was 15 mg/dl. Between the two groups, there were no significant differences in the spike values although an interesting observation was that the highest spike value was considerably higher with only fruits compared to the fruit and nuts group. It was also noticed that the spike duration in minutes was 15 minutes delayed with the blunter/unsharpened response coming from group 2 with nuts compared to only fruits group. Which means with group 1, the postprandial spike was seen quicker with higher spike number compared to group 2, where the spike was lesser and much delayed in time proving to minimise glycemic variability.

Table 3 and 4 highlights that both groups saw improvement in metabolic score and percentage time in target from baseline to end of CGM period, and both groups were able to successfully reduce average blood glucose level over this period. Although there were no significant improvements observed from group 2 with fruits and nuts alone, this could be due to multiple factors contributing to betterment of the metabolic conditions over the cgm period for all the participants on Sugarfits Diabetes Reversal Program who were on multiple personalized interventions. This could also be an impact of baseline Hba1c which was higher in group 1 compared to group 2.

Results were plotted on graphs using python's matplotlib and seaborn library. Kernel density estimation charts [Figure 1a, 1b and 2] and scatter charts [Figure 3] were plotted to understand first and second hour glucose levels, highest recorded readings and density of spikes.

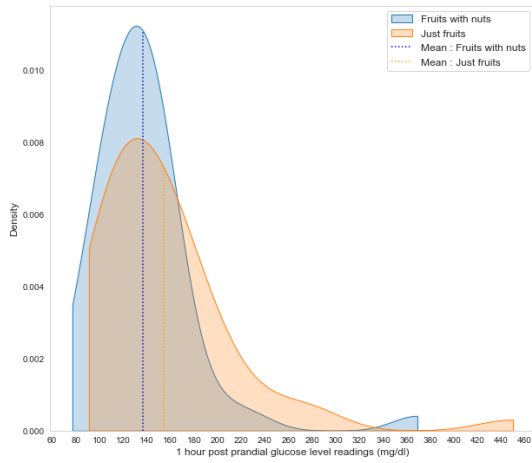
Table 2: Spike Analysis

	Baseline Sugars (mg/dl)	1st Hour postprandial (mg/dl)	Spike (mg/dl)	2nd Hour postprandial (mg/dl)	Spike (mg/dl)	Highest spike value (mg/dl)	Highest spike duration (minutes)
Fruits	132	152	20	142	10	157	58
Fruits with nuts	122	137	15	134	12	147	73

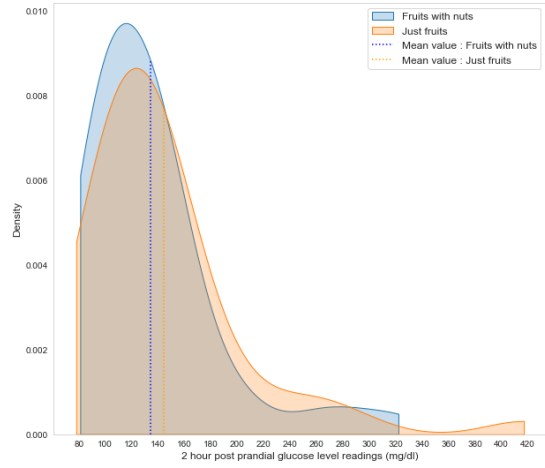


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Figure-1 :

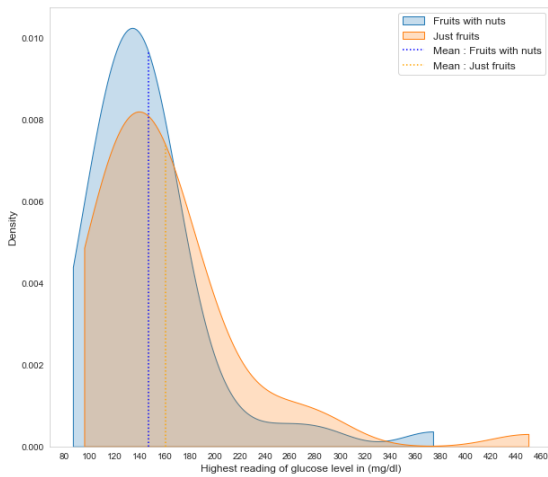


1 a) First hour postprandial glucose levels after consuming fruits (pink) and after consuming fruits with nuts (blue)



1 b) Second hour postprandial glucose levels after consuming fruits (pink) and after consuming fruits with nuts (blue)

Figure-2 :



Highest recorded reading with just fruits were around 160 mg/dl while fruits with nuts were around 140 mg/dl

Figure-3 :

