Mineral Content in Different Banana Varieties of Bangladesh

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Abstract

Seven varieties comprising twenty-five sub-varieties of banana of Bangladesh have been analyzed for their minerals contents. The samples were procured from farmer's field and from the major local wholesale markets where bananas from different part of the country are brought for sale. Mineral profile was estimated by atomic absorption flame emission spectrophotometric method. Result was analyzed by SPSS program and values were expressed as mean±SE in mg/100gm fresh banana. Calcium content in bananas ranged from 0.87 to 7.38 mg per 100gm edible were portion (EP). Phosphorus and magnesium content found to be relatively high and ranged between 20.17 to 100.93 mg and were 13 to 41.71mg per 100gm EP. Zinc and sodium content of banana were found to be relatively low and ranged 0.01 to 0.58 mg and 0.07 to 3.59 mg per 100 gm EP respectively. Banana contains a fairly good amount of magnesiun and phosphorus and low amount of zinc and sodium.

Key words : Bananas, Essential Minerals, Calcium, Magnesium, Phosphorus, Zinc, Sodium, Potassium.

Introduction

Fruit is a convenient source of food contributing to a balance diet. Banana is one of the most important fruit in Bangladesh[1]. When grown on a commercial basis, banana is one of the most profitable crop in Bangladesh. It can easily be cultivated through out the year and has a comparatively cheap market value, making it affordable for all economic level of people. Statistical report notes that the production of banana is higher than any other fruit in our country. Bananas contain appreciable amount of essential minerals[2,3] that are essential for normal functioning of human body, each of which has a specific role to play. Mineral deficiency does not occur in normal person eating a variety of the traditional foods. Potassium is plentiful in bananas. Potassium deficiency may occur in diarrhea and vomiting. PEM may also lead to potassium deficiency. Bananas are generally low in sodium.

To develop a food composition table for Bangladesh, a mumber of food staffs has been analysed, but data on essential mineral contents are quite scarce. The present study is an attempt to fill this data gap and accordingly the study concerns with the analysis of essential minerals in bananas of Bangladesh. The minerals that have been

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prioritized in the present study are calcium, magnesium, phosphorus, zinc, sodium and potassium.

Materials and Method

Collection of bananas : Twenty five different bananas were collected from different markets of Dhaka city that were brought from different districts of Bangladesh. Whole bananas were thoroughly washed with deionized water. Edible portion (EP) were separated carefully and used for analysis. Analyses were done in triplicate and the results are presented on a fresh weight basis.

Analytical technique

Adequate precaution was adopted to avoid contamination of minerals from glassware and reagent used for analysis. One gm of sample was wet ashed using a mixture of 18M sulfuric acid, 12M per choleric acid and 16M nitric acid (0.5: 1.0: 0.5 by vol.). After required dilution, the concentration of Ca, Mg, Zn were determined by measuring atomic absorption while sodium and potassium were determined by measuring atomic emission. Dilution was done with 0.4% lanthanum (w/w) to overcome ionic interference during the estimation of calcium and magnesium. Estimation of phosphorus was done by coloromelric method.

Results

Table 1 shows Ca, Mg, P content in bananas. Calcium present in different banana varieties ranged from 0.88 to7.38gm /100gm EP). Calcium content was low (0.88 mg/100 gm EP) for Malvogue kala and high (7.38 mg/100 gm EP) for Buita kala. Magnesium present in different varieties ranged from 8.48 gm to 41.70 gm per 100 gm EP. It was low (8.48 gm /100 gm EP) for Malvogue kala and high (41.70 gm/100 gm EP) for Meher sagar. Phosphorus content in different banana varieties ranged 20.17 mg to 100.93 mg per 100 gm EP.

