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Determination of Monosaccharide's In Uttapam from Different Local Eateries

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Abstract:

Now days, we are consuming the different types of fast food in our day to day life due to our busy schedule, which contain the high or low sucrose in it which may affect the health of the people having diabetes. Here, we are estimated the amount of the Glucose from the Uttapam samples from three different eateries. For this estimation of glucose we used the DNSA method, in which the acid hydrolysis of sample was done. After the sample was cooled down the stock solution, DNSA reagent and distilled water was added stepwise and then optical density was observed at 530 nm by using colorimeter. After successful estimation of the glucose from the sample we observed the amount of sugar in all three samples, the percentage of sugar found in each sample are 3.90%, 16.37% and 18.67% respectively. As we observed the all three samples from three different eateries; the amount of sugar found in sample A, B and C are 2.42, 10.38 and 34.42 gm/serving respectively. From this we can conclude that the sample C contain more amount of glucose concentration of glucose in the body.

Keywords:

Determination, Monosaccharide, Uttapam, GI (Glycemic Index), Polysaccharides and Oligosaccharide

1. Introduction:

Carbohydrates:

Carbohydrates plays an important roles for controlling many biological processes in human body by acting as reciprocating compounds with proteins in molecular recognitions events [1,2] The human body uses carbohydrates in the form of glucose. Glucose can be converted to glycogen. Carbohydrates are Polyhydroxy aldehydes or ketones or substances that yield such compounds on hydrolysis. There are three major size class of carbohydrates are ***Monosaccharides*** the simplest form of carbohydrates, the monosaccharides are either aldehydes

or ketones with two or more hydroxyl group [3]. These are unbranched carbon chain in which all the carbon atoms are linked by single bond. The monosaccharide is a ketone. ***Polysaccharides*** most carbohydrates found in the nature occur as polysaccharides, polymers of medium to high molecular weight. It is also called as glycans. It has two types (A) Homopolysaccharides and (B) Heteropolysaccharides [3]. An ***Oligosaccharide*** is saccharide polymer containing a small number of monosaccharides (simple sugars). Oligosaccharides can have many functions including cell recognition and cell binding. For example, glycolipids have an important role in the immune response. The sugars include monosaccharides, such as glucose and fructose and disaccharides such as sucrose (table sugar), maltose and lactose (milk sugar). Complex carbohydrates (polysaccharides) comprise starches and dietary fibers. Starches are polymers of glucose.

The importance of dietary carbohydrate in human evolution:

We propose that plant foods containing high quantities of starch were essential for the evolution of the human phenotype during the Pleistocene. Although previous studies have highlighted a stone tool-mediated shift from primarily plant-based to primarily meat-based diet as critical in the development of the brain and other human traits, we argue that digestible carbohydrates where also necessary to accommodate the increase metabolic demands of a growing brain. Furthermore, we acknowledge the adaptive role cooking played in improving the digestibility and palatability of key carbohydrates. We provide evidence that cooked starch, a source of performed glucose, greatly increase energy availability to human tissues with high glucose demand, such as the brain, red blood cells and the developing fetus. We also highlight the auxiliary role copy number variation in the salivary amylase genes may have played in increasing the importance of starch in human evolution following the Origins of cooking. Salivary amylases are largely ineffective on raw crystalline starch, but cooking substantially increases both their energy- yielding potential and glycemia. Although uncertainties remain regarding the antiquity of cooking and the origins of salivary amylase gene copy number variation, the hypothesis we present makes a testable prediction that these events are correlation [3].

2. Diabetes:

Diabetes is disease that occurs when your blood glucose (blood sugar), is too high. Blood glucose is your main source of energy and comes from the food you eat. Insulin, a hormone

made by the pancreas, helps glucose from food get into your cells to be used for energy. Sometimes your body doesn't make enough-or any-insulin or doesn't use insulin well. Glucose then stays in your blood and doesn't reach your cells. Over time, having too much glucose in your blood can cause health problems. Although diabetes has no cure, you can take steps to manage your diabetes and stay healthy. The most common types of diabetes are type (1), type (2) and gestational diabetes [4].

Type (1) if you have this diabetes, your body does not make insulin. Your immune system attacks and destroys the cells in your pancreas that make insulin. It is usually diagnosed in children and young adults, although it can appear at any age. People with this diabetes need to take insulin every day to stay alive.

