Investigation of the Nutritional Values in Three Brands of Cookies

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***Abstract*: Cookies are convenient food products. They are usually sweet and often baked prepared from flour, sugar, baking powder, egg and some type of oil or fat. In this research paper, the nutritional values of cookies samples (I, II, and III) were analyzed. They were purchased from local super market at Mandalay, Myanmar. The pH, fat, protein carbohydrate, starch, sugar and elemental composition of these cookies were determined by some sophisticated methods. The ash and moisture contents were also determined. The crude fat content of samples was examined with soxhlet extraction method. The protein content was determined using Kjeldahl's analyzer. The total carbohydrate content was determined by phenol-sulphuric acid method. The starch content in samples were determined by sodium hydroxide solution method. Sugar contents in samples were determined by iodometric titration method. The elemental compositions of samples were also determined by EDXRF (Energy Dispersive X-ray Fluorescence) spectroscopy. The experimental data from this research indicated that cookie samples (I, II and III) in Myanmar local market contain suitable nutritional composition.**

Keywords: cookies, nutritional value, sophisticated methods, local market

I. Introduction

Food is one of the essential of human and different sources of food are cereals, fruits, meat, vegetable, milk and milk product [8]. Wheat has an important as a staple food of the people in this world. Every food can be described "functional" as they supply macro and micro components, proteins and vitamins. Cookies are the most popular variety of wheat widely consumed in Myanmar. Cookie are produced from wheat. The production of cookie starts with dough. Biscuits type cookie are cereal based, and have high sugar and fat levels. The ingredients in cookies recipe have been carefully balanced to result in a quality product. Cookies are good alternatives for any other unhealthy snack choices. They contain macro nutrients that provide energy for the body like proteins and fats.

Cookies are widely consumed throughout the world. In fact, they represent the largest category of snack foods in most parts of the world. The consumption of cereal based foods like cookies require the development of an adequate substitute for wheat [4]. The substitute should be one that is readily available, cheap and able to replace wheat flour in terms of functionality. Composite flours produced from cereals and legumes have the advantage of improving overall nutrition [5]. Cookie can be a good source of major and trace elements need by humans. These contain proteins, calcium, silicon, sulfur, potassium, fat and sugar. Most foods are considered functional in terms of providing nutrients and energy to sustain daily life, but dietary system that are capable.

II. Materials and Methods

Sample Collection

Three brands of cookie (sample-I, II and III) were purchased from Retail Market, Mandalay Region, Myanmar.

Sample I

Sample II

Sample III

Figure 1. Instant Cookie of Sample (I, II and III)

Determination of pH

The pH of sample was determined by pH meter (Official Methods of Analysis (OMA), 16th edition, 1999).

Determination of Ash Content

The sample 5 g was weight and placed in preheated, cooled and weighed the crucible. The crucible was heated carefully in the furnace at 550°C for 2 hours burned off without flaming or until all the carbon was eliminated. When the materials are converted to white ash powder. The crucible was coded at room temperature in desiccators and weighed again. To obtain a constant weight, the heating, cooling and weighing were repeated (Official Methods of Analysis (AOAC, 1990, No-942-05).

Determination of Moisture Content

The moisture was determined by oven drying method. 5 g of each sample was placed in pre-weighed porcelain crucible. Then it was kept in an oven at 105ºC for 4 hours. It was cooled in desiccators and then weighed again. The process of cooling and weighing were repeated until a constant weight was achieved (Official Methods of Analysis, AOAC, 1990, No-930.15).

Determination of Fat Content

20 g of sample accurately weighed was introduced in a thimble and the bag was then placed in a Soxhlet extractor. Petroleum ether (b.p 40-60°C) 300 mL was poured into the extractor until some of it overflowed into the flask. The flask was heated on a water bath until the oil was previously removed from the sample. A duration of about 4 hours was required for complete extraction. After the extraction, the oil dissolved in the solvent was removed by distillation. The last trace of the solvent was the removed by placing the content in an oven at about 100ºC until the constant weight was obtained. The fat content of samples were calculated (Official Methods of Analysis, AOAC, 1990, No-920.39).

