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Trace Elements in Medicinal Seeds

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Abstract

Moisture, ash and trace elements such as iron, cobalt, zinc, manganese and copper present in medicinal seeds, popularly used and available in Pakistan, were determined by Atomic Absorption Spectrophotometry. The highest moisture content was found in Cucumisativis (Kheira), while, the lowest was in Parsley (Ajwain). The highest content resulted from complete burning of Planpagomajorlill (Burtung). Carumcarvi (Caraway) was found to contain the highest amounts of trace elements determined, while Cichorimintybus (Wild Cichory) contained their lowest amount. Copper was found to be highest in Trigonellafoenumgracum (Medicago), while it was lowest in Planpagomajorlill (Burtung) and Cucumisativis (Kheira). Zinc, manganese and cobalt were found highest in Carumcarvi (Caraway), Cichorimintybus (Wild Cichory) and Cumin (SufaidZeera) and lowest in Phyllanthusmaderoslimm (Kanocha), Planpagomajorlill (Burtung) and Cichorimintybus (Wild Cichory).

Keywords: trace elements, medicinal seeds, atomic absorption spectrophotometry, Cucumisativis, Parsley, Planpagomajorlil, Cichorimintybus.

1. Introduction

The importance of trace elements for the normal functioning of living body has been realized recently. Many of these elements function as co-factors of enzyme that are responsible for key bio-chemical reactions responsible for the framework of different metabolic pathways essential for the supply of energy and raw material for the synthesis of functional biomolecules [1]. Thus, their excess or deficiency may lead to many physiological disorders. Govindon reviewed the role of trace elements in human health in 1973 [2].

It is now well appreciated that microelements are as important as are the vitamins whose physiological role was well established long ago. In fact, microelements become even more important in the context that the living body can synthesize some of the vitamins for itself, but it is completely dependent on exogenous sources such as food and drinks for all requisite microelements.

Since the discovery of the importance of trace elements in functioning of the living body, an extensive research has been carried in different contexts. The research in this field has been further intensified by the development of atomic absorption spectrometry that can estimate the traces of elements present in different samples. The major dimensions of the research work have been the exploration of functions of the trace elements, their contents in the foodstuffs and the development of the methods of their determination [3-5]. The work is yet in progress and the reports are appearing with reference to nutrition, disease and health [6, 7].

Following the rout narrated above, the work presented here was about the determination of trace elements in medicinal seeds commonly used in Pakistan and subsequent defining of their physiological status in health and disease.

The samples of the medicinal seeds were collected from the local market of Lahore. Care was taken to buy good quality material. Most of the seeds were processed same day. The samples were carefully cleaned, were ground to fine powder and stored for prolonged periods in dry glass sample bottles.

1.1. Determination of Moisture

Moisture was determined by Oven Drying Method [3]. 10g of seed sample were taken in a pre-weighed china dish. It was then dried to a constant weight at 100 to 105°C in an oven by repeating heating and weighing at intervals of one hour. The dish with the material was finally weighed after cooling and loss in weight was reported as percentage of moisture.

1.2. Determination of Ash

Ash was determined by igniting the oven-dried material from 10g sample in a Muffle Furnace and reporting the weight of ash as percentage of the starting sample [8]. The sample was placed in a muffle furnace and ignited at 550°C for 12 to 16 hours till the ash was nearly white. Then 5 ml concentrated HNO₃ was added and the dish was again placed in the furnace to render it carbon free. The china dish was removed from the furnace, cooled in desiccators and weighed. The process was repeated to a constant weight. The ash was reported as the percentage of sample taken before drying and igniting as narrated above.

1.3. Determination of Trace Metals

The trace elements were by Atomic Absorption Spectroscopy. The steps involved in the determination of trace metals are given below.

1.3.1. Digestion of the Sample. To the ash obtained above, 5 ml of concentrated HCl was added and the mixture was evaporated to dryness. To the dried material, 2ml HCl was added again. The dish was covered with a watch glass and heated for five minutes on a steam bath. The mixture was filtered, through Whitman No. 42, into a 50 ml volumetric flask. The filter paper was washed with hot de-ionized water and the volume was finally made up to the mark.

1.3.2. Reading in the Atomic Absorption Spectrophotometer. The solutions obtained from twenty different samples were read in Atomic Absorption Spectrophotometer. For different elements, different lamps were used. Side-by-side, the standards of different trace metal salt solutions were also read. The amounts of different trace metals present in different samples were calculated by comparison of the absorbance of the sample with the corresponding standard and the values were reported as amounts in μg per gram of sample.

2. Results and Discussion

The percentages of moisture and ash in the samples under investigation are reported in table 1 and the trace metal contents of different samples of medicinal seeds are reported in table 2.