Type (2) if you have this diabetes, your body does not make or use insulin well. You can develop this diabetes at any age, even during childhood. However, this type of diabetes occurs most often in middle-aged and older people. It is most common type of diabetes.

Gestational diabetes develops in some women when they are pregnant. Most of the time, this type of diabetes goes away after the baby is born. However, if you have had gestational diabetes, you have greater chance of developing type (2) diabetes later in life. Sometimes diabetes diagnosed during pregnancy is actually type (2) diabetes [4].

2.1 Glycemic Index:

The glycemic index or glycaemic index (GI) is a number associated with the carbohydrates in a particular type of food that indicates the effect of these carbohydrates on a persons blood glucose (also called blood sugar) level. A value of 100 represents the standard, an equivalent amount of pure glucose. The GI represents the rise in a person's blood sugar level two hours after consumption of the food. The glycemic effects of food depends on a number of factors, such as the type of carbohydrate, physical entrapment of the carbohydrate molecules within the food, fat and protein content of the food and organic acids or their salts in the meal. The GI is useful for understanding how the body breaks down carbohydrates and takes into account only the available carbohydrate (total carbohydrate minus fiber) in a food [4].

2.2 Process of Sugar in Human Body:

When you eat sugars, your body either converts it into energy or into fat, which is then stored in your fat cells. As sugar enters your blood stream it goes to pancreas, which then releases a

hormone called insulin- your body's sugar regulator. The sugar is then stored in your liver, muscles and fat cells.

3. Role of the Food Matrix and Digestion on Calculation of the Actual Energy Content of Food:

The energy content of food is calculated on the basis of general factors for fat, protein, and carbohydrates. These general factors were derived by W. O. Atwater in the late 19th century. These factors are applied indiscriminately to all types of foods, yet the same nutrient may be digested to different extents to generate energy, depending on the characteristics of the food matrix, the processing methods applied to food, and the meal composition. As a consequence, the actual energy content of food may differ from what is theoretically calculated with the Atwater factors. Estimates of the discrepancy between calculated energy content and actual energy content are provided for different diets. The findings may have implications for consumer purchasing decisions as well as for the design of dietary interventions.

4. The Glycemic Potential of White and Red Rice Affected by Oil type and Time of Addition:

Limited research exists on how different oil types and time of addition affect starch digestibility of rice. This study aimed to assess the starch digestibility of white and red rice prepared with two oil types: Vegetable oil (unsaturated fat) and Ghee (clarified butter, saturated fat) added at three different time points during the cooking process ("before": frying raw rice in oil before boiling "during": adding oil during boiling, and "after": stir-frying cooked rice in oil). Red rice produced a slower digestion rate than white rice. White rice digestibility was not affected by oil type, but was affected by addition time of oil. Adding oil "after" (stir-frying) to white or red rice resulted in higher slowly digestible starch. Red rice cooked using ghee showed the lowest amount of glucose release during in vitro digestion. The addition of ghee "during" (that is boiling with ghee) or "before" (that is frying rice raw with ghee then boiling) cooking showed potential for attenuating the postprandial glycemic response and increasing resistant starch content. This is the first report to show healthier ways of preparing rice. White rice with oil added "after" (stir-fried) may provide a source of sustained glucose and stabilize blood glucose levels. Boiling red rice with ghee or cooking red rice with ghee pilaf-style may provide beneficial effects on postprandial blood glucose and insulin concentrations, and improve colonic health.

Practical Application: rice is predominant source of energy in most of Asia with excessive consumption of rice being implicated in the rice of type two diabetes. Stir-frying white rice can be a source of sustained glucose and provide a stabilizing effect on blood glucose levels. Boiling red rice with ghee or cooling red rice with ghee pilaf-style may provide beneficial effects on postprandial blood glucose and insulin concentrations. This suggests how a single technique of adding fat in the cooking of rice at certain time points may be a useful method in providing taste and lowering glycaemia. Also the rice converts in starch after cooking, but the starch amount produced is differing by the different cooking methods of rice.