Table 1 : Ca, Mg and P contents in different varieties of bananas

Bengali Name of Main varieties	Scientific Name	Bengali Name of Sub-varieties	Ca	Mg	P
Sagar Kala	Musa acuminate	Sagar Amrito Sagar Kala	1.48 ±0.18	23.01 ±0.69	48.46±0.95
		Rangin Sagar Kala	1.69±0.05	17.48±2.41	55.34±1.58
		Agnisor	2.99±0.14	37.40±0.41	55.52±0.71
		Meher Sagar	4.07±0.32	41.71±0.83	66.43±0.00
Singapori Nepali Sager kala	Musa cavandishi	Nepali Sagar kala	1.61±0.03	17.67±0.83	34.88±0.68
		Gomenath	2.56±0.18	24.90±0.73	43.53±0.60
Sabri Kala	Musa sapientum	Sabri kala	1.55±0.17	19.43±0.45	48.99±0.60
Champa Kala	Musa sapientum	Champa kala	1.25±0.38	17.68±0.53	22.20±0.96
		Chini champa kala	0.87±0.07	14.95±0.39	20.17±0.78
Kacha Kala	Musa parodisicaca	Kacha kala big Anagi kala	2.62±0.26	17.94±0.55	76.21±0.8
		Kacha kala small Risha kala	1.23±0.06	10.13±0.17	55.92±1.17
Kobri Kathali kala	Musa SP	Kobri kala	1.42±0.05	20.61±067	26.84±1.47
		Ghera kala	1.31±0.06	18.57±0.20	80.25±0.61
		Modon morali kala	1.53±0.03	20.45±0.89	82.47±0.86
		Malvogue kala	0.88±0.00	8.48±0.27	30.20±1.30
		Dud kathali kala	1.56±0.13	18.84±0.62	23.21±0.21
		Thudi kala	1.75±0.08	26.08±0.33	51.20±1.39
		Baghnoli kala	3.44±0.14	31.73±0.55	57.25±0.66
Bichi kala	Musa balbisiana	Aita Deshal Kala	6.20±0.1	18.54±0.27	71.07±0.71
		Tula bichi kala	3.73±0.28	19.39±064	57.16±1.50
		Buita kala	7.38±0.11	19.36±0.16	66.70±2.35
		Boro bichi kala	7.01±0.17	19.92±0.33	78.14±1.49
		Kylan Jerri kala	2.83±0.09	13.30±0.25	20.93±0.20
		Nielya kala	3.29±0.05	12.86±0.32	3.55±0.44
		Gin kala	2.22±0.01	19.01±0.12	100.93±7.63

Results were expressed as mean ± S.E of triplicate determination and as mg/100 gm EP.

Table 2 Shows Zn, Na and K contents in bananas. Zinc present in bananas ranged between 0.05mg to 0.58 mg per 100gm EP. Sodium ranged from 0.07 mg to 3.54 mg per 100 gm EP. Potassium ranged between 4.94 mg to 28.19 mg per 100gm EP.

