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Determination of Estimation of Potassium Ion in Dry Fruits by Flame Photometry and Their Proximate Analysis

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ABSTRACT

Studies were carried out on dry fruits Almond, Cashewnut, Pepper, Pistachious, Drydates, Raisin(black), Raisin(common), Amla, Acrota, Apricot to determine the Potassium ion concentration in them. Chemical analysis of the extracts of the fruits revealed that moisture was 4.2% in pepper, to 22.7% in raisin black. The ash value ranged from 1.80% in acrota to 4.05% in apricot, while dry matter ranged from 77.3% in raisin black to 95.8% in Pepper. Fruits with low moisture content could store for longer time without spoilage. Potassium was found to be the most abundant with a level as high as 125.1 mg/100g in apricot and as low as 21.84 mg/100g in Chinese beans. The results showed that the fruits have safe and adequate dietary nutrients if consumed in right proportion. Present work to determine Potassium is based on flame photometry and it is very simple, inexpensive and less time consuming. This method is properly validated using standard chemicals and it can be applied to formulation.

Key words: Fruits, Potassium, Flame photometry, Dry fruits, Dry matter.

INTRODUCTION

Fruits are generally acceptable as good source of nutrient and supplement for food in a world faced with problem of food scarcity. They are known to be excellent source of nutrients such as minerals and vitamins [1]. Mineral ions are of prime importance in determining the fruit nutritional value. Potassium, calcium and magnesium are the major ones. In the tissue of many fruits, calcium is one of the mineral believed to be an important factor governing fruit storage quality [2]. It has been reported to delay ripening and senescence [3] and to reduce storage disorder [4]. The importance of minerals such as potassium, calcium, sodium *etc.* to human health is well known. Required amounts of these elements must be in human diet to pursue good healthy life [5]. The content of mineral elements in plants depends to a high degree on the soils abundance, including the intensity of fertilization [6]. Dry fruits contain substantial quantities of

essential nutrients in a rational proportion. They are excellent source of minerals, vitamins and enzymes. They are easy to digest and clean the blood and the digestive area [7]. Dried fruits retain most of the nutritional value of fresh fruits, and so are included with fresh fruit in dietary recommendations by U. S.[8] and world health agencies. The specific nutrient content of the different dried fruits reflect their fresh counterpart and the processing method (e.g. traditional dried fruits versus sugar infused dried fruit). In general, all dried fruits provide essential nutrients and an array of health protective bioactive ingredients, making them valuable tools to both increase diet quality and help reduce the risk of chronic disease. The combination of nutritional value and enjoyable taste is the reason dried fruits have been popularly considered a healthy food for millennia. Because they are naturally resistant to spoilage, easy to store and transport and relatively low in cost, dried fruits are a convenient way to increase the number of servings of fruit in the diet. One of the most important parts of prevention is good nutrition. Making sure that you regularly consume the standard recommended daily intake levels of the vitamins, mineral and other nutrients your body needs is the first vital step in keeping a healthy physic and mind [13].

But because of today's lifestyle and diet, it is very hard therefore to intake the proper daily amount of potassium necessary for a normal life. For this concern, nutritional supplements are the solution.

Potassium (K) is the major cation found inside of cells [14]. The proper level of Potassium is essential for normal cell function. An abnormal increase of potassium (hyperkalemia) or decrease of potassium (hypokalemia) can profoundly affect the nervous system and heart, and when extreme, can be fatal. The normal blood potassium level is 3.5 - 5.0 millimoles/liter (mmol/l).

Potassium also plays an important role to mental function as well as to physical processes. It helps to promote efficient cognitive functioning by playing a significant role in getting oxygen to the brain [15].

In view of the nutritional and health benefits of dry fruits, their daily need in our diet and the effects of anti nutritional factors, this study was designed to determine the Potassium ion in highly nutritive dry fruits such as almond, cashewnut, pepper, Pistachious, drydates, raisin(black), raisin(common), amla, acrota, apricot by Flame photometry method.