5. Effects of Cooking Methods and Starch Structures on Starch Hydrolysis Rates of Rice:

This study aimed to understand effects of different cooking methods, including steamed, pilaf, and traditional stir-fried, on starch hydrolysis rates of rice. Rice grains of 3 varieties, japonica Indica and waxy, were used for the study. Rice starch was isolated from the grain and characterized. Amylose contents of starches from japonica, Indica and waxy rice were 13.5%, 18% and 0.9% respectively. The onset gelatinization temperature of Indica starch (71.6 C) was higher than that of the japonica and waxy starch (56.0 and 56.8 C, respectively). The difference was attributed to longer amylopectin branch chains of the Indica starch. Starch hydrolysis rates and resistant starch (RS) contents of the rice varieties differed after they were cooked using different methods. Stir-fried rice displayed the le ast starch hydrolysis rate followed by pilaf rice and steamed rice for each rice variety. RS contents of freshly steamed japonica, Indica and waxy rice were 0.7%, 6.6% and 1.3% respectively; those of rice pilaf were 12.1%, 13.2% and 3.4% respectively; and the stir-fired rice displayed the largest RS contents of 15.8%, 16.6% and 12.1 respectively. Mechanisms of the large RS content, stir-fried rice were studied. With the least starch hydrolysis rate and the largest RS contents, stir-fried rice would be a desirable way of preparing rice for food to reduce postprandial blood glucose and insulin responses and to improve colon health of humans.

6. Sample:

Now a days our lifestyle gets busy, and I this busy lifestyle we did not pay attention to our diet or our food. So we consume more junk food like Uttapam, Idali, Dosa, Burger, etc. This all type of food contains different amounts of glucose, which may be high or low as Compared to GI range. So we get the Uttapam sample from two different places, to determine the amount of glucose present in the Uttapam.

7. Materials and Methods:

7.1 Materials:

Table No. 1 Materials

	Component	***Quantity***
Sample	Uttapam sample(Ratio- 75:25, Rice:Pulse)	3 gm
Reagents	-DNSA Reagent -1 N HCL (for acid hydrolysis)	26 ml 30 ml
Standard	- Glucose 1 mg/ml - Stock solution	 10ml
Dilluent	Distilled water	95 ml
Glassware	- 1 ml pipette - 10 ml pipette - 25 ml beaker - Test tubes - Cuvette - Funnel	4 4 6 18 3 3
Miscellaneous	- Muslin cloth - Hot water bath - Test tube stand - Wash bottle - Discard beaker - Filter paper - Graph	3 1 1 1 1
Instrument	Colorimeter at 530 nm	

7.2 Methods

- 1 gm of sample A (uttapam sample)
- Boil the 1 gm of Uttapam sample in 10 ml of 1 N HCL for acid hydrolysis
- Cool it and filter it with muslin cloth
- Use the extract for estimation
- Prepare the standard taking concentration by taking 0.8, 1.6, 2.4, 3.2 & 4.0 mg/ml
- Add the extract or stock in each tube

- Add 2 ml of DNSA reagent in each tube
- Keep it in hot water bath for 8-10 minutes
- Cool it
- Add 8 ml of distilled water each tube
- Observe the O. D. at 530 nm
- Plot the graph

8. Instrument:

8.1 Introduction:

A colorimeter is a light-sensitive device used for measuring the transmittance and absorbance of light passing through a liquid sample. The device measures the intensity or concentration of the color that develops upon introducing a specific reagent into a solution. There are two types of colorimeters- color densitometers, which measure the density of primary colors, and color photometer, which measure the color reflection and transmission

8.2 Design of Colorimeter:

The three main components of a colorimeter are light source, a cuvette containing the sample solution and photocell for detecting the light passed through the solution. The instrument is also equipped with either colored filters or specific LEDs to generate color. The output from a colorimeter may be displayed by an analog or digital meter in terms of transmittance or absorbance. In addition, a colorimeter may contain a voltage regulator for protecting the instrument from fluctuations in mains voltage. Some colorimeters are portable and useful for on-site tests, while others are larger, bench-top instruments are useful for laboratory testing.

8.3 Working Principal

The colorimeter is based on Beer-Lambert's Law, according to which the absorption of light transmitted through the medium is directly proportional to the medium concentration. In a colorimeter, a beam of light with a specific wavelength is passed through a solution via a series of lenses, which navigate the colored light to the measuring device. This analyzes the color compared to an existing standard. A microprocessor then calculates the absorbance or percent transmittance. If the concentration of the solution is greater, more light will be absorbed, which can be identified by measuring the difference between the amount of light at its origin and that after passing the solution.

