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Fluorine content in vegetables grown by selected farm families of Himachal Pradesh

S. R. Malhotra, A. Sharma and S. Bhama
Department of Food Science and Nutrition
College of Home Science
CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur-176 062.

Abstract

Fluorine is an important trace element in human nutrition helpful in preventing tooth decay. It is usually present in drinking water and in varying amounts in different food groups. A study was conducted in three different urban and rural zones of the state to assess the fluorine content of foods consumed by the farm families, especially the vegetables. Average fluorine content recorded in green leafy vegetables grown by urban areas of Himachal Pradesh was 289.7± 230.17µg per 100g from Una, 654.0± 749.97µg per 100g from Kangra and 241.5± 143.97µg per 100g from Kullu , whereas these contents were observed as 274.4± 159.8, 291.5± 177.2 and 156.7 ±120.0 µg per 100g respectively, in the vegetables from rural areas of Una, Kangra and Kullu. In case of roots and tubers the average minimum fluorine content was 158.0± 121.7µg per 100g in the samples collected from the rural area of Kullu whereas maximum content were 301.8± 230.0 µg per 100g in samples collected from rural area of Kangra. Among other vegetables the minimum fluorine contents were found as 143.2± 98.2 µg per 100g in the samples collected from rural Una and maximum were found as 197.7± 175.9 µg per 100g in rural Kangra. The fluorine content ranged between 7.1 to 5880.1ug per 100g, minimum in bathua leaves and maximum in fenugreek leaves. In case of roots and tubers carrot and colocasia taken from urban Kangra and Kullu showed nil amount of fluorine whereas the carrot from urban Una depicted the maximum 1080.07µg per 100g of fluorine content. Among the other vegetables the range of fluorine content varied from 0.0 to 1008µg per 100g. As is evident from the above observations sufficient amount of fluorine is present in the vegetables which form a part of daily diets and no symptoms of fluorosis were observed in the selected areas.

Introduction

Fluoride is an essential element. It is a negative ion salt and is present in most of the foods and water. Traces of this element are regularly present in human tissues, especially in the bones, teeth, thyroid glands and skin. Traces of fluoride in the teeth help to protect them against decay and are needed for normal growth. The chief source of fluorine is drinking water. Very few foods contain more than 1ppm of fluorine content. Tea and sea foods are also good sources of fluorine. Fluoride intake through food and water in higher concentration leads to fluorosis causing dental and skeletal fluorosis. An estimated 62 million people in India suffer from dental, skeletal and non-skeletal forms of fluorosis associated with health complaints (Susheela, 1999). In many parts of the world where the fluoride content of the water is high, mottling of teeth is common. The enamel loses its luster and becomes rough. All the teeth may be affected, but mottling is usually associated with any evidence of skeleton fluorosis or indeed with any poisoning as reported in many parts of India also, where the water supply contains over 10ppm fluoride. Keeping in view the importance of fluorine in human nutrition the present study was undertaken with the following objectives.

1. Screening of vegetables for fluorine contents.
2. Analysis of vegetables for their fluorine contents.

Material and Methods

Technical Plan

Locally available green leafy vegetables, roots and tubers and other vegetables were collected from three different zones namely zone I (Low hill), zone II (Mid hill) and zone III (High hill) of Himachal Pradesh. Collected samples were cleaned from dirt and dust and dried. The dried samples were ground and kept in polyethylene bags for the further estimation.

Chemical Analysis

Fluorine in vegetable samples was analyzed by the method of Alberto Eurique Villa (1979) and Anasuya *et al.* (1997).

Results and Discussions

About 94 green leafy vegetables were collected from rural and urban areas of different zones of Himachal Pradesh. Among green leafy vegetables *bathua* leaves taken from rural area of kullu showed minimum 7.1µg per 100g and fenugreek leaves collected from urban area of una revealed maximum 5880.0µg per 100g of fluorine content.

The minimum average value was observed as 7.25 in case of bathua leaves and maximum was 5460.0µg per 100g in case of fenugreek leaves. In case of zone I the leafy vegetables collected from rural areas of Una the minimum fluorine content was 47.2µg per100g (mean values), observed in bathua leaves and maximum 5880.0µg per100g of this content was found in fenugreek leaves. In zone II the mean value of fluorine content was ranged between 11.7 to 724.0µg per 100g minimum (bathua leaves) and maximum (spinach) from urban kangra. Bathua leaves from rural area of zone III showed minimum 7.3µg per 100g and coriander leaves of urban showed maximum 391.3µg per 100g of the fluorine content.

Table1. Mean fluoride content of green leafy vegetables (µg/100g) from selected zones of H.P.

S.No.	Foods	Zone I (Una)		Zone II (Kangra)		Zone III (Kullu)	
		Urban	Rural	Urban	Rural	Urban	Rural
1	Amaranth	153.5	144.2	182.9	132.4	9.0	12.6
2	Bathua	50.2	47.2	11.7	00.0	9.1	7.1
3	Coriander leaves	153.4	2066.4	387.7	410.6	391.3	220.6
4	Fenugreek	5460.0	394.0	170.2	00.0	00.0	00.0
5	Japani mustard	189.2	227.2	245.1	78.4	68.1	65.1
6	Mint leaves	257.2	252.6	249.1	289.1	00.0	00.0
7	Mustard leaves	992.9	132.1	211.6	299.2	90.2	75.6
8	Radish leaves	364.1	245.1	130.2	598.1	81.2	00.0
9	Saunf	00.0	248.3	254.9	250.8	48.6	00.0
10	Spinach	540.5	525.9	724.0	450.8	68.3	50.7
	Mean ±SD	816.1 ±964.1	428.3 ±347.1	256.7 ±119.6	250.9 ±158.6	76.6 ±66.6	42.3 ±47.9

Values are in (µg/100g) on dry weight basis

Table 2. Mean fluoride content of roots and tubers from selected zones of H.P.