Flame photometry is a highly empirical, rather than an absolute, method of analysis such as gravimetry. That is, we must calibrate the method carefully and frequently. Many different experimental variables affect the intensity of light emitted from the flame and that finding its way to the detector. Therefore, careful and frequent calibration is required for good results.

EXPERIMENTAL SECTION

Sample Preparation:

Eleven dry fruits namely almond, cashewnut, pepper, pistachious, drydates, raisin (black), raisin(common), amla, acrota, apricot and kheerbhez were obtained commercially from market. They were washed with distilled water and external moisture is removed with a dry cloth. The individual fruit was separated, dried in hot air oven at 50^0C for 1 h. The dried samples were then powdered in blander [16] and sieved with a 2 mm rubber and 2 g of each of fruit sample powder was weighed and subjected to dry ashing in a well-cleaned silica crucible at 550^0C in a muffle furnace for about 5 h [17]. The resultant ash was dissolved in 5 mL HNO_3 / HCl / H_2O (1:2:3),

heated gently on a hot plate until brown fumes disappeared. To the remaining residue in each crucible, 5 mL of DIW was added and heated till colorless solution was obtained. The mineral solution in each crucible was transferred into 100 mL volumetric flask by filtration through a Whatman filter paper No. 42 and the volume was made up to the mark with DIW. The solution was used for the determination of potassium by using a flame photometer (Systronic 129) as per AOAC, 1990 procedures.

Proximate composition:

The ash, moisture and dry matter composition of samples were determined using standard methods (AOAC, 1990). Ash content was determined by incineration of 2g of the sample power placed in a muffle furnace maintained at 550^0C for 3 h. the % of residue weighed was expressed as ash content. Moisture was determined by drying 2g sample in an oven at 105^0C for 24h. The difference in weight gave the moisture content. Dry matter was determined as (100 - % of Moisture).

Calculations:

$$\% \text{ of Moisture} = \frac{(b-a)-(c-a)}{(b-a)} \times 100$$

$$\% \text{ of Ash} = \frac{(c-a)}{(b-a)} \times 100$$

a = Empty weight of Glass Petri dish
b = Weight of Petri dish + Sample before Oven drying
c = Weight of Petri dish + Sample before After drying

Measurment procedure:

As per specifications of the flame photometer, pressure on pressure gauage was maintained at 10 lbs/sq.inch(0.7 kgs/cm^2) and samples of dry fruits extracts were analysed for detection of potassium using standard potassium solutions and deionized water as reference as per instrument manual procedure. The instrument gives the concentration of the element in milli equivalent per liter.

The amount of potassium present in terms of mg /100g of dry fruit was calculated.

Calculation:

$$\text{ppm} = \text{m.Eq of } K^+ \text{ ion} \times \text{Atomic weight of potassium}$$

$$\text{mg of ion present in 100 g of dry fruit} = ppm \times 0.1$$

RESULTS AND DISCUSSION

Table 1 gives the results of analysis of proximate composition of different fruits. From table it is evident that the moisture content varied between 4.2% in pepper to 22.7% in raisin black with the mean value of 10.345. The ash value ranged from 1.80 to 4.05% with the mean value of 2.634%, while dry matter ranged from 77.3 to 95.8 with the mean value of 89.864. The ash content and dry matter values were not varied much. The observed values of moisture and dry matter in fruits were found to be similar to those reported [18-20] for cashew nut, apricot and dry dates. Fruits with low moisture content could store for longer time without spoilage. Further, the

fruits may have high nutritive value. Low values of %RSD highlighted the reproducibility of the results.

Analyses can be made far more rapidly by the flame photometer compared to the best gravimetric and volumetric methods. With flame photometry, results can be produced promptly because of the direct analysis which is not possible with chemical methods. While both time and material may be saved by the use of the flame photometer, the responsibility of the operator is in no way reduced.

Once the range has been established and remains stable, it is often possible to take many successive readings which are reproducible and constant over a long period of time. In Table 2, the results of potassium content in standard solution are given. Validation data obtained with standard solutions are shown in Table.3, which demonstrate that the method is suitable for the analysis of potassium in several dry fruit extracts. The reproducibility of the results was evident from low % RSD values.