Table 1. Percentage of Moisture and Ash in Medicinal Seeds

Sr. No.	English Name / Local Name	Botanical Name	Moisture g/100g	Ash g/100g
1	Mace/Jawatri	Myristica fragrance	9.6	4.6
2	Medicago Seeds/ Methi	Trigonellafoenumgracum	3.9	16.1
3	Parsley (Ajwain)	Carumcopticum	3.6	9.1
4	Fannel/Saunf	Foeniculumvalgare	7.0	8.5
5	Caraway/Kala Zeera	Carumcarvi	7.5	4.1
6	Cumin/SufaidZeera	Cumiumcyminum	9.5	5.4
7	Onion (Red)/Piaz	Allium sepa	5.9	8.1
8	BlackPepper/Kali Mirch	Paper nigrum	11.5	8.5

Trace Elements in Medicinal Seeds				
9	Rye	Brassica alba	3.7	4.6
10	Mustard/Sarsun	Brassica compestris	6.2	6.4
11	Sesum/Till	Sesammedicum	4.1	4.5
12	Khashkhash	Poversomiferumlinn	5.1	5.8
13	Carot /Gajar	Daucuscarota	9.8	6.6
14	Bartung	Planpago major linn	14.8	18.5
15	Rahan	Ocimumsonctumlinn	10.2	14.8
16	Kalongi	Nigella sativa	8.6	8.1
17	Kanocha Seeds	Phyllanthusmaderoselinn	9.8	5.1
18	Gircan Seeds/Kheira	Cucumissativis	18.5	6.5
19	Wild Chichory/Kasni	Cichoriumintibus	11.6	11.6
20	Soya	Anthermasowakurz	5.8	10.7

The major objectives of the work reported here, were the assessment of different medicinal seeds as source of different trace metals and subsequent comparison of trace metal contents of analyzed samples with the trace metal contents of the seeds already reported.

The results computed here (table 2) indicate that the medicinal seeds contain different trace metals in wide ranges. For example, Fe is from 23.3 µg/g to 250.0 µg/g, Cu is from 5.3 to 27.1.0 µg/g, Mn from 0.00 to 40.01 µg/g, Zn from 4.10 to 46.90 µg/g and Co from 0.2 to 2.8 µg/g.

The amount of iron is usually high in nearly all seeds. The highest amount of iron is found in caraway that is 275µg/g, which is followed by Nigella sativa seeds (Kalongi) that is 245 µg/g. Next in order are parsley (185.3 µg/g), cumin and carrot (165.0 µg/g), Black pepper (135 µg/g) and fennel (110.0 µg/g). Moderate amounts of iron are contained in rye (98.1) medicago (60.3 µg/g), Rahan (59.01 µg/g), Mustard (56.2) and sesum (50.6 µg/g) seeds respectively. Lower amounts of iron are present in bartung and Soya seeds. Other seeds contain iron in lower quantities that are below 50 µg/g.

Table 2. Trace metal contents of different spices and condiments

Sr No	English Name	Botanical Name	Fe µg/g	Cu µg/g	Mn µg/g	Zn µg/g	Co µg/g
1	Mace/Jawatri	Myristica fragrance	25.8	7.30	13.2 5	26. 9	0.6 0
2	Medicago Seeds/ Methi	Trigonella foenum-graecum	60.3	27.1 0	BD L	16. 8	0.4 0
3	Parsley (Ajwain)	Carum copticum	185. 3	11.3 0	29.9 0	44. 1	1.0 1
4	Fennel/Saunf	Foeniculum vulgare	110. 0	9.80	26.1 0	11. 8	1.2 0
5	Caraway/Kala Zeera	Carum carvi	275. 0	17.9 0	28.4 0	46. 9	1.5 0
6	Cumin/Safed Zeera	Cuminum cyminum	165. 0	12.5 0	27.2 5	15. 8	2.8 0
7	Onion (Red)/Piaz	Allium sepa	10.9	14.9 8	0.00	31. 1	1.2 0
8	Black Pepper/Kali Mirch	Piper nigrum	135. 0	15.0 0	41.1 0	36. 2	0.2 0
9	Rye	Brassica alba	98.1	5.60	21.9 0	27. 5	BD L
10	Mustard/Sarson	Brassica campestris	56.2	15.9 0	20.5 0	15. 5	0.4 0
11	Sesum/Til	Sesamum indicum	50.0	22.8 0	8.10	4.1	0.5 0
12	Poppy/Khashkhash	Papaver rhoeas	20.1	10.5 0	30.9	24. 8	0.2 0
13	Carrot /Gajar	Daucus carota	165. 0	8.50	10.5 0	13. 6	0.5 0
14	Bartung	Plantago major	10.8	Nil	Nil	BD L	BD L
15	Rahana	Ocimum sanctum	59.0 1	7.90	13.5 0	44. 5	2.8 0

			Trace Elements in Medicinal Seeds				
16	Kalongi	Nigella sativa	245.0	14.50	20.10	35.1	1.50
17	Kanocha Seeds	Phyllanthus maderas-einn	40.9	8.01	BDL	Nil	2.10
18	Gircan Seeds/ Kheira	Cucumis sativus	29.5	BDL	30.50	14.6	0.40
19	Wild Chichory/ Kasni	Cichorium intybus	Nil	13.50	40.01	7.5	Nil
20	Soya	Anthriscus officinalis	10.6	20.50	19.50	16.9	1.20

In general, manganese follows iron in content of different seeds. The highest amount is observed in black pepper (41.10 µg/g), wild chicory (40.01 µg/g) and garcon (30.5 µg/g). Mace, fennel, poppy and garcon contain manganese in the range of 13.3 to 29.90 µg/g. The remaining seeds contain still lower amounts of manganese.