8.4 Applications:

Colorimeters are widely used to monitor the growth of a bacterial or yeast culture. They provide reliable and highly accurate results when used for the assessment of color in bird plumage. They are used to measure and monitor the color in various foods and beverages, including vegetable products and sugar. Certain colorimeters can measure the colors that are used in copy machines, fax machines and printers.

9. Observations:

9.1 Description of sample:

Table No. 2 Description of sample

Day	*Ratio*	*Temp.*	*Dilution*	*Sample*	*Uttapam Sample*
Day 1	A (70:30)		01:01	Sample 1	Center uttapam (70:30) Uk1
	A (70:30)			Sample 2	Center uttapam (70:30) Uk2
	A (70:30)			Sample 3	Off center uttapam (70:30) Uk1
	A (70:30)			Sample 4	Off center uttapam (70:30) Uk2
	A (70:30)			Sample 5	Corneruttapam (70:30) Uk1
	A (70:30)			Sample 6	Corneruttapam (70:30) Uk2
Day 2	B (70:30)	100^{o}c	01:01	Sample 7	Center uttapam (70:30) Uk1
	B (70:30)			Sample 8	Center uttapam (70:30) Uk2
	B (70:30)			Sample 9	Off center uttapam (70:30) Uk1
	B (70:30)			Sample 10	Off center uttapam (70:30) Uk2
	B (70:30)			Sample 11	Corner uttapam (70:30) Uk1
	B (70:30)			Sample 12	Corner uttapam (70:30) Uk2
	B (70:30)	37^{o}c	01:01	Sample 13	Center uttapam (70:30) Uk1
	B (70:30)			Sample 14	Off center uttapam (70:30) Uk1
	B (70:30)			Sample 15	Corner uttapam (70:30) Uk1
Day 3	C (60:40)	100^{o}c	01:05	Sample 16	Center uttapam (60:40) Uk1
				Sample 17	Off center uttapam (60:40) Uk1
				Sample 18	Corner uttapam (60:40) Uk1
By Graph					
Day 2	B (70:30)	37^{o}c	01:05	Sample 19	Center uttapam (70:30) Uk2
	B (70:30)			Sample 20	Off center uttapam (70:30) Uk2

	B (70:30)			Sample 21	Corner uttapam (70:30) Uk2
Day 2	B (70:30)	100°c	01:05	Sample 22	Center uttapam (70:30) Uk1
	B (70:30)			Sample 23	Off center uttapam (70:30) Uk1
	B (70:30)			Sample 24	Corner uttapam (70:30) Uk1
Day 3	C (60:40)	100°c	01:05	Sample 25	Center uttapam(60:40)Uk2
	C (60:40)			Sample 26	Off center uttapam(60:40)Uk2
	C (60:40)			Sample 27	Corner uttapam(60:40)Uk2
Day 3	C (60:40)	37°c	01:05	Sample 28	Center uttapam (60:40)Uk1
	C (60:40)			Sample 29	Off center uttapam (60:40)Uk1
	C (60:40)			Sample 30	Corner uttapam (60:40)Uk1

9.2 Standard Graph for Estimation of Glucose: Day- 1

Table No. 3 Estimation of Glucose

Standard (4 mg/ml)	*Stock (ml)*	*Diluent (ml)*	*DNSA (ml)*	*D/W*	*OD at 530 nm*
Blank	0	1	2	8	0
0.2	0.2	0.8	2	8	0.01
0.4	0.4	0.6	2	8	0.08
0.6	0.6	0.4	2	8	0.16
0.8	0.8	0.2	2	8	0.24
1	1	0	2	8	0.32

9.3 Standard Graph for Estimation of Glucose: Day- 2

Table No. 4 Estimation of Glucose

Standard (4 mg/ml)	*Stock (ml)*	*Diluent (ml)*	*DNSA (ml)*	*D/W*	*OD at 530 nm*
Blank	0	1	2	8	0
0.8	0.2	0.8	2	8	0.15
1.6	0.4	0.6	2	8	0.29
2.4	0.6	0.4	2	8	0.42
3.2	0.8	0.2	2	8	0.52
4	1	0	2	8	0.55

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9.4 Center Uttapam :