Determination of Protein Content

The protein content of each sample was determined by using Kjedahl's Method (Official Methods of Analysis, AOAC, 1988, No-988.05).

(a) Digestion

1 g of sample (finely ground) was weighed and placed in the Kjeldahl's digesting flask. 5 g of potassium sulphate, 0.5 g of anhydrous copper II sulphate and 12.5 mL of 98% sulphuric acid were added into it in such a way as to wash down any solid adhering to the neck. The flask was shaken until the contents were thoroughly mixed and it was heated till the mixture became colourless.

The digestion was continued for half an hour to make sure that all nitrogen in the sample was converted to ammonium sulphate. It was allowed to cool and 10 ml of distilled water was carefully added with frequent shaking.

(b) Distillation

The Kjeldahl's distillation apparatus was set up, taking come that the tip of the condenser extended below the surface of the standard boric acid solution 50 mL in the receiver. The digested solution was poured into the flask together with 100 mL of 40% sodium hydroxide to make mixture strongly alkaline. The evolved ammonia was distilled off.

(c) Titration

The distillate was titrated with 0.1M hydrochloric acid solution, using methyl oranges as an indicator. A blank determination was carried out without sample using all the reagents as in the case of sample.

The nitrogen content of sample can be calculated by using following formula :

$$\text{Nitrogen (\%)} = \frac{(V_S - V_B) \times M \times 14.01}{W \times 10}$$

Where, V_S = the volume of acid used in the test

V_B = the volume of acid used in the blank

M = the concentration of acid used

14.01 = atomic weight of N

W = the weight of sample,

10 = Factor to convert mg/g to %

F = Factor to convert N to protein

Protein (%) = Nitrogen × 6.25

Where, 6.25 = a factor of protein – Nitrogen conversion

Sugar Contents in Cookies

Determination of Concentration of Iodine Solution

10 mL of glucose solution was placed in the 150 mL of conical flask. 20 mL of iodine solution and 45 mL of 0.1 M sodium hydroxide solution were added into the flask, closed the flask and left the flask in the dark place for 30 minutes. 6 mL of 1 M hydrochloric acid solution was added to mixture. The mixture solution was titrated with 0.05 M sodium thiosulphate solution. When the liquid become straw color, 1 mL of starch indicator was added. The solution became dark blue again and 0.05 M sodium thiosulphate solution was added until the colorless solution was reached and end point was obtained. For the experimental data, the concentration of iodine solution can be calculated.

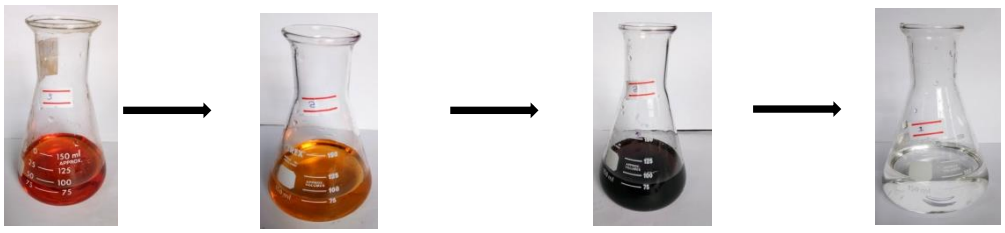

Figure 2. Determination of Iodine Concentration

Determination of Sugar Contents

The reducing sugar content of each sample was determined by Iodometric Titration Using Sodium Hydroxide (Pandey O.P., *et al.*, 1972).

Dry sample 10 g was boiled with distilled water 100 mL and filtered through a piece of white cloth after cooling. The volume of the filtrate was made up to 250 mL in a volumetric flask with distilled water. The solution is called stock solution. The stock solution (12.5 mL) was taken and purified by adding a mixture of 10 mL of 5% $ZnSO_4$ and 10 mL of 5% $Ba(OH)_2$ to the solution. Then the solution was filtered and the filtrate was made to 100 mL with distilled water in a volumetric flask to obtain purified sugar solution.

