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GC-MS Determination of Glucose Content in Eight Food Samples Obtained from Swali Ultra Market in Yenagoa

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ABSTRACT

This study assessed the occurrence variability of glucose in food samples. Eight different food samples (semolina, wheat flour, wheat grains, guinea corn, corn grains, corn flour, samvita and millet grains) were bought at Swali Ultra Market, Yenagoa, Bayelsa State. The grains were ground into powder form and were sieved to get fine powder. 1 g of each of the samples was dissolved in eight different conical flasks, containing 50 mL of 65% ethanol each. The conical flasks were placed on an electric shaker and agitated for 1 hour, after which they were filtered and the filtrates were sent for Gas chromatography-Mass spectroscopy analysis (GC-MS). The GC-MS analysis shows that β –glucose was found in the food items; semolina (0.63%), corn grains (0.71%), corn flour (0.83%), Samvita (0.14%) and millet grains (0.08%). The trend in the total sugar contents in the eight food samples revealed that sucrose was present in all and with the highest percentage concentration of 4.92% and 4.93% respectively for semolina and corn flour. Sucrose only, with the percentage concentration of 0.23% and 0.43% was found in wheat and guinea corn grains respectively. The sample with the highest percentage of glucose was corn flour (0.83%) while millet grain has the least percentage of 0.08. Maltose was observed in all samples except guinea corn and wheat grains with the lowest concentration of 0.04% in millet grains.

Keywords : GC-MS, Determination, Glucose, Content, Food Samples.

I. INTRODUCTION

Glucose also called dextrose is a simple sugar with the molecular formula C6H12O6. It is a form of carbohydrate known as monosaccharide (simple sugar). Glucose can be obtained by the hydrolysis of carbohydrates such as milk sugar (lactose), cane sugar (sucrose), maltose, cellulose, glycogen, etc. It is commonly commercially manufactured from corn starch by hydrolysis via pressurized steaming at controlled pH in a jet followed by further enzymatic depolymerization [1]. All forms of glucose are colourless and soluble in water and acetic acid but sparingly soluble in methanol and ethanol. The naturally occurring form of glucose is D-glucose, while L-glucose is produced synthetically in comparably small amounts and is of lesser importance [2, 3]. The D-glucose can exist in two forms; alpha D-glucose and beta D-glucose. When alpha-glucose molecules are joined, starch is formed (a polymer). When beta-glucose molecules are joined, a polymer is formed which is a cellulose (fibre). Corn flour is cholesterol free and a source of phytonutrient and antioxidant [4]. Corn also contain small amount of sugar (1-3%). Sweet corn also known as sugar corn is a special low starch variety (28%) with a higher sugar content (18%), most of which is sucrose [5]. Millet is a grain that is a good source of magnesium which has

been shown to reduce the severity of asthma and to reduce the frequency of migraine attacks. Samvita is prepared from cassava and is sugar free (low carbohydrates), and can be taken by anyone including the elderly and diabetics [6]. It was found [7] that excess added sugar consumption is tied to poor health outcomes in children. It was observed [8] that the predominant sugar in milk drinks, jelly tots, pudding, cookie and cake samples was sucrose.

II. METHODS AND MATERIAL

Sample Preparation

The eight food samples (semolina, wheat flour, wheat grains, guinea corn grains, corn grains, corn flour, samvita and millet grains) were bought from the Swali Ultra Market, Yenagoa, Bayelsa State. The grains were placed on aluminum trays and dried for two days and were ground and sieved to obtain a fine powder. 50 mL each of 65% ethanol was measured using a measuring cylinder and was put into eight different conical flasks, labeled with the eight different food samples. 1 g each of the samples was weighed and added into the eight different conical flasks containing the ethanol, according to its label. Thereafter, the conical flasks were properly covered and placed on an electric shaker and were agitated for one hour, after which they were removed and filtered using filter papers. 5 mL of each of the filtrates were analyzed with GC-MS.

III. RESULTS AND DISCUSSION

Results of the Gas chromatography –Mass spectroscopy (GC-MS) analysis of the eight different food samples (Semolina, wheat flour, wheat grain, and guinea corn, corn grain, corn flour, Samvita and millet grain) are presented in Figures 1 - 4.