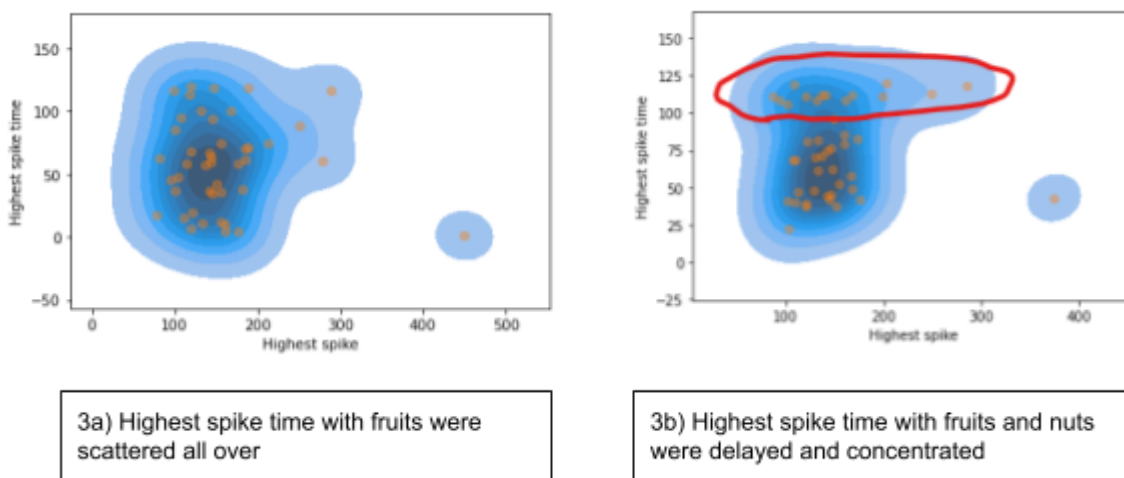


Table 3: Improvement in 14 days CGM period for only Fruit data

Improvement in 14 days CGM period	Baseline CGM	End of CGM	Improvement
Metabolic Score	51.2	63.2	12 ↑
Time in Target (%)	41.5	56.4	15 ↑
Average glucose	155.3	126.8	28.5 ↓

Table 4: Improvement in 14 days CGM period for Fruit with nuts data

Improvement in 14 days CGM period	Baseline CGM	End of CGM	Improvement
Metabolic Score	64.3	72.2	8 ↑
Time in Target (%)	57.3	69.4	12 ↑
Average glucose	127.7	121.8	6 ↓

Conclusion:

Fruit is a good source of dietary fibre, minerals and antioxidants, which may work synergistically to confer several benefits on metabolism including anti-oxidative, anti-inflammatory, anti-proliferative, anti-platelet, anti-hypertensive, anti-dyslipidaemic, anti-hyperglycaemic, and anti-atherogenic effects, and modulation of the composition and metabolic activity of gut microbiota, which could reduce the risk of diabetes as well as of vascular complications among those who have already developed diabetes (4). The study was to analyse if the inclusion of nuts which is the best combination of proteins with fats,



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does bring in additional benefits important to bring down postprandial glucose spikes post fruit consumption. Though the hypothesis proved right, it was not statistically significant enough to approve nuts and seeds' impact on postprandial levels along with fruits. It was also noticed that the quantity of nuts and seeds consumed with 115 grams of fruits were less than 15 grams on average. Therefore, it is possible that the impact of nuts and seeds were not observed with such a low quantity and with increase in the quantity of nuts and seeds to atleast 2 tablespoon per fruit serve, i.e. around 30 grams of nuts and seeds can bring in additional and better postprandial response.

It is of course also possible that the data collected from the food log were not entirely correct, as the accuracy and performance of CGM systems are yet to be tested for its performance. The error difference between CGM and blood glucose tests through glucometers can be anywhere between 0 to 50 mg/dl depending on the day of the CGM sensor and mode of scanning the device (through a reader vs near field communication applications).

We can however conclude that the goodness of fruits cannot be negated due to the sole reason for them bringing postprandial spikes in individuals with diabetes. Fruits can be a part of a healthy diabetes treatment plan by keeping a few things in mind.

1. Type of fruit that causes peak: Finding the right fruit that can go a long way. Every individual's metabolism is different and hence we can see for a few, bananas causing a spike while for others it might not. Also, one should always choose fresh fruits to fruit juices. Fruit juice gives a higher spike post consumption as fiber is removed in the process of making juice. This speeds up the process of digestion and absorption of glucose in the blood. The finer the particle, the higher the Glycemic response.
2. Combination of food: Understand Glycemic Index (GI) and Load (GL) of different fruits. Combining 2 fruits in smaller quantities, one with a low GI and the other with a moderate GI. This helps in two ways. 1. To get more nutrients in one serving. 2. Reduce impact of high GI fruit, which usually brings in higher spike post consumption.
3. Portion it well: Stick to one serving of fruit per meal or snack. One fruit serving equals 15 grams of carbohydrates. How much of one serving is in a fruit depends on the type of fruit. For example, 1 serving of banana is around $\frac{1}{2}$ a medium sized banana, while 1 serving of strawberries is about 1 medium bowl of strawberries. Choose the best fruit combination and portion it accordingly. Instead of having a huge bowl of fruit as one meal, break it into two small servings in the day.
4. Sequencing of food: Start any carbohydrate rich meal with a protein and/or fat snack. Especially when considering fruit for breakfast. Since there would be more than 10 hours of fasting from dinner the previous night, eating fruit first can cause a sharp spike in sugar levels. But when consumed after a protein and/or fat snack like boiled egg whites or handful of nuts and seeds, a better postprandial response can be seen.



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