Table 2: Zn, Na and K content 3 in different varieties of bananas

Bengali Name of Main varieties	Scientific Name	Bengali Name of Sub-varieties	Zn	Na	K
Sagar Kala	Musa acuminate	Sagar Amrito Sagar Kala	0.21 ±0.04	1.18 ±0.027	11.08 ±0.00
		Rangin Sagar Kala	0.11 ±0.01	0.18 ±0.00	5.43 ±0.00
		Agnisor	0.35 ±0.00	1.22 ±0.12	18.83 ±0.00
		Meher Sagar	0.08 ±0.00	1.17 ±0.38	28.19 ±0.00
Singapori Nepali Sager kala	Musa cavandishi	Nepali Sagar kala	0.58 ±0.02	0.78 ±0.04	8.94 ±0.00
		Gomenath	0.39 ±0.04	1.46 ±0.23	12.57±0.00
Sabri Kala	Musa sapientum	Sabri kala	0.15 ±0.00	1.33 ±0.42	9.76±0.00
Champa Kala	Musa sapientum	Champa kala	0.37 ±0.08	1.18 ±0.08	7.83±0.00
		Chini champa kala	0.21 ±0.04	0.98 ±0.08	7.12±0.00
Kacha Kala	Musa parodisicaca	Kacha kala big Anagi kala	0.18 ±0.01	0.11 ±0.09	8.91±0.00
		Kacha kala small Risha kala	0.05 ±0.00	0.07 ±0.00	6.96±0.00
Kobri Kathali kala	Musa SPP	Kobri kala	0.17 ±0.03	1.12 ±0.34	11.48±0.00
		Ghera kala	0.12 ±0.01	0.88 ±0.03	8.80±0.00
		Modon morali kala	0.09 ±0.01	0.27 ±0.12	13.12±0.00
		Malvogue kala	0.01 ±0.00	0.48 ±0.08	4.94±0.00
		Dud kathali kala	0.15 ±0.02	0.52 ±0.06	10.45±0.00
		Thudi kala	0.11 ±0.03	0.40 ±0.10	16.77±0.00
		Baghnoli kala	0.13 ±0.02	1.38 ±0.37	19.77±0.00
Bichi kala	Musa balbisiana	Aita Deshal Kala	0.30 ±0.02	3.59 ±0.03	7.60±0.00
		Tula bichi kala	0.44 ±0.07	1.28 ±0.12	9.16±0.00
		Buita kala	0.32 ±0.00	0.42 ±0.10	7.76±0.00
		Boro bichi kala	0.32 ±0.00	0.96 ±0.05	7.45±0.00
		Kylan Jerri kala	0.10 ±0.00	0.44 ±0.11	6.68±0.00
		Nielya kala	0.14 ±0.01	0.27 ±0.07	5.05±0.00
		Gin kala	0.26 ±0.05	0.28 ±0.03	13.54±0.00

Results were expressed as mean ± SE of triplicate determination and as mg/100 gm EP.

Discussion

This study shows that banana contains a very good amount of minerals. Values are in close agreement as reported elsewhere[3,4]. Since bananas are rich in proximate nutrients, it would be an ideal food for the maintenaee of heath.

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Evaluation of Nutritive Values of Different Diabetic Diet Chart Using in BIRDEM Hospital

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Abstract

Determination of nutrient values of different food materials is very important to design a healthy diet. This is specially relevant for nutrition related diseases like diabetes and hypertension. Nutritive values of foods change in different geographical and environmental conditions and in different agricultural practices. In developed countries extensive research works have been carried out to find the nutritive values of local food items. But it is lacking in Bangladesh. In the present study analysis of nutritive values of certain food items, which were suggested to the diabetic patients through different diet charts in the BIRDEM Hospital, was done by some relevant methods.

Proximate (moisture, ash, fat, protein) analysis was done by conventional method followed by AOAC International. Calcium, potassium, sodium, phosphorus, magnesium, manganese, iron, copper and zinc analysis was performed by atomic absorption spectrophotometric method and phosphorus was done by UV-visible spectrophotometric method. In some cases duplicate analysis was performed.

When a 1000 kcal diet of BIRDEM was recalculated using the values of food conversion tables, it showed a value of 1174 kcal. Calculation of the same diet by the observed values showed almost similar level of energy (1195 kcal). Thus by this diet around 19% excess calorie is provided to the diabetic patients which, on consumption over a long period, may lead to substantially high energy intake from excess carbohydrate and thereby uncontrolled diabetes. Similar differences in calorie values were found in the remaining 9 diet charts. Considering the nutrient content based on proper analysis, it is, therefore, necessary to modify the diet charts being provided to diabetic patients.

Key words : Diabetes mellitus, Nutritive value, Diet.