The applicability of the proposed method was examined by analyzing the content of potassium in different dry fruits and the corresponding results are shown in Table 4. The amounts of potassium in fruits like cashew nut, dry date and apricot were found to agree with of methods [18-20]. Potassium was found to be the most abundant with a level as high as 125.1 mg/100g in apricot and as low as 21.84 mg/100g in Chinese beans.

Table.1: Proximate composition of fruits

S. No.	Fruit Sample	Moisture* (%)	%RSD	Ash*, %	%RSD	Dry matter* (%)	%RSD
1.	Kheer BeeZ (Chinese beans)	7.2	1.65	2.74	1.67	92.8	2.12
2.	Almond	7.4	1.78	2.81	1.98	92.6	2.05
3.	Cashew	6.9	2.05	2.64	1.54	93.1	1.76
4.	Pepper	4.2	2.12	3.51	1.49	95.8	1.98
5.	Pistachious	7.3	2.04	2.78	2.11	92.7	1.58
6.	Dry Dates	9.1	1.99	1.88	1.89	91.9	2.14
7.	Raisin(Black)	22.7	1.64	2.18	2.15	77.3	2.02
8.	Raisin(Common)	21.2	2.15	1.87	2.08	78.8	1.74
9.	Amla	10.7	1.87	2.68	2.03	89.3	1.59
10.	Acrota	4.7	1.66	1.80	1.56	95.3	2.04
11.	Apricot	11.09	1.89	4.05	1.96	88.9	2.13

** Average of 5 determinations*

Table.2: Data for Standard Potassium solution Analysis

S. No.	Potassium (K^+)				
	Standard Solution	Amount Present	Amount* Found	% Found	%RSD
1	20 mg/L	0.512	0.510	99.6	2.16
2	40 mg/L	1.024	1.021	99.7	2.22
3	60 mg/L	1.536	1.528	99.5	2.04
4	80 mg/L	2.048	2.050	100	2.34
5	100 mg/L	2.56	2.54	99.22	1.87

** Average of 5 determinations*

Table.3: Statistical Validation for the analysis of Standard Potassium solution

Component	Mean value*		% RSD*	%Error*
Potassium(K^+)	100.0	99.12	1.48	0.88

* Average of 5 determinations

In order to check the accuracy of the proposed methods, we have also analyzed the samples for potassium content by atomic absorption spectrophotometric method (using GBC-932 Atomic Absorption Spectrophotometer) and the results obtained are shown in Table 5. As evident from Table 5, the results agree favorably. The results are also supported by low RSD values.

Potassium is an essential nutrient used to maintain fluid and electrolyte balance pH regulation in the body and it is also associated with protein and carbohydrate metabolism. A deficiency in potassium causes fatigue, irritability, and hypertension (increased blood pressure). Overdose of potassium from natural sources is nearly impossible, however, it is possible to consume too much potassium via potassium salts which can lead to nausea, vomiting, and even heart attack. The current recommended daily allowance for potassium is a whopping 3.5 grams, below is a list of fruits high in potassium.

Table.4: Potassium content in Dry Fruits

Sl. No.	Fruit Sample	In m. Eq / L	In ppm	mg /100g	%RSD
1.	Kheer BeeZ (Chinese beans)	0.56	21.84	21.84	1.34
2.	Almond	0.77	29.84	29.84	1.67
3.	Cashew	0.78	30.42	30.42	1.47
4.	Pepper	0.88	34.32	34.32	1.98
5.	Pistachious	0.86	33.35	33.35	1.78
6.	Dry Dates	0.57	22.04	22.04	2.03
7.	Raisin(Black)	1.54	59.87	59.87	2.07
8.	Raisin(Common)	1.22	47.39	47.39	2.11
9.	Amla	1.59	62.01	62.01	1.43
10.	Acrota	1.08	42.12	42.12	1.66
11.	Apricot	3.21	125.19	125.19	1.87