The chromatograms for Semolina and Wheat Flour are presented respectively in A and B of Fig. 1 and the concentrations of sugars are shown in Table 1.

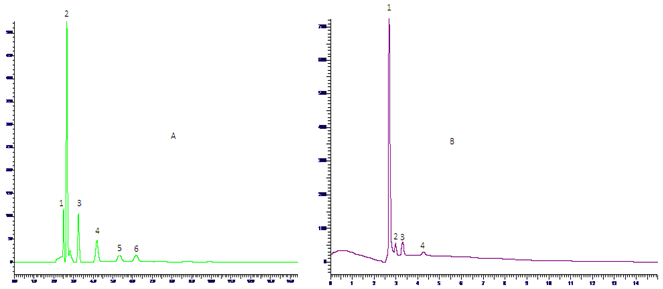

Fig. 1. Chromatogram of sample analysis. A = Semolina, B = Wheat flour.

Table 1 : Concentrations of sugars in semolina and wheat flour

Peak No.	Component Name	Retention Time (min)	Percentage (%)
SEMOLINA			
1	β-Glucose	2.709	0.63
2	Sucrose	2.876	4.92
3	Xylose	2.971	0.21
4	Maltose	3.369	0.92
5	Mannose	4.133	0.55
6	Lactose	5.369	0.36
WHEAT FLOUR			
1	Sucrose	2.875	1.21
2	Xylose	2.974	0.23
3	Maltose	3.374	0.28
4	Mannose	4.135	0.06

Results in Table 1 indicate that the semolina sample consists of; β–Glucose (0.63%), Sucrose (4.92%), Xylose (0.21%), Maltose (0.29%), Mannose (0.55%), Lactose (0.36%), and Maltose (0.07%). Sucrose had the highest percentage (4.92%) of sugar concentration while maltose had the lowest sugar concentration (0.07%). While for the wheat flour, the concentration of sugars consist of; Sucrose (1.21%), Xylose (0.23%), Maltose (0.28%), and mannose (0.06%). The concentration of sucrose (1.21%) was higher than the other varieties of sugars found in wheat flour. Maltose (0.28%), had the least concentration.

The chromatograms for wheat grain and guinea corn are presented respectively in C and D of Fig. 2 and Table 2 shows the concentrations of sugars in the samples.

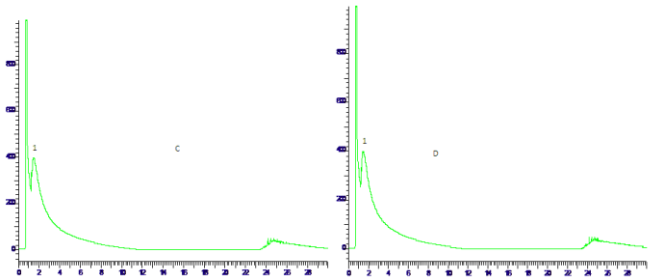

Fig. 2. Chromatogram of sample analysis. C = Wheat grain, D = Guinea corn.

Table 2. Concentrations of sugars in wheat grain and guinea corn

Peak No.	Component Name	Retention time (min)	Percentage (%)
WHEAT GRAIN			
1	Sucrose	24.087	0.23
GUINEA CORN			
1	Sucrose	24.086	0.43

It is shown in Table 2 that, only sucrose was found in both wheat grain and guinea corn with percentage concentrations of 0.23% and 0.43% respectively.

Generally, the trend in the total sugar contents in all the four food samples (Semolina, Wheat flour, Wheat grain and Guinea corn grain) revealed that sucrose is present in all, and with the highest percentage concentration. The above results also show that the concentration of sucrose in the processed form of wheat flour, sold in the market is higher than the grains. The concentration of sucrose in wheat flour was found to be 1.21% and the concentration of sucrose in wheat grain was 0.23%, given us a difference of 0.98%. β–glucose which was found in semolina is a monomer of cellulose (insoluble fibre). Although it does not digest in the body, it helps to keep the digestive system healthy by aiding the growth of gut bacteria which feed on sugars and fibers in foods. These healthy gut florae prevent bad bacteria from proliferating and causing illness.

The chromatograms for corn grain and corn flour are presented respectively in E and F of Fig. 3. Table 3 shows the concentrations of sugars in the corn grain and corn flour.