Introduction

Life can not be sustained without adequate nourishment. Adequate food is required for growth and development and for an active and healthy life. Consumption of all the nutrients in appropriate amount is needed daily and hence in planning a diet care

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is to be taken in selecting proper amount of foods to get all the nutrients in required amount, keeping in view the dietary habit and availability.[1] Intake of inadequate and imbalanced diet over an extended period of time may lead to malnutrition and infectious diseases. Thus nutrient content of specified food materials is essential for planning balanced diets. Over consumption of one or more nutrients such as calorie, protein, fat may lead to obesity and obesity, in turn, may lead to chronic diseases like diabetes mellitus. Therefore, diet related disease exerets deleterious influence on health, longevity and economy of the family or the community at large. For the management of most of the diseases, diet should be nutritionally proper and balanced especially for diabetic patients who suffer from metabolic disorders due to a mismatch between energy supply and insulin secretion. Since this disease is a life long abnormal condition, diet is specifically important for leading normal life. Thus dietary modification remains the key to the management of diabetes. In all diabetic patients the type and quality of nutrients should be matched to the availability of insulin. Dietary carbohydrates are commonly categorized as simple sugars and complex carbohydrates. These terms are imprecise and confusing, and their use should be abandoned. Instead, dietary carbohydrates should be referred to as monosaccharides, disaccharides, polysaccharides. Collectively, the mono and disaccharides may be referred to as sugars, while polysaccharides should be referred to as starch. A further refinement in terminology would be to refer to food fiber as non-starch polysaccharides.[2]

When a diabetic patient fails to maintain his or her blood sugar to a recommended level, complication of diabetes increases day by day. The effect may not be apparent before 5 to 10 years. Since majority of patients do not have a clear conception regarding diet, they eventually fail to control diabetes. To control diabetes mellitus one must have clear conception about caloric and nutritive value of different foods. This study will focus on the appropriate dietary calculation as it is necessary to control and maintain diabetes for the wellbeing of the diabetic patients.

Materials and Methods

Study Design:

Food samples were selected from different group of foods which diabetic people consume regularly. Those vegetables, fruits, cereals, fishes, meats, and eggs were selected on the basis of availability in market all the year round.

Sample analysis

Moisture, ash, fibre, protein and fat were analyzed by conventional and AOAC International[3] methods. Macro-minerals (calcium, magnesium, sodium, potassium, phosphorus), micro-minerals (iron, copper, zinc, manganese) were analyzed by

Atomic absorption spectrophotometric method and UV-visible spectrophotometric method.

Dietary calculation

The diet charts presented in the diabetic guide book of Diabetic association is used for the calculation of prescribed diabetic diet.[4] Nutritive values of these diet charts were calculated based on raw weight of the food items. By using food conversion table[5] and nutritive values of local food items published by the Institute of Nutrition and Food Science, Dhaka University[6], nutritive values of raw weight of individual food items of the diet chart were calculated. Secondly, nutritive values of the same diets charts were also calculated using the observed value as found by present chemical analysis of the same food items, and termed as observed values. All these values were then compared and presented.

Results

Presecribed calorie value of diet chart-1 was 1000 kcal, whereas calculated value of the same diet was 1174 kcal and observed value was 1195 kcal. The difference between prescribed value and calculated value was 174 kcal, and between prescribed value and observed value was 195 kcal. That is calculated value was 17% and observed value was 19% more respectively than prescribed value (Table-1). Prescribed calorie value of diet chart-10 was 2800 kcal, whereas calculated value of the same diet was 3103 kcal and observed value was 3162 kcal. The difference between prescribed value and calculated value was 303 kcal, and between prescribed value and observed value was 362 kcal. That is calculated value was 11% and observed value was 13% more respectively than prescribed value (Table-1). Similar differences in calorie values of the remaining 9 diet charts were observed with highest differences of 24 & 22 per cent respectively in case of diet chart-4.

Table-2 shows the comparison among prescribed, calculated and observed nutrient values of different diet charts. It shows that in diet chart-1 total presecribed carbohydrate value was 150 gm and the observed value was 178.1 gm, with a difference of 28.1 gm. Total prescribed fat value was 27.7 gm and the observed value was 29.5 gm, with a difference of 1.8 gm. Total prescribed protein value was 37.5 gm and the observed value was 53.9 gm, with a difference of 16.4 gm (Table-2).