Table No. 5 Center Uttapam

Day	*Ratio*	*Temp.*	*Dilution*	*Sample No.*	*Uttapam Sample*	*Total Sugar*	*Percentage*
Day 1	A-1 (70:30)		01:01	Sample 1	Center Uttapam (70:30) Uk1	2.232	3.6
	A-2 (70:30)			Sample 2	Center Uttapam (70:30) Uk2	2.48	4
Day 2	B-1 (70:30)	100°c	01:01	Sample 7	Center Uttapam (70:30) Uk1	7.9947	12.6
	B-2 (70:30)			Sample 8	Center Uttapam (70:30) Uk2	1.6497	2.6
	B-7 (70:30)	37°c	01:01	Sample 13	Center Uttapam (70:30) Uk1	6.2181	9.8
Day 3	C-1 (60:40)	100°c	01:05	Sample 16	Center Uttapam (60:40) Uk1	58.086	31.5
Day 2	B-10 (70:30)	37°c	01:05	Sample 19	Center Uttapam (70:30) Uk2	1.269	2
Day 2	B-13 (70:30)	100°c	01:05	Sample 22	Center Uttapam (70:30) Uk1	21.89025	34.5
Day 3	C-4 (60:40)	100°c	01:05	Sample 25	Center Uttapam (60:40) Uk2	12.908	7
Day 3	C-7 (60:40)	37°c	01:05	Sample 28	Center Uttapam (60:40) Uk1	11.986	6.5

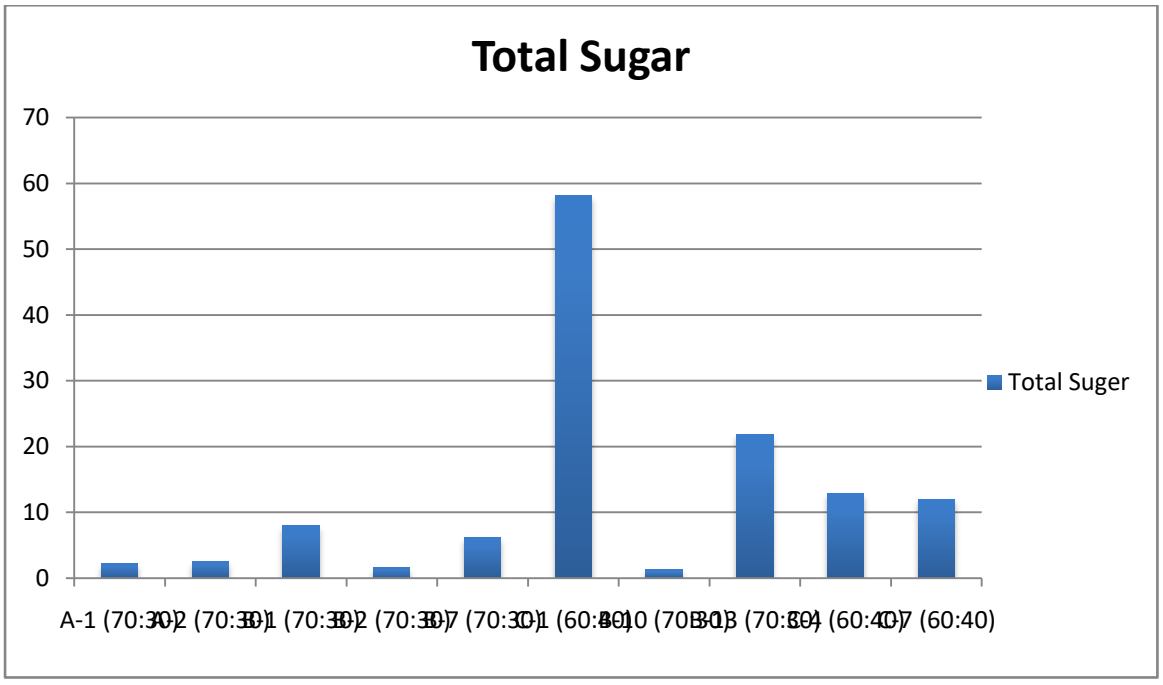

Figure No. 1 CenterUttapam

9.5 OffCenter Uttapam :

Table No. 6 OffCenter Uttapam

Days	*Ratio*	*Temp*	*Dilution*	*Sample No.*	*Uttapam Sample*	*Total Sugar*	*Percentage*
Day 1	A-3 (70:30)		01:01	Sample 3	Off Center Uttapam (70:30) Uk1	1.488	3.6
Day 1	A-4 (70:30)		01:01	Sample 4	Off Center Uttapam (70:30) Uk2	3.596	4

