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Survey on the Moisture and Ash Contents in Agricultural Commodities in Al-Rass Governorate, Saudi Arabia in 2017

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Abstract

Researchers and governments are paid great interest concerning food safety and quality of food stuff. Determination of moisture and ash contents was accomplished by using simple, easy and low cost method to establish a database for agricultural commodities. Twenty four types of agricultural commodities were collected from the local market in Al-Rass governorate, Al-Qassim region, Saudi Arabia. The samples were collected in the period from the beginning of January 2017 to the end of July 2017. The survey show that higher values of moisture contents were found in tomato and cucumber (95.79 and 94.65%, respectively) while the higher values of ash content were found in leafy vegetables in particular spinach and watercress of 1.91% and 1.51% respectively.

Keywords: *Ash contents, Food commodities, Moisture contents, Saudi Arabia.*

Introduction

Vegetable is any part of a plant that is consumed by humans in a meal. Nowadays, most vegetables are grown all over the world as climate permits, and crops may be cultivated in protected environments in less suitable locations. It may include roots, stems, leaves, fruits or seeds of the plants that can be eaten as raw and/or cooked form and play an important role in human nutrition, being mostly low in fat and carbohydrates, but high in vitamins, minerals and dietary fiber. Most vegetables contain with 84 to 96 % of water [1,2]. The traditional wild vegetables have also some medicinal value like antibacterial and anticancer activity, which make them a valuable addition to the diet [3].

Moisture content is one of the most commonly measured properties of food materials for a number of different reasons such as to define of the limits to the maximum or minimum amount of water that must be present in certain types of food, to calculate the cost of many foods which depends on the amount of water they contain, and to examine the quality of the food such as the texture, taste, appearance and stability of it.

Ash refers to the inorganic residue remaining after either ignition or complete oxidation of organic matter in a foodstuff. The ash content is a measure of the total amount of minerals present within a food, whereas the mineral content is a measure of the amount of specific inorganic components present within a food, such as Ca, Na, and K [4].There are two major types of ashing; first one is dry ashing, which is primarily for proximate composition and for some types of specific mineral analyses; it requires high temperature muffle furnace capable of maintaining temperatures of between 500 and 600^{o}C for many hours. Therefore, water and other volatile materials are vaporized and organic substances are burned in the presence of the oxygen in air to CO_2, H_2O and N_2. Most minerals are converted to oxides, sulfates, phosphates, chlorides or silicates as this method is based on the fact that minerals are not destroyed by heating, and that they have a low volatility compared to other food components. Second method is wet ashing (oxidation), which is used prior to the analysis of certain minerals using different techniques [5].

Determining the ash content may be important for several reasons such as it is a part of proximate analysis for nutritional evaluation. Additionally, ashing is the first step in preparing a food sample for specific elemental analysis by using many spectroscopic techniques. The results of analysis of vegetable *Daucus carots L* (Carrot) show that 1.027% ash and 1.841 mg /1oo g of iron. The analysis data of *Lycopersicon esculentaum* (Tomato) show 0.508% ash and 0.455 mg/ 100 g of iron. The ash contents of both vegetables *Daucus carota* (Carrot) and *Lycopersicom esculentum* (Tomato) are found to be same [6]. Moisture content was found maximum in all the selected vegetables. Sweet pepper, cauliflower, carrot, cabbage, lettuce, spinach, tomato, potato, reddish, and bottle gourd, ranging from 77% moisture in potato to 94.5% in bottle gourd, ash contents ranged from 0.9 to 2.1%, 0.3 to 1.2% and 0.5% to 1.1%, respectively.

Vegetables are poor sources of fat that make them good food for obese people. The water content of the leafy vegetables varied between 83.8 to 95.5 g/100 g fresh vegetable sample. The ash content of the samples varied between 8.0 to 22.6 g /100 g of dry vegetable powder [7]. The results of nutritional values showed that the wild vegetables such as Dhekishak (Dryopteris filix-mas), Helencha (Enhydra fluctuans), Kalmishak (Ipomoea aquatica), Patshak (Corchorus capsularis) and Shapla stem (Nymphaea stellata) had a low content of crude fat and high content of moisture, ash, crude protein, crude fiber, carbohydrate and energy having the recommended dietary allowances [8].

In this study, our aim is to create a database for agricultural commodities starting from determination of their moisture and ash contents, moreover to overcome the scarcity of reliable data on this region as there are no published reports on the agricultural commodities in Al-Rass governorate, Al-Qassim region, Saudi Arabia.