10 mL of purified sugar solution was placed in the 150 mL of comical flask. 20 mL of iodine solution and 45 mL of 0.1 M sodium hydroxide solution were added into the flask and closed the flask and left the flask in the dark place for 30 minutes. 6 mL of 1 M hydrochloric acid solution was added to mixture in the flask. The mixture solution was titrated 0.05 M sodium thiosulphate solution in the burette. When the liquid become straw color, 1 mL of starch indicator was added. The solution became dark blue again and 0.05 M sodium thiosulphate solution was added until the colorless solution was reached and end point was obtained. From the experiment data, the concentration of iodine solution can be calculated.

Determination of Water-soluble Carbohydrate Contents

The water soluble carbohydrate content was determined by phenol-sulphuric acid colourimeric method in terms of glucose (Carbohydrate Analysis, James N. BeMiller, AACC, 2007).

Preparation of Sample Solution

0.1g of sample powder was dissolved in 100 mL of distilled water and heated for ten minutes. 1 mL of this solution was then diluted to 10 mL with water and this solution was taken as the sample extract.

Preparation of Standard Sugar Solution

100 mg (0.1g) of hydrated glucose was exactly weighted and dissolved in 100 mL of distilled water. 1, 2, 4, 6, 8 and 10 mL of these solutions were drawn out and put in each 100 mL volumetric flask and dilute to the mark with distilled water. These solutions contained 10, 20, 40, 60, 80 and 100 µg of glucose per ml respectively.

1 mL of sample solution and six standard sugar solution containing 10, 20, 40, 60, 80 and 100 µg of glucose per mL were put in each test tube. 1mL of 5% phenol solution was added to each test tube and mixed. A blank also prepared with 1 mL of distilled water instead of sugar solution. 5 mL of 96% sulphuric acid was again added to each tube so that the stream hit the liquid surface directly to procedure good mixing. Each test tube was agitated during the addition of acid.

After ten minutes, the tube were shaken and placed in water bath at 25-30ºC for twenty minutes. The yellow orange colour was stable for several hours. Absorbance were measured at 490 nm using UV-visible spectrophotometer.

A standard curve was plotted by the absorbance of the standard solution against the concentration in µg per mL. Using this standard curves the concentration of glucose in the sample was calculated.

Determination of Starch Content

The starch content of each sample was determined by (Salwa M *et al.*, 2010).

In this research, starch was isolated from cookie sample by using

(i) distilled water

(ii) various concentration of sodium hydroxide solution

(5.0 g) of powder sample and 25 mL of 0.04 M sodium hydroxide solution were introduced into a conical flask. It was stirred from 30 minutes at a rate of 600 rpm at room temperature. It was allowed to stand for 30 minutes and filtered by using double layer cotton cloth. The residue was washed with distilled water until the filtrate was neutral. Then the residue was dried in air and the dried sample was ground to obtain the starch powder. The weight of extracted starch was determined.

Determination of Mineral Content

The mineral contents of samples were measured by applying EDXRF (Energy Dispersive X-ray Fluorescence) Spectroscopy.

III. Results and Discussion

Nutritional Composition of Samples I, II and III

Table (1) Results for Nutritional Composition of Samples I, II and III

Nutritional Parameters	Sample-I		Sample-II		Sample-III	
pH	6.3	6.3±0.26	6.6	6.5±0.31	6.7	6.6±0.31
	6.4		6.5		6.6	
	6.3		6.6		6.7	
Ash (%)	4.4	4.3±0.31	4.0	4.0±0.31	4.6	4.5±0.07
	4.3		4.1		4.5	
	4.4		4.1		4.5	
Moisture (%)	5.37	5.37±0.01	6.31	6.30±0.01	5.75	5.75±0.01
	5.38		6.30		5.76	
	5.38		6.31		5.75	
Fat (%)	29.7	29.7±0.07	30.3	30.3±0.01	29.1	29.1±0.01
	29.8		30.4		29.2	
	29.7		30.4		29.2	
Protein (%)	7.1	7.1±0.07	7.3	7.2±0.07	7.2	7.1±0.1
	7.2		7.2		7.1	
	7.1		7.2		7.2	
Reducing Sugar (%)	22.0	21.9±0.15	24.0	23.9±0.15	26.0	25.8±0.07
	21.9		23.9		25.8	
	21.7		23.7		25.7	
Carbohydrate (%)	35.1	35.1±0.2	31.9	31.8±0.1	28.7	28.7±0.2
	35.2		31.8		28.8	
	35.1		31.9		28.7	
Starch (%)	32.0	32.1±0.1	30.0	30.1±0.1	29.0	29.1±0.1
	32.1		30.1		29.1	
	32.2		30.2		29.2	