Day 2	B-3 (70:30)	100°c	01:01	Sample 9	Off Center Uttapam (70:30) Uk1	7.7049	12.6
Day 2	B-4 (70:30)	100°c	01:01	Sample 10	Off Center Uttapam (70:30) Uk2	1.6497	2.6
Day 2	B-8 (70:30)	37°c	01:01	Sample 14	Off Center Uttapam (70:30) Uk1	6.0912	9.8
Day 3	C-2 (60:40)	100°c	01:05	Sample 17	Off Center Uttapam (60:40) Uk1	55.32	31.5
Day 2	B-11 (70:30)	37°c	01:05	Sample 20	Off Center Uttapam (70:30) Uk2	1.269	2
Day 3	B-14 (70:30)	100°c	01:05	Sample 23	Off Center Uttapam (70:30) Uk1	23.15925	34.5
Day 3	C-5 (60:40)	100°c	01:05	Sample 26	Off Center Uttapam (60:40) Uk2	11.986	7
Day 3	C-8 (60:40)	37°c	01:05	Sample 29	Off Center Uttapam (60:40) Uk1	12.908	6.5

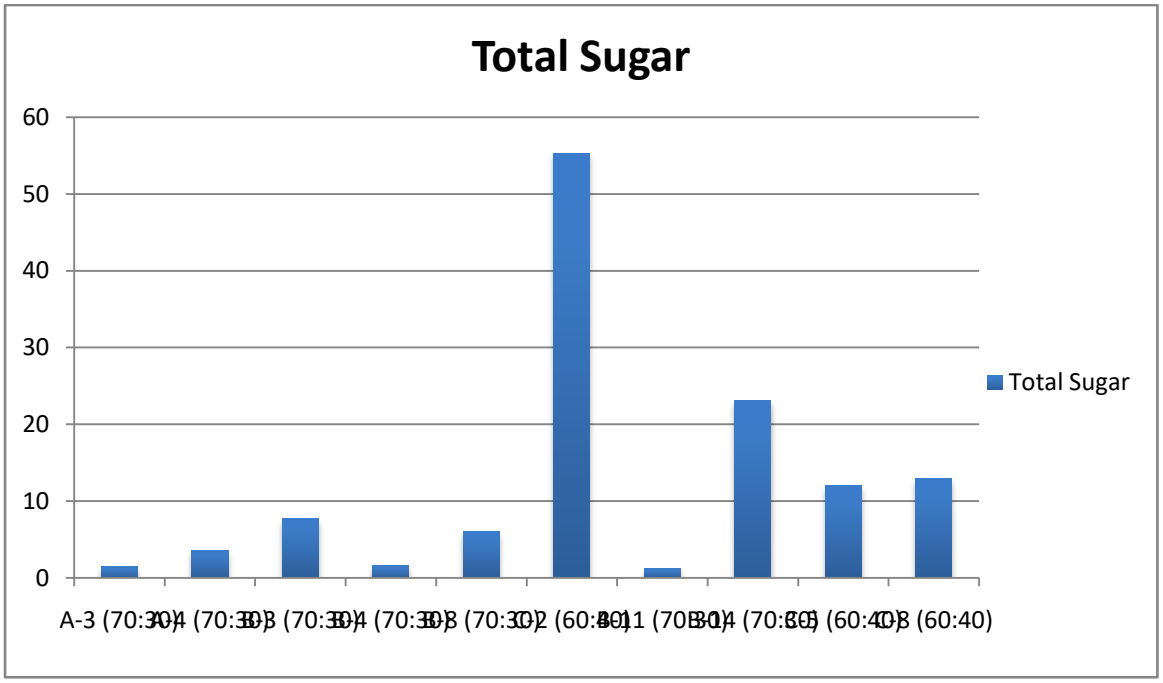

Figure No. 2 OffCenterUttapam

9.6 Corner Uttapam :

Table No. 7 CornerUttapam

Days	*Ratio*	*Temp*	*Dilution*	*Sample No.*	*Uttapam Sample*	*Total Sugar*	*Percentage*