Materials and Methods

Sample Collection

Twenty four types of harvested fresh vegetables and fruits such as (tomato, parsley, green pepper, etc.) were collected from different markets in Al-Rass governorate, Al-Qassim regions, Saudi Arabia, from the beginning of January 2017 to the end of July 2017. The representative fresh sample from the market was 250 g. The samples were kept in sterile polyethylene bags and transported to the laboratory in an ice chest box. In the laboratory, edible portions of the samples were used for analysis while bruised or rotten samples were removed then, samples were cut into small pieces and slices using a clean knife and either analyzed immediately or stored in polyethylene bags at 4°C ±1 in the fridge until analysis.

Drying of Samples

The fresh vegetables were collected from the local vegetable market of Al-Rass governorate, Al-Qassim region, Saudi Arabia. It is highly recommended that samples are carefully chosen to represent the original plants and total number of 755 samples were dried. 250 g of each vegetable samples were homogenized thoroughly in an electrical grinder (Kenwood CH550, China). 65-70 g of the homogenous sample weighed in a porcelain crucible using a digital analytical balance (Kern, AE5-4C, Germany) and dried at 105°C overnight by using a drying and heating oven (BINDER, ED 53, Germany). The dried samples were re-weighed to determine the water content [10]. All the experimental procedures are depicted in Figure

Dry ashing of the samples

A total number of 320 samples were ash dried where, the dried sample was grinded and homogenized into a fine powder and then, 5-7 g was weighed in a porcelain crucible glass tube by using the abovementioned analytical balance. The samples were thermally treated using a laboratory furnace with flap door (Nabertherm, P330, Germany) at 550°C for 12 h with a heating/cooling ramp of 5°C/min to remove most of the organic components in the dried sample. The ash dried cooled in the desiccators and re-weighed to determine the ash contents [9, 10]. Interval until the loss of mass between two successive weighing was not more than 2 mg.

Fig. 1: Schematic diagram of the experimental procedures

Results and Discussions

Moisture content in food commodities

The moisture percent in the samples was calculated according to the following equation:

$$\% \text{ Moisture content} = \frac{W_1 - W_2}{W_1} \times 100$$

eq. (1) Where, W_1 is the initial weight of the sample before drying and W_2 is the Weight of the sample after drying at 105°C overnight.

Table 1. The moisture contents in food commodities

S.N.	Vegetable type	no. of samples	Average moisture (%)	Range
1	**Broccoli**	4	88.94	85.74-90.76
2	**Cabbage**	6	92.12	87.61-94.38
3	**Carrot**	13	90.50	88.39-98.00
4	**Coriander**	28	89.01	86.14-91.50
5	**Cucumber**	97	95.79	88.82-96.93
6	**Dill**	8	89.07	86.58-91.94
7	**Eggplant**	60	92.12	88.60-95.90
8	**Green chili pep**	38	88.67	84.25-97.90
9	**Green onion**	9	91.72	90.42-95.70
10	**Green pepper**	93	93.93	88.78-95.56
11	**Leek**	21	92.66	90.59-96.14
12	**Lettuce**	17	93.23	90.42-95.03
13	**Mint**	11	87.65	78.95-95.07
14	**Onion**	4	86.20	85.14-87.09
15	**Okra**	15	87.14	83.50-94.89
16	**Parsley**	45	87.06	72.62-97.00
17	**Potato**	10	81.41	79.11-83.95
18	**Pumpkin**	17	85.43	76.69-94.65
19	**Spinach**	5	91.80	88.35-96.60
20	**Squash**	77	93.39	86.66-95.34
21	**String beans**	12	89.24	86.25-93.24
22	**Tomato**	162	94.65	85.81-96.80
23	**Watercress**	19	92.23	89.69-94.90
24	**Watermelon**	4	93.66	92.41-94.35

From the results of the studied samples in Table 1 and Figure 2 in which the highest values of moisture content were found in tomato and cucumber with value of 95.79 and 94.65% respectively while the lowest values of moisture content were presented in potato and pumpkin of 81.41 and 85.43%, respectively.

