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Source of Lectin and β-Carotene in Vegetables and Fruits

KEYWORDS: PBS-phosphate buffered saline, PVP-polyvinyl pyrolidone, VDRL-Venereal disease research laboratory.

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ABSTRACT *The petroleum ether extracts of 40 green yellow vegetables and their parts such as root, tuber, rhizome leaf, flower, fruit, seed and some cereals and millets containing β-carotene and lectins β-carotene is a natural pigment abundant in vegetables and fruits, where as lectin is a carbohydrate binding proteins or glycoproteins of non immune origin. The presence of lectin and β-carotene in the selected species of fruits and vegetables are detected and Identified.*

Introduction
A great deal of interest has been expressed in the relationship between the occurrence of β-carotene and lectin in the selected species. Presence of β-carotene in the plant species such as fruits and vegetables have effective association in chemoprevention (12). Consumption of green yellow vegetables and fruits reduces cancer risk (2). Lectins are a group of proteins or glycoproteins having the capacity to combine with specific Saccharides on cell surfaces. Lectins agglutinate cells or precipitates erythrocytes (4) and the malignant cells (6-10, 13-15). The preferential binding of normal cells and malignant cells due to the presence of lectin receptors. Occurrence of lectins in vegetables and fruits of many plant Species exhibited important biological roles.

The purpose of the present study is to correlate the significance and presence of β-carotene and lectin in vegetables and fruits reflecting their biological properties.

Materials and Methods
Plant samples were collected from IIHR (Indian Institute of Horticulture Research) Bangalore. Plant lectins were isolated in saline (PBS) extracts,one gram of plant material (root, bark, stem, leaf, flower, fruit and seed etc.) were finely ground in a glass mortar and pestle and was suspended overnight in 10 ml of petroleum ether to remove lipids. The suspension was centrifuged at 10,000 rpm, for 5 min. The pellet was air dried to remove the residual ether and suspended in 10 ml of 0.02 M. Phosphate buffered saline (PBS) at p^H 7.2 containing 0.15 Nacl and kept overnight at 4° C. (Malik and Singh 1980).

The suspension was centrifuged on the following day at 15,000 rpm for 15 min in cold. The supernatant was collected and tested for lectin activity.

Erythroagglutination test
Human blood samples were repeatedly washed in PBS and a two percent cell suspension of erythrocytes in PBS was used to assay agglutination activity (Moore, 1980). Erythroagglutination activity was studied in glass VDRL plates, 50 µl suspension of prepared erythrocytes was added to the wells containing 50 µl of plant extracts.

The contents of the wells were mixed well and observed after 2 hrs. under the low power (10 x/10 x) of a compound microscope to visually determine the intensity of erythroagglutination. The degree of agglutination was assessed and recorded as weak (+), strong (++), and very strong (+++), in ascending order and lack of agglutination is recorded as –.

β-carotene was estimated taking 100g fresh sample of the species by solvent extraction method.

Results
The samples of the edible species are studied for the lectin and β-carotene in 40 selected Species (Table-1), all the 40 samples containing specific and non specific lectins agglutinate the erythrocytes of human blood groups (A, B. AB and O). All the 40 Species exhibited lectin activity and erythroagglutination enhanced in PVP. 16 Species exhibited erythroagglutination in saline (PBS) and PVP medium. Artocarpus integrifolia fruit with seed, Lab-lab purpureous pod, Morus alba fruit, Phaseolus vulgaris pod exhibited very strong agglutination (+++) in both PBS and PVP medium. Brassica oleracea var. caulerpa tuber, Lycopersicon esculentum fruit and Trichosanthes anguina fruit exhibited strong erythroagglutination (++) in PBS and PVP medium. In Momordica charantia fruit PVP enhances erythroagglutination from weak to strong in PBS and PVP medium. Macrotyloma unifolrum lectin is specific to blood group A and AB. β-carotene rich sources like fruits, vegetables, yellow-orrange vegetables, and dark green leafy vegetables. Long storage and dehydration destroys β-carotene.

The species containing β-carotene also contains lectins in the sample taken for assay. Anti-cancer property exhibited by these species is due to the presence of secondary metabolites like β-carotene and lectin. The highest percentage of β-carotene is found in Basella rubra leaf (7,440), Beta vulgaris leaf (5,862), Daucus carota leaf (5,700), Spinacia oleracea leaf (5,580), where as lectin content is fairly less.

Discussion
β-Carotene is a natural pigment in plants, precursor of vitamin-A. β-carotene is vegetables and fruits. Where as lectin is abundant in seeds, leaves and fruits fairly in other parts of species.

The species were selected largely basing on a survey of literature and application of the criterias. β-carotene is an anti oxidant which neutralizes the free radicals epidemiological and biological evidences suggests that β-carotene are chemo preventive agents against cancer.

Increased consumption of yellow fruits and vegetables helped prevention of cancer (Block et al., 1992). The number of cancer related deaths can be reduced by an increased consumption of fruits and vegetables (Block et al., 1992, WatenBerg 1985). Dietary β-carotene is positively associated with chemo prevention (Suzuki, 1990). Dunaliella salina a marine alga is now commercialized as a source of β-carotene.