Day 1	A-5 (70:30)		01:01	Sample 5	CornerUttapam (70:30) Uk1	1.984	3.2
Day 1	A-6 (70:30)		01:01	Sample 6	CornerUttapam (70:30) Uk2	2.728	4.4
Day 2	B-5 (70:30)	100°c	01:01	Sample 11	CornerUttapam (70:30) Uk1	7.7409	12.2
Day 2	B-6 (70:30)	100°c	01:01	Sample 12	CornerUttapam (70:30) Uk2	1.6497	2.6
Day 2	B-9 (70:30)	37°c	01:01	Sample 15	CornerUttapam (70:30) Uk1	5.8374	9.2
Day 3	C-3 (60:40)	100°c	01:05	Sample 18	Corner Uttapam (60:40) Uk1	55.32	30
Day 2	B-12 (70:30)	37°c	01:05	Sample 21	CornerUttapam (70:30) Uk2	1.269	2
Day 2	B-15 (70:30)	100°c	01:05	Sample 24	CornerUttapam (70:30) Uk1	19.98675	31.5
Day 3	C-6 (60:40)	100°c	01:05	Sample 27	Corner Uttapam (60:40) Uk2	12.908	7
Day 3	C-9 (60:40)	37°c	01:05	Sample 30	Corner Uttapam (60:40) Uk1	13.83	7.5

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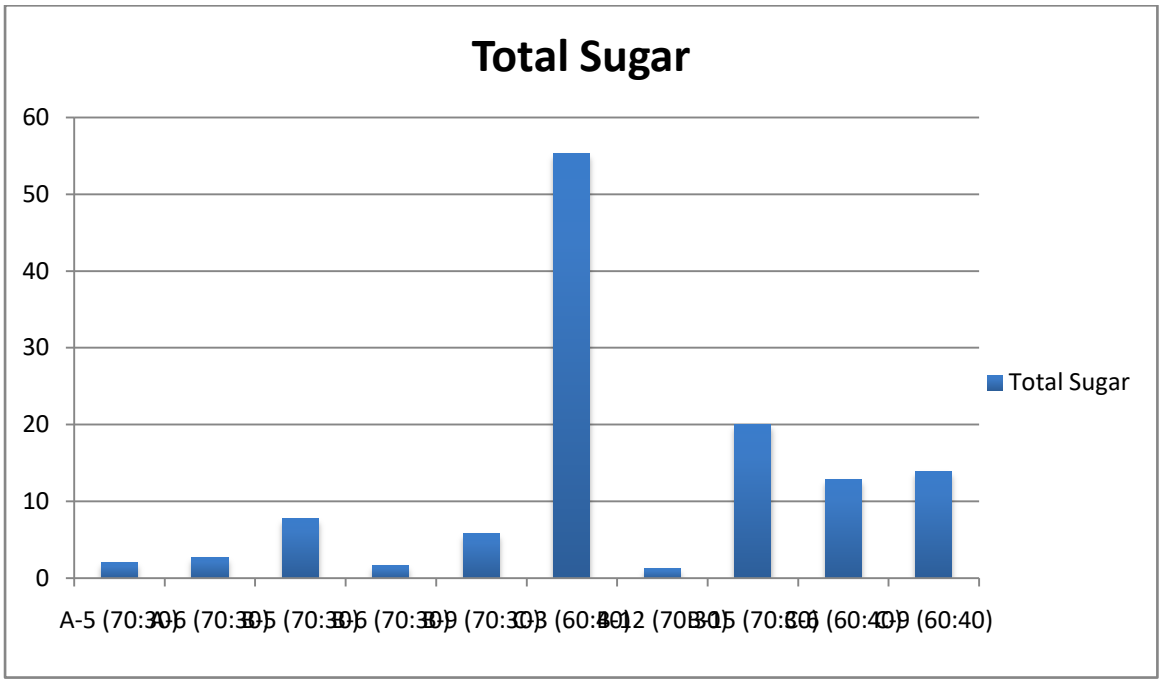