The energy contents from carbohydrate, protein, and fat of the same diet according to prescribed value were 60%, 15% and 24.9% respectively. The corresponding figures according to calculated value were 59.7%, 18.5%, and 21.0% respectively, while those according to observed value were 59.7%, 18.1% and 22.3% respectively (Table-2).

Table 1: Difference of calorie between prescribed, calculated, and observed value of different diet charts.

List of Diet Charts	Prescribed value by BIRDEM	[a]Calculated value	[b]Observed value	Difference between prescribed value & calculated value	Difference between prescribed value & observed value	% of difference between prescribed value & calculated value	% of difference between prescribed value & observed value
Diet chart-1	1000	1174	1195	174	195	17	19
Diet chart-2	1200	1451	1445	251	245	21	20
Diet chart-3	1400	1706	1648	306	284	22	20
Diet chart-4	1600	1990	1955	390	355	24	22
Diet chart-5	1800	2153	2167	353	367	20	20
Diet chart-6	2000	2286	2297	286	297	14	15
Diet chart-7	2200	2531	2514	331	314	15	14
Diet chart-8	2400	2629	2636	229	236	10	10
Diet chart-9	2600	3090	3053	490	453	19	17
Diet chart-10	2800	3103	3162	303	362	11	13

a: based on values of food conversion table

b: Based on values found in the present study

Table-2: Comparison among prescribed, calculated and observed nutrient values (CHO, protein & fat) of the diet charts

List of Diet charts	Prescribed value			Calculated value			Observed value		
	CHO	Protein	Fat	CHO	Protein	Fat	CHO	Protein	Fat
Diet-1	150	37.5	27.7	175.4	54.3	27.4	178.1	53.9	29.5
	(60)	(15)	(25)	(60)	(18)	(21)	(60)	(18)	(22)
Diet-2	180	45	33.3	214.8	59.6	37.6	215.0	56.8	40.3
	(60)	(15)	(25)	(59)	(16)	(23)	(59)	(16)	(25)
Diet-3	210	52.5	38.9	239.5	64.5	52.7	243.0	65.6	50.1
	(60)	(15)	(25)	(56)	(15)	(28)	(58)	(16)	(27)
Diet-4	240	60	44.4	267.0	80.9	64.8	270.3	79.5	62.5
	(60)	(15)	(25)	(53.6)	(16.3)	(29.3)	(55.3)	(16.3)	(28.8)
Diet-5	270	67.5	50	308.3	82.6	63.3	308.0	82.6	65.4
	(60)	(15)	(25)	(57.2)	(15.4)	(26.5)	(57.4)	(15.4)	(27.5)
Diet-6	300	75	55.5	339.6	89.0	60.9	341.8	90.4	63.0
	(60)	(15)	(25)	(59.4)	(15.6)	(24)	(59.6)	(15.6)	(24.7)
Diet-7	330	82.5	61.1	364.5	82.4	76.3	375.8	92.0	71.4
	(60)	(15)	(25)	(57.6)	(13.1)	(27.2)	(59.8)	(14.7)	(25.6)
Diet-8	360	90	66.6	401.9	96.6	67.0	409.2	98.6	67.1
	(60)	(15)	(25)	(61.2)	(14.7)	(23)	(62.1)	(15)	(23)
Diet-9	390	97.5	72.2	423.5	116.5	99.6	420.2	120.7	122.7
	(60)	(15)	(25)	(54.9)	(15.1)	(29)	(55.1)	(16)	(29.1)
Diet-10	420	105	77.7	469.3	118.1	79.8	480.1	122.4	83.7
	(60)	(15)	(25)	(60.5)	(15.2)	(23.2)	(60.7)	(15.5)	(23.9)

* (Figures in the parenthess indicate percentage)

Discussion

Development of human body in all respects depends upon balanced food intake. The requirement of food at various stages of life is different. It also differs again when the same person suffers from any disease, because the disease may result from excess or lack of food intake and as such sometimes modification or exchange of food is also needed.