** Average of 5 determinations*

Table.5: AAS data of measured Potassium content in Dry Fruits

Sl. No.	**Fruit Sample**	**AAS In µg /ml**	**%RSD**	**Flame Photometry mg /100g**	**%RSD**
1.	Kheer BeeZ (Chinese beans)	20.7	2.15	21.84	2.11
2.	Almond	23.4	2.22	29.84	2.03
3.	Cashew	29.4	2.13	30.42	2.18
4.	Pepper	28.0	2.02	34.32	2.11
5.	Pistachious	35.2	1.87	33.35	2.03
6.	Dry Dates	22.8	1.56	22.04	1.79
7.	Raisin(Black)	62.4	2.01	59.87	1.56
8.	Raisin(Common)	47.6	2.16	47.39	2.03
9.	Amla	69.1	2.11	62.01	2.07
10.	Acrota	43.6	2.04	42.12	1.69
11.	Apricot	126.0	2.14	125.19	1.94

Average of 5 determinations

CONCLUSION

The proposed flame photometric method was successfully employed to estimate the amount of potassium in eleven different dry fruits. The proposed method was found to be simple, specific, accurate and precise. This study provided yielded results so as to compare mineral content of different fruits. More study on physicochemical characteristics in different fruits is needed. The out come of this investigation has greatly illustrated the potassium content of the fruits as quality food with good nutritive and medicinal properties. Hence, the proposed method can be

employed for routine analysis of mineral composition in various fruits, fruit extracts, vegetables etc.

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REFERENCES

[1]. Nahar N, Rahaman,S., Mosiihuzzaman, M., *J. Sci. Food Agric.* 5:185-192,**1990**.
[2]. Lechaudel, M. Joas J., Caro Y., Genard M. And Jannoyer M.,: *J Sci Food Agric.* 85:251–260,**2005**.
[3]. Fergusan, I. B. *Plant cell environ.***7**:397-405 (**1984**).
[4]. Bangeruh F, *A review phytopathol.* 17: 97-122,**1979**.
[5]. San,B., Yildirim, A.N., Pola, T, M. and Yildirim, F. *Asian J. of Chem.*21 (4)**:** 2898-2902,**2009**.
[6]. Kruczek A. *Acta. Sci. Pol. Agric.* 4(2)**:**37-46,**2005**.
[7]. http://www.buzzle.com/editorials/8-21-2004-58197.asp.
[8]. United States Department of Agriculture, MyPyramid.gov http://www.mypyramid.gov/pyramid/fruits.html.
[9]. United States Department of Agriculture, Dietary Guidelines for Americans **2005** Appendix B. Food Sources of Selected Nutrients http://www.health.gov/dietaryguidelines/dga2005/document/html/AppendixB.htm#appB1.
[10]. Rainey C.J. et al. *J Amer Diet Ass*; 99:335-340,**1999**.
[11]. Devirian T.A. and Volpe S.L. *Crit Review Food Sci Nutr*; 43(2):219-231,**2003**.
[12]. United States Department of Agriculture. Nutrient Data Laboratory http://www.nal.usda.gov/fnic/foodcomp/search/.
[13]. Potassium and Its Benefits to the Human Body By Charlene J. Nuble **2005**. Retrieved July 19, 2010 from http://eziнearticles.com/?Potassium-and-Its- Benefits-to-the-Human Body & id = 74138.
[14]. Potassium. Retrieved July 19, 2010, from http://en.wikipedia.org/wiki/Potassium.
[15]. Importance Of Potassium In Human Body by Samuel Murray Retrieved July 9, **2010**, from http://articles.directorym.com/Importance.
[16]. Ali Aberoumand and Deokule S.S., *Asian Journal of Agricultural Sciences* 2(1):35-37,**2010**.
[17]. Okwu D.E. and Emenike I.N. *Journal of Food and Tecnology* 5(2):105-108,**2007**.
[18]. Akinhanmi T.F. and Atasie V.N. *J.Agricultural, Food and Environmental Science.,* 2 (1), **2008**.
[19]. Mhommed S. Al Jasser., *Journal of Food and Tecnology* 7(4):102-105,**2009**.
[20]. Arshad Hussain, Azra Yasmin and Javed ali, *Pak.J.Bot.*,42(4):2497-2502,**2010**.