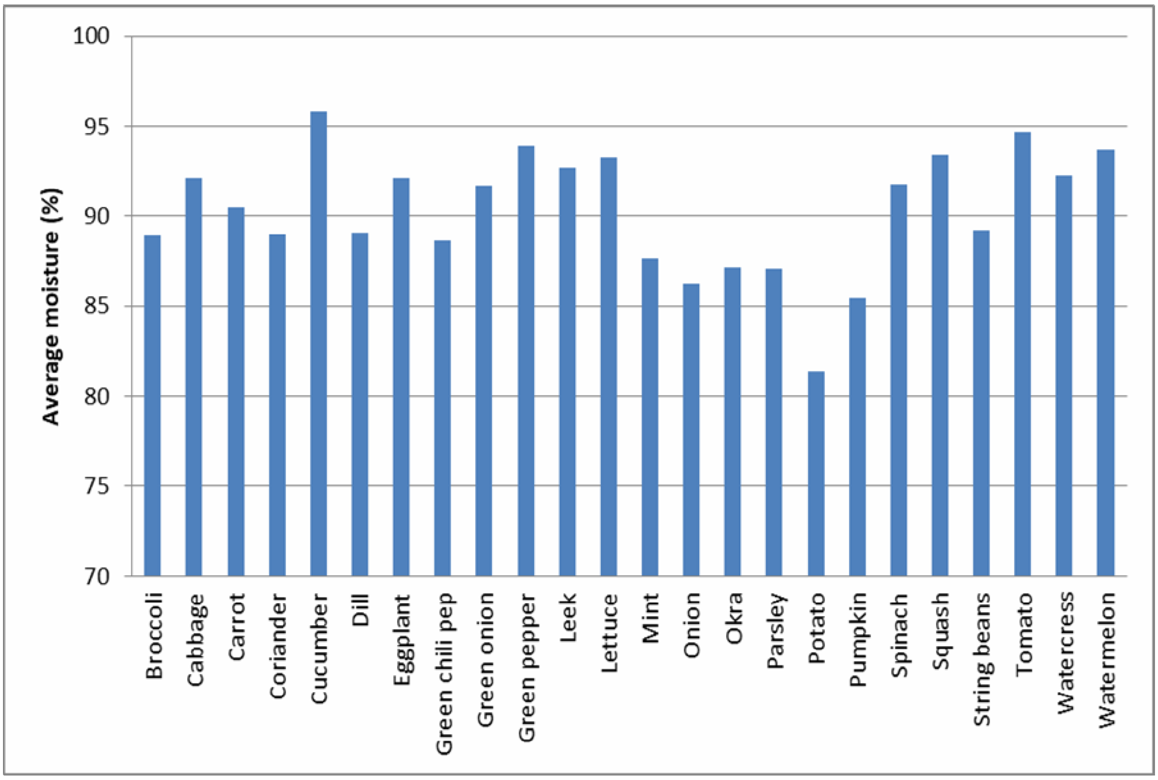

Fig. 2: The moisture contents in food commodities

Ash content in food commodities

The ash content can be calculated as follow:

% ash content = $\frac{W_2 - W_3}{W_1} \times 100$ eq. (2)

Where, W_3 is the final weight of the dried after ashing.

Table 2. The ash contents in food commodities

S.N.	Vegetable type	No. of samples	Average Ash (%)	Range
1	**Broccoli**	4	0.67	0.56-0.81
2	**Cabbage**	5	0.53	0.44-0.69
3	**Carrot**	12	0.47	0.25-0.76
4	**Coriander**	20	1.30	0.85-1.79
5	**Cucumber**	20	0.54	0.26-0.84
6	**Dill**	12	1.03	0.49-1.87
7	**Eggplant**	20	0.47	0.14-0.60
8	**Green chili pep**	20	0.43	0.24-0.67
9	**Green onion**	12	0.68	0.41-0.93
10	**Green pepper**	20	0.37	0.21-0.54
11	**Leek**	20	1.17	0.55-1.72
12	**Lettuce**	12	0.84	0.55-1.27
13	**Mint**	12	1.08	0.61-1.75
14	**Onion**	4	0.25	0.20-0.29
15	**Okra**	12	0.52	0.33-0.79
16	**Parsley**	20	1.23	0.98-1.56
17	**Potato**	12	0.27	0.20-.047
18	**Pumpkin**	12	0.28	0.21-0.46
19	**Spinach**	3	1.91	1.64-2.35
20	**Squash**	20	0.85	0.51-1.83
21	**String beans**	12	0.50	0.36-0.63
22	**Tomato**	20	0.62	0.31-0.93
23	**Watercress**	12	1.51	1.02-2.21
24	**Watermelon**	4	0.32	0.21-0.45

The results of ash contents of the studied samples are shown in Table 2 and Figure 3 in which the highest values of ash content were found in leafy vegetables in particular in spinach and watercress of 1.91% and 1.51%, respectively, while the lowest values of ash content were found in onion of (0.25%) and for potato (0.27%).