Determine of Water Soluble Carbohydrate Contents of Samples

Table (2) Results for Absorbance of Standard Glucose Solutions

No	Concentration of Glucose (mg/ml)	Absorbance at 490nm
1.	10	0.045
2.	20	0.096
3.	40	0.21
4.	60	0.312
5.	80	0.404
6.	100	0.503

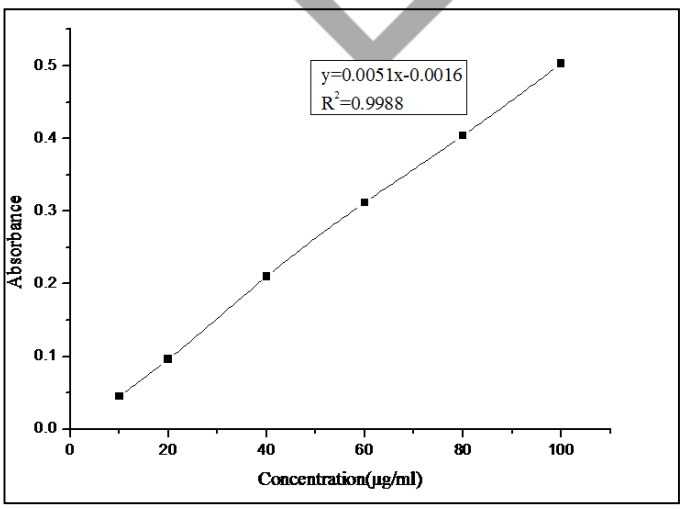

Figure (3) Standard Calibration Curve for Glucose

Comparison of Relative Abundance of Elemental Contents in Sample I, II and III

Table (3) Result for Comparison of Relative Abundance of Elemental Contents in Sample I, II and III

Mineral	Si (%)	P (%)	S (%)	K (%)	Ca (%)	Fe (%)	Ti (%)	Cu (%)	Zn (%)
Sample I	0.106	0.105	0.094	0.067	0.028	0.002	0.001	0.001	0.001
Sample II	0.110	0.097	0.079	0.013	0.001	0.001	ND	ND	ND
Sample III	0.113	0.059	0.057	0.016	0.001	0.001	ND	ND	ND

According to these results, the sample contained the significant amount of silicon, phosphorus, sulfur, potassium and calcium, than the others. The presence of heavy toxic metals was not detected. Based on the aspect of heavy toxic metals, eating cookie is safe for human health.

IV. CONCLUSION

Cookies are popular instant food product. In this paper, the sample cookies were purchased from retail Market, Mandalay Region, Myanmar. The pH of sample I was found to be 6.3, the sample II would have 6.5 and the sample III would have 6.6. This values indicated that the sample was within acidic pH range. Low pH in acidic range may be an indication of good shelf-life.

The moisture contents of samples were found to be 5.37% in sample I, 6.30% in sample II and 5.75% in sample III. The ash contents of sample I was found to be 4.3% in sample I, 4.0% in sample II and 4.5% in sample III.

According to the results of table 3, the mineral contents of silicon, sulfur, phosphorus, potassium and calcium were observed in the samples. The higher value of silicon and phosphorus could be observed. They were important factor in maintaining physiological processes.

In addition, the amounts of protein in samples were found to be 7.1% in sample I, 7.2% in sample II and 7.1% in sample III. The sample II contained higher protein than sample I and III. The sugar content in sample were found to be 21.9% in sample I, 23.9% in sample II and 25.8% in sample III. The fat content in sample I 29.7%, 30.3% in sample II and 29.1% in sample III. The carbohydrate were found to be 35.1% in sample I, 31.8% in sample II and 28.7% in sample III. The starch were found to be 32.1% in sample I, 30.1% in sample II and 29.1% in sample III. These combinations also improved the physicochemical properties of cookies. The results of this study suggested that cookies were valuable for nutrition of human.

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