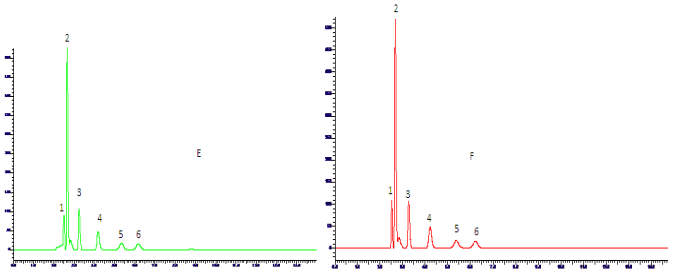

Fig. 3. Chromatogram of sample analysis. E = Corn grain, F = corn flour

Table 3. Concentrations of sugars in corn grain and corn flour

Peak No.	Component Name	Retention time (min)	Percentage (%)
CORN GRAIN			
1	β-Glucose	2.702	0.71
2	Sucrose	2.881	4.80
3	Xylose	2.974	0.18
4	Maltose	3.370	0.93
5	Mannose	4.133	0.53
6	Lactose	5.368	0.35
CORN FLOUR			
1	β-Glucose	2.705	0.83
2	Sucrose	2.807	4.93
3	Xylose	2.968	0.29
4	Maltose	3.369	1.06
5	Mannose	4.123	0.43
6	Lactose	5.367	0.31

Table 3 shows that the corn grain contained six sugars: glucose, sucrose, xylose, maltose, mannose and lactose with percentage

concentrations of 0.71%, 4.80%, 0.18%, 0.93%, 0.53% and 0.35% in that order. The component with the highest percentage (4.80%) was sucrose while the component with the least percentage (0.18%) was xylose.

In the corn flour also, six components were detected as shown in Table 3, which included; glucose, sucrose, xylose, maltose, mannose and lactose. The percentage concentrations of the component detected were; glucose (0.83%), sucrose (4.93%), xylose (0.29%), maltose (1.06%), mannose (0.43%) and lactose (0.31%). In the corn flour sample, the component with the highest concentration (4.93%) was for sucrose while xylose had the lowest concentration (0.29%).

The chromatograms for Samvita and Millet grains are presented respectively in G and H of Fig. 4 and the concentrations of sugars in the samples are presented in Table 4.

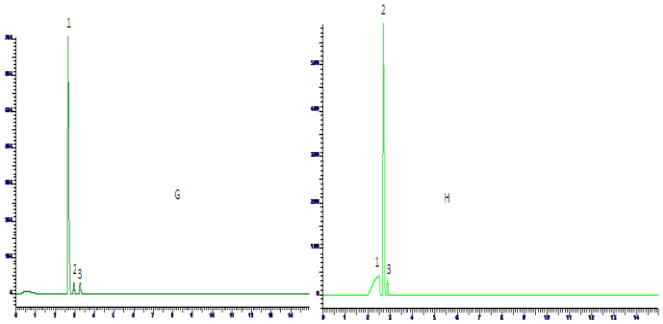

Fig. 4. Chromatogram of sample analysis. G = Samvita, H = Millet grain

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Table 4. Concentrations of sugars in Samvita and Millet Grain

Peak No.	Component Name	Retention time (min)	Percentage (%)
SAMVITA			
1	β-Glucose	2.875	0.14
2	Sucrose	2.973	1.15
3	Maltose	3.367	0.05
MILLET GRAIN			
1	β-Glucose	2.699	0.08
2	Sucrose	2.855	1.39
3	Maltose	2.964	0.04

Results in Table 4 indicate that, three sugar components were detected for Samvita and millet grain. The percentage concentrations of the sugars were; glucose (0.14), sucrose (1.15) and maltose (0.05) for Samvita while for millet grains the percentage concentrations were; glucose (0.08), sucrose (1.39) and maltose (0.04). The results indicate that for both samples (Samvita and millet grains), sucrose has the highest percentage concentration while maltose has the lowest concentration.

IV.CONCLUSION

The research has shown that there are variabilities of glucose occurrence in the eight food samples under investigation. Corn flour has the highest percentage concentration of β –glucose while wheat flour, wheat grain, and guinea corn do not contain glucose. Corn flour also contained the highest concentration of sucrose which was closely followed by semolina.

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