S.No.	Foods	Zone I (Una)		Zone II (Kangra)		Zone III (Kullu)	
		Urban	Rural	Urban	Rural	Urban	Rural
1	Beet Root	779.4	711.2	741.6	654.5	389.25	51.7
2	Carrot	507.3	1217.6	565.7	295.7	240.3	43.3
3	Colocasia	462.4	476.3	96.5	112.0	00.0	00.0
4	Garlic	00.0	107.4	11.8	10.6	28.4	00.0
5	onion	446.5	427.1	00.0	14.5	53.0	89.0
6	Potato	168.8	188.7	138.6	144.2	38.5	38.4
7	Radish	619.3	00.0	112.9	616.7	30.9	31.2
8	Turnip	128.4	132.8	102.0	96.7	97.2	52.1
	Mean ±SD	389.0 ±217.5	407.6 ±300.4	221.1 ±216.3	243.1 ±209.4	109.7 ±102.5	38.2 ±20.9

Values are in (µg/100g) on dry weight basis

Total 87 roots and tubers samples were procured from the three different agro climatic zones of Himachal Pradesh. Among roots and tubers garlic taken from rural area of Kangra showed minimum 10.6µg per 100g and carrot collected from urban area of una revealed maximum 1080.0µg per 100g of fluorine content.

In case of roots and tubers samples collected from zone I, garlic taken from rural area of Una revealed the average fluorine content as 107.4µg per 100g (minimum) and beet root showed an average 1080.0µg per 100g (maximum) of fluorine collected from urban area of Una. In case of zone II the mean value of fluorine content was ranged between 10.6 to 741.6µg per 100g in garlic (minimum) procured from rural area of Kangra and in beetroot (maximum) collected from urban area of Kangra. An average fluorine content in the garlic procured from urban area of zone III showed minimum 28.4µg per 100g and beetroot of the same area showed maximum 389.3µg per 100g.

Table 3. Mean fluoride content of other vegetables from selected zones of H.P.

S.No.	Foods	Zone I (Una)		Zone II (Kangra)		Zone III (Kullu)	
		Urban	Rural	Urban	Rural	Urban	Rural
1.	Bitter gourd	714.8	498.3	186.0	-	4.1	-
2	Bottle gourd	33.5	26.6	-	-	9.7	1.8
3	Brinjal	1008.0	924.0	140.1	82.3	60.2	80.9
4	Cabbage	780.4	758.4	9.7	21.2	89.1	85.9
5	Cauliflower	-	227.5	122.3	-	72.3	135.2
6	Capsicum	-	331.2	462.2	-	183.5	-
7	Cucumber	-	56.4	108.9	42.3	41.8	33.9
8	Faba bean	-	617.4	-	-	-	-
9	French bean	-	-	67.9	-	40.7	32.5
10	Green chillies	-	177.6	158.2	-	64.5	30.5
11	Lady finger	39.3	137.3	57.6	122.4	103.8	72.5
12	Peas (Fresh)	105.9	272.5	42.8	85.3	79.9	109.6
13	Pandol	-	-	-	98.0	-	-
14	Ridge gourd	-	-	268.7	338.5	-	-
15	Samephalli	119.5	126.5	195.2	119.5	-	-
16	Squash	-	-	-	-	17.9	24.4
17	Tinda	82.4	120.4	88.9	102.8	135.5	172.2
18	Tori	-	-	110.6	42.4	65.8	87.9
19	Tomato	542.3	321.9	504.4	78.8	85.9	30.2
20	Tyree tomato	-	-	145.2	178.4	172.3	-
	Mean ± SD	380.7 ±338.4	328.3 ±212.6	166.8 ±97.8	109.3 ±53.6	76.7 ±39.1	69.0 ±40.1

Values are in (µg/100g) on dry weight basis
(-) indicates that samples were not available in that area, at that particular time.

About 150 other vegetable samples were collected from all the three zones of Himachal Pradesh. The minimum fluoride content was observed as 4.6 µg per 100g in case of cabbage collected from urban area of Kullu and maximum as 1008.0 µg per 100g in case of brinjal taken from urban Una. From zone I, average fluoride content was recorded as 26.6 µg per 100g (minimum)in case of bottle gourd and 1008.0µg per 100g (maximum) in case of brinjal. From zone II, the average value for the fluoride content was minimum 9.0µg per 100g in case of cabbage and maximum 504.4µg per 100g in case of tomato.The bottle gourd samples collected from the IIIrd zone showed the minimum fluoride content as 1.8µg per 100g and capsicum revealed the maximum fluoride content as 183.5µg per 100g.

Conclusion

- Fluorine content varied from area to area.
- The foods analyzed contained fluoride content in accordance with the literature available except for a few foods containing higher amounts of fluorine.
- No fluorosis cases were observed during the study.

Recommendations

Awareness camps regarding the importance of fluoride, its deficiency and toxicity in daily diets need to be organized for better health and well being of the population.

References

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