Lectins are carbohydrate binding proteins or glycoproteins of non-immune origin, and agglutinate cells. Lectins agglutinate red blood cells reflecting blood group specificites.

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(Boyd and Shapleigh, 1954). Lectin stimulates lymphocyte division in in vitro and found to be mitogenic (Sharon, 1976). The plant protein ricin has emerged as toxin of choice in cancer therapy. It inhibits tumour cell development. (Nicolson & Blaustein, 1972).

Lectin binding studies are useful in examining changes of neoplastic transformation, irregular staining, is an indicator of malignant potential (Balaram et al., 1996, Beena et al., 1998). Psophocarpus tetragonolobus and Jack fruit (Artocarpus integrifolia) lectins bind to the malignant lesions of oral cavity, breast, uterus and thyroid gland, (Vijayakumar et al., 1985, 1987, 1992; Remani et al., 1980, 1990, 1993, 1994, 1997, 1998). The preferential agglutination and binding of normal and malignant cells is based on the lectin receptors.

Table-1

Distribution of lectin and b-carotene in edible species

Sl. No.	Species & samples	1 Agglutination in PBS				2 Agglutination with PVP				3 b-Carotene content
1	Abelmoschus esculentus-pod.	+	-	-	-	+	+	+	+	52
2	Achros zapota – fruit	+	+	+	+	+	+	+	+	97
3	Allium sativum-bulb	-	-	-	-	+	+	+	+	220
4	Anacardium occidentale – seed kernel	-	-	-	-	+	+	+	+	60
5	Artocarpus integrifolia fruit with seed	+++	+++	+++	+++	+++	+++	+++	+++	175
6	Basella rubra – leaf	-	-	-	-	+	+	+	+	7440
7	Beta valgaris – leaf	-	-	-	-	+	+	+	+	5862
8	Brassica oleracea var. botrytis cauli flower inflorescence	-	-	-	-	+	+	+	+	30
9	Brassica oleracea var.calurapa– tuber	++	++	+	+	++	++	++	++	21
10	Coccinia indica- fruit	-	-	-	-	+	+	+	+	156
11	Cucumis melo - fruit	-	-	-	-	+	+	+	+	169
12	Cucuribita maxima- fruit	-	-	-	-	+	+	+	+	50
13	Curcuma domestica- rhizome	-	-	-	-	+	+	+	+	30
14	Cyamopsis tetragonoloba- pod	-	-	-	-	+	+	+	+	198
15	Daucus carota –leaf	+	-	-	+	+	+	+	+	5700
16	Ipomoea batatus- root	-	-	-	-	+	+	+	+	6
17	Lab-lab purpureus- pod	+++	+++	+++	+++	+++	+++	+++	+++	1480
18	Luffa acutangula -fruit	+	+	+	+	+	+	+	+	33
19	Lycopersicon esculentum- fruit	++	++	++	++	++	++	++	++	315
20	Macrotyloma uniflorum- pod	+	-	+	-	++	-	++	-	187
21	Mangifera indica- fruit	-	-	-	-	+	+	+	+	2743
22	Momordica charantia- fruit	+	+	+	+	++	++	++	++	126
23	Morus alba- fruit	+++	+++	+++	+++	+++	+++	+++	+++	57
24	Phaseolus vulgaris- pod	++	+++	+++	+++	+++	+++	+++	+++	132
25	Phoenix dactylifera- fruit	+	+	+	+	+	+	+	+	26
26	Phyllanthus fraternus- fruit	+	+	+	+	+	+	+	+	1264
27	Piper nigrum- seed	-	-	-	-	+	+	+	+	1080
28	Pistacia vera- kernal	+	+	+	+	+	+	+	+	144
29	Prunus armeniaca -fruit	-	-	-	-	+	+	+	+	2160
30	Prunus domestica- fruit	-	-	-	-	+	+	+	+	160
31	Spinacia oleracea- leaf	-	-	-	-	+	+	+	+	5580
32	Syzygium cumnii-fruit	-	-	-	-	+	+	+	+	48
33	Syzygium jambolanum- fruit	+	+	+	+	+	+	+	+	141
34	Thea sinensis- leaf	+	-	-	+	+	+	+	+	1280
35	Triticum vulgare- fruit	+	+	+	+	++	+	++	++	64
36	Tricosanthes anguina-fruit	++	++	++	++	++	++	++	++	96
37	Vigna unguiculata- pod	-	-	-	+	+	+	+	+	564
38	Vitis vinifera var.black-fruit	-	-	+	-	+	+	+	+	03
39	Zingiber officinale- rhizome	-	-	-	-	+	+	+	+	40
40	Zizyphus jujuba- fruit	-	-	-	-	+	+	+	+	21

Note:
β-Carotene values given per 100 g. of edible portion.
+++: Very strong agglutination,
++ : Strong agglutination,
+ : Weak agglutination
A,B,AB and O: Blood groups

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