Figure No. 3 Corner Uttapam

9.7 Final Graph:

Estimation of Sugar from Uttapam from Different

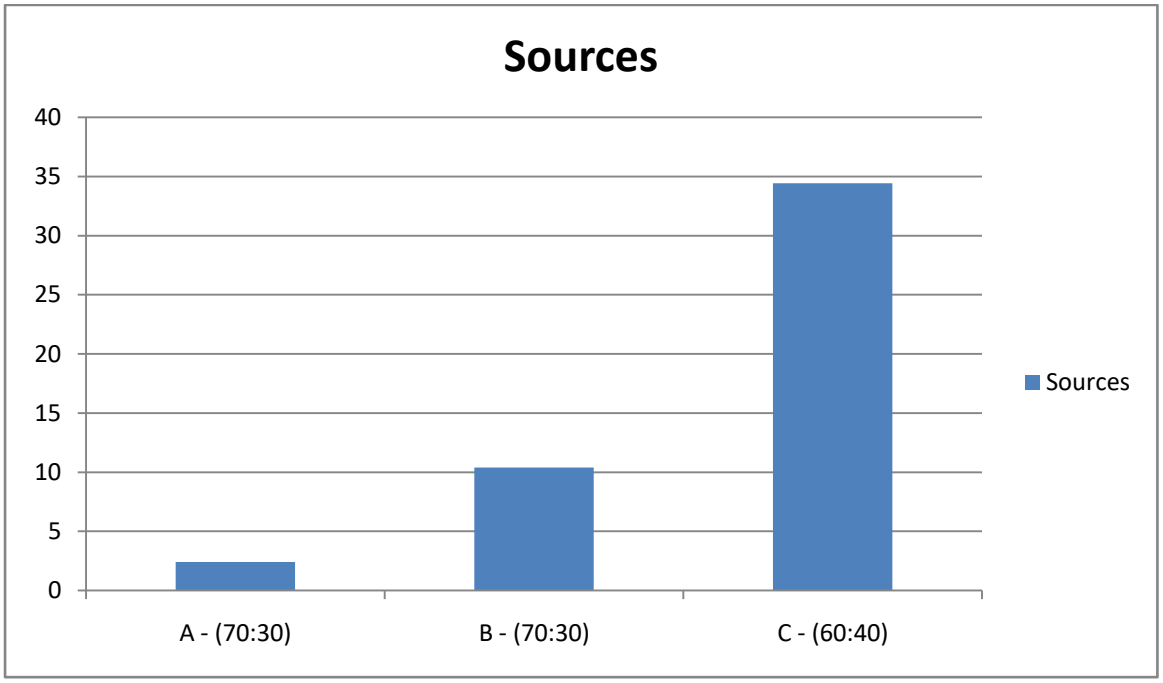

Figure No. 4 Final Graph

10.Result:

The estimation of glucose (sugar) from the uttapam sample is done by DNSA method was carried out successfully. The amount of free sugar found in sample A (70:30) is 2.42 gm/serving, in sample B (70:30) is 10.38 gm/serving and in sample C (60:40) is 34.42 gm/serving and the percentage of sugar found in each sample are 3.90%, 16.37% and 18.67% respectively.

11. Conclusion:

The normal range of glucose in human body is 80-120mg/dl. If he amount of glucose in the body will increase or decrease (fluctuate) the person may get suffer from several disease, such as diabetes. Now a days we eat different local foods that might be having more or less amount of sugar in it. The amount of free sugar was estimated from 3 different uttapam samples. Out of these 3 samples 2 are of same ratio and one has different ratio of rice and pulse.

Sample "A" was bought from South Indian Restaurant and having ratio of rice and pulse is 70:30 respectively. The hydrolysis of this sample is done at 100^{o}c and the dilution used for this sample is 1:1 in sample A we have taken sample from 3 different site i.e. center, off-center, off-center and corner. The more amount of glucose found in off-center site i.e. 3.90%

Sample "B" was bought from the same restaurant and having same ratio but, the hydrothesis is done at 2 different temperature i.e. at 37^{0}c and 100^{o}c and the glucose dilution used for this sample is 1:4 at 37^{0}c the amount of glucose is very low as compared to the sample at 100^{o}c

Sample "C" was bought form Sai Ram Stall and having the ratio of rice and pulse 60:40 respectively. The hydrolysis is done for this sample is at 2 different temperatures that is 37^{0}c and 100^{o}c and the glucose dilution used is 1:4. The glucose amount found in this sample is 18.67%

We can conclude that the sample "C" is having more amount of glucose concentration of glucose in the body. If the GI range high that is indicates that the concentration of glucose in the body is low. The high GI is 70+. People having diabetes they should avoid such foods and the moderate range is 55-69, people should eat the food with caution. The low GI is 0-53.

The GI of rice is 58 is moderate and the GI pulse is 43 which is less. Therefore it is determined that the cooking process had an effect on the food for having the different amount of glucose in it. As the Uttapam is cooked by using oil the amount of glucose obtains in Uttapam is large, as compared to other cooking process like steaming.

12.References:

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