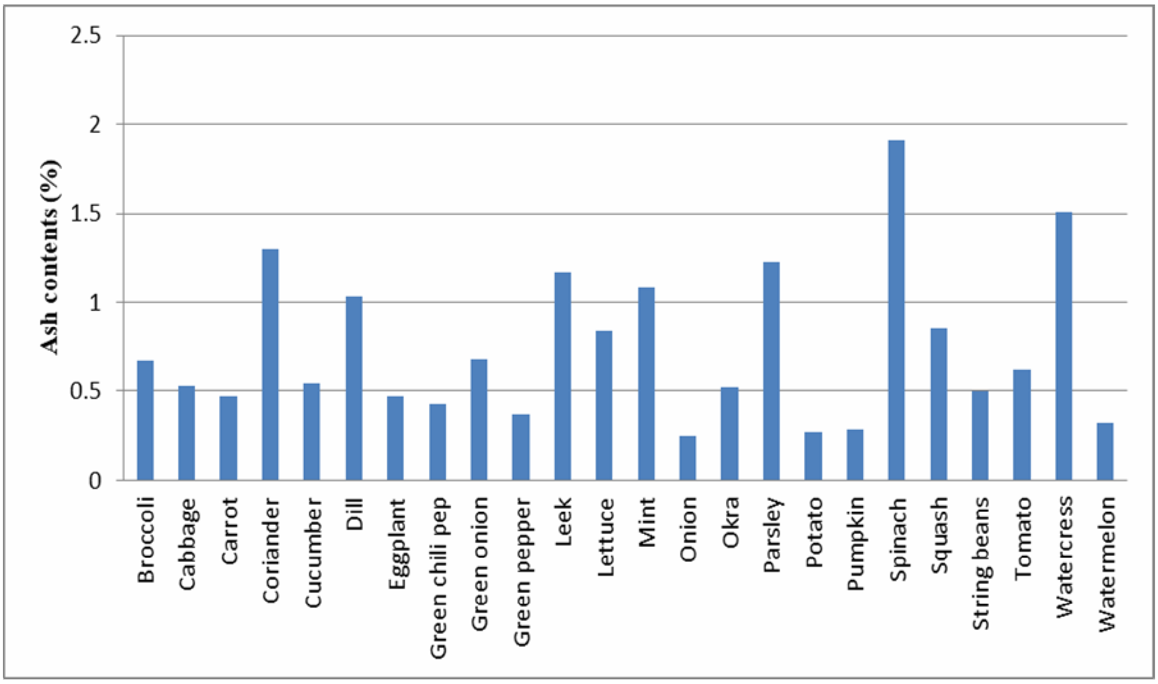

Fig. 3: The ash contents in food commodities

Conclusion

Simple, economical and easy method was implemented to determine the moisture and ash contents in agricultural commodities in Al-Rass governorate, Saudi Arabia in 2017. Results show that the highest values of moisture content were found in tomato and cucumber while the lowest values were presented in potato and pumpkin. On the other hand, the highest values of ash content was found in spinach and watercress while, the lowest values were found in onion and potato. Further research should be done to determine the content of each individual heavy metal in the agricultural commodities.

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دراسة عن نسبة الرطوبة والرماد فى المنتجات الزراعية بمحافظة الرس بالسعودية في عام ٢٠١٧ م

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الملخص

يولي الباحثون والحكومات قضية جودة وسلامة الغذاء الكثير من الإهتمام لما لها من تأثير على الصحة العامة للإنسان. وقد تم في هذه الدراسة تحديد نسب الرطوبة والرماد في بعض المنتجات الزراعية بطريقة بسيطة وغير معقدة ومنخفضة التكاليف لإنشاء قاعدة بيانات خاصة بالمنطقة. تم جمع أربعة وعشرون نوعاً من المنتجات الزراعية بالسوق المحلى لمحافظة الرس بمنطقة القصيم بالمملكة العربية السعودية فى الفترة من بداية شهر يناير ٢٠١٧ وحتى نهاية شهر يوليو في نفس العام. بينت الدراسة أن أعلى نسبة رطوبة في العينات ظهرت في عينات الطماطم والخيار بنسبة ٩٥,٧٩% و ٩٤,٦٥ % على الترتيب بينما ظهرت أعلى نسبة للرماد في عينات الخضار الورقية وخاصة السبانخ والجرجير بنسبة ١,٩١% و ١,٥١% على الترتيب.

كلمات مفتاحية: *نسبة الرماد، نسبة الرطوبة، الغذاء، المملكة العربية السعودية*