The percentage of energy content from carbohydrate, protein and fat from all diet charts are almost similar in prescribed, observed and calculated values. But total calorie contents of ten different diets are dissimilar in prescribed, observed and calculated values. As for example in diet-1 the prescribed value is 1000 kcal, whereas the calculated and observed values are 1174 and 1195 kcal respectively. It is observed that difference between prescribed and calculated values is 174 kcal, that means 19% more calories than prescribed value, while the difference between prescribed and observed values is 195 kcal, that means 19% more calorie than prescribed value. These excess calories are obtained mainly from carbohydrate and to some extent from protein.

Carbohydrate should provide 50-55% of dietary energy. But all the ten diet charts provide almost 60% of its total calorie contents from carbohydrate. High carbohydrate diets increases blood glucose and lipid levels. The consumption of foods with a low glycaemic index may help to improve glycaemic control and lipid levels. The intake of dietary fibers, particularly soluble fibers from vegetables, pulses, fruits and some wholegrain cereals, should exceed 30g/day[7]. Culturally we are used to eat more carbohydrate. We need to bring about change in our diet. Starches are rapidly converted into 100% glucose during digestion. If the absorption is not slowed down by intake of less refined and more complex carbohydrate and mixed meal containing more fiber, the glycemic index of the total diet may be high. In contrast, sucrose is metabolized to glucose and fructose. Fructose has lower glycemic index than does glucose, because it has a slower rate of absorption and is stored in the liver as glycogen. As such simple sugars should be avoided. As sugar has one molecule of glucose and a molecule of fructose, its intake may not change blood glucose greatly than starch intake does. More starch intake lead to hyperglycemia and in some cases in long meal time rebound hypoglycemia.

Protein should constitute 10-15% of total energy intake. But protein in all ten diet charts provide almost 15-18% of its total calorie contents. Protein should not be less than 0.6 gm per kg normal body weight per day, because this may lead to malnutrition, but diet high in protein that contribute more than 20% of total energy should be discouraged[7,8], because of chances of high nitrogen retention.

Fat should provide around 30% of total energy intake for person with diabetes.[7] But all the ten diet charts provide almost 25% of its total calorie contents from fat which is less than the recommended allowance. Saturated fat should account for 10% of

total energy intake, polyunsaturated fat should not exceed 10% and monounsaturated fatty acids should provide >10% of total energy [7,8], but this balance of fat is not maintained in the diet of diabetic patient in Bangladesh. As a result the diabetic do have more microvascular complications like retinopathy, nephropathy, heart attack and stroke. So proper diet for a Bangladeshi diabetic is yet to be developed and prescribed scientifically. The study concluded that less cereals and more vegetables and cooking oils should be prescribed along with invisible fat. This will make the diet palatable and it will be able to control sugar and blood lipids to give full normal life despite of diabetes. Thus around 22% more calorie is provided to the diabetic patients and the prescribed amount of carbohydrate in the Diabetic Guide Book is 240g and calculated and observed values are 266.96g and 270.33g (Table-2). Comparatively the observed and calculated values contain more carbohydrates which, on consumption over a long period, may lead to substantially high energy intake thereby uncontrolled diabetes. The diet list 1 to 9 should be reorganized by increasing complex carbohydrate and calcium containing food using exchange diet list. Similarly food containing more potassium should be exchanged, so that diabetic patients are safe from neuropathy.

This may partly be explained by the difference between the nutritional values of the same food item appeared in the Diabetic Guide Book and the prescribed values did not tally with the present study and perhaps foods are being eaten by many diabetic patients and their blood glucose is not controlled.

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