In general the copper content of the analyzed seeds is less than 25 µg/g. Medicago seeds (27.1 µg/g) and sesam (22.9 µg/g) appear to contain the highest amounts of this metal. Cumin (12.50 µg/g), caraway (17.90 µg/g), soya (20.1 µg/g) and kalongi (14.5 µg/g) appear to be the moderate sources of copper. Others contain relatively lower amounts of copper and thus are poor sources of this micronutrient.

Caraway (46.9 µg/g), rahan (44.5 µg/g) and parsley (41.1 µg/g) seeds appear to be rich in zinc, while mace (26.9 µg/g), poppy (24.8 µg/g), rye (27.5 µg/g) and black pepper (36.2 µg/g) come out to be the moderate sources of zinc. Most of the seeds contain zinc in the range 15 to 35 µg/g. Sesum, bartung and kanocha seeds contain negligibly small amounts of zinc.

Cobalt contents in the medicinal seeds are found to be in the range 0.2 to 2.8 µg/g. Thus the cobalt content of the medicinal seeds is far less as compared to the other seeds.

Our results for iron in cumin, caraway, black pepper and mace that contain 165, 275, 135 and 25.8 µg/g while the values reported by Fox and Bender in 1977 are 170, 132, 44.0 and 26.4. This means our results for two seeds that are cumin and mace are quite in agreement, while widely differ for other two that are caraway and black pepper. Similarly, the values for fennel, medicago, mustard and poppy

are 110, 60.3, 66.2, and 22.2 $\mu\text{g/g}$, while those reported by the referred workers are 105, 55.6, 70.2, and 10.1 $\mu\text{g/g}$ respectively. The comparison indicates that these results are quite in agreement except for poppy where the ratio of values is nearly 2:1.

Copper in black pepper and fennel has been found to be 15.0 and 7.80 $\mu\text{g/g}$, while the values reported by McCance and Widdosons in 1960 are 3.5 and 10.5 $\mu\text{g/g}$ respectively. The comparison indicates that our value for black pepper is lower and for fennel is higher.

According to our determination the values for manganese in black pepper and caraway are 41.10 and 28.40 respectively, while the values reported by Wenlock *et al.* in 1973 for these seeds are 39.90 and 45.0 indicating agreement in case of black pepper and disagreement in case of caraway. Similarly, the values for manganese in mace, cumin, and mustard here are 13.25, 27.25, and 20.5 $\mu\text{g/g}$, respectively, while those reported by Wenlock *et al.* in 1973 are 28.0, 23, 17.0 to 23.0 $\mu\text{g/g}$. So, there is a good agreement for manganese in cumin and mustard but it is different for mace.

3. Conclusion

The conclusions that may be drawn from the results and the recommendations that can be made from the results may be as follows:

- Iron is the most abundant element present in the medicinal seeds. Thus in order to treat the iron deficiency diseases the seeds high in iron content such as caraway, parsley and carrot may be used provided the overall dose per day remains below 50mg as otherwise, the excess iron may accumulate in the liver to cause haemochromatosis characterized by grey skin pigments, hepatic enlargement, which ultimately result into heart failure.
- The amount of zinc, in parsley, caraway, and rahan is high. So, these seeds can be used to overcome zinc deficiency. The human body contains 3.3g of Zn, which is concentrated in liver, prostate and bones. It is involved as cofactor in the proper functioning of Vitamin. Zinc deficiency is related to retarded growth of foetus that translates into low birth weight of infants.
- As manganese exerts beneficial effects against arteriosclerosis and prevents the development of this disease in animals and humans by activating the enzymes such as blood and bone phosphatase and arginase, the medicinal seeds rich in this element such as black pepper, wild chicory and poppy may be used to treat the narrated disease.
- Copper, being the second important trace element after iron in the nutrition of man due to its requirement in the hemoglobin synthesis, medicago, sesum, and soya containing high amounts of this element, may be given to

make up hemoglobin deficiency. Care should be taken that their excess is avoided as the increased amount of copper in the liver and urine may lead to Wilson's disease.

- As cobalt is an essential component of cynocobalamin (Vitamin-B12) whose deficiency may cause anemia, good sources of cobalt such as cumin, and rahan may be used. The excess of cobalt, being toxic, may be avoided.
- Finally, we recommend that where our results, differ from those of other workers, some third party of workers may repeat the analysis. Of course, the composition of soil where the seeds are grown may be considered to interpret the differences.

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