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RESEARCH ARTICLE

HEMATOLOGICAL STATUS OF SELECTED WOMEN IN MARATHAWADA REGION

*Dr. Varsha S. Zanvar and Pradnya Dhutmal

Department of Home Science, Shri Yogan and swami Arts college, Basmat, Dist. Hingoli (M. S.). India

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*Corresponding author:
Dr. Varsha S. Zanvar

ABSTRACT

A study was conducted on hematological status of selected women in Marathwada region, of Maharashtra state, India. Seven uncommonly consumed green leafy vegetables namely *Drumstick Leaves*, *Amranthus Spinousus*, *Amranthus Paniculatus*, *Cauliflower Leaves*, *Mustered Leaves*, *Bathua Leaves* and *Beetroot Leaves* were selected. Fresh and dehydrated green leafy vegetables were analyzed for proximate composition, minerals and vitamin content. On the basis of high mineral content of leafy vegetables, five products i.e. *Shev*, *Chakali*, *Kharapara*, *Papad* and *Bundi* were developed utilizing cauliflower green dehydrated vegetable. Intervention study was carried out for a period of 90 days on selected 75 women household women who were suffering with anemia. Prior to intervention the HB content was determined. Based on the HB content household women were arranged in descending order. Subjects belonging to experimental group received developed product, experimental control group neither received tablet nor product and normal control group received tablet. After the feeding trail was over the blood sample was collected with the help of trained personnel. The collected blood was immediately analyzed for HB, RBC, MCV, MCH and MCHC content. The result showed that among all selected vegetables dehydrated cauliflower leaves exhibits highest mineral content in dehydrated form i.e. iron (234.12 mg/100gm) and calcium (6504.62 mg/100gm). The nutrient content of products was ranged for protein (12.12 to 20.95 gm/100gm), fiber (3.15 to 8.94 gm/100gm), iron (26.63 to 43.57 mg/100gm), calcium (708.36 to 780.67 mg/100gm), ascorbic acid (1.88 to 3.16mg/100gm) and β -carotene (297.17 to 401.02ug/100gm) respectively. Among all products *Chakli* was highly accepted and nutritious hence selected for intervention. The experimental women exhibited 2.95 percent increment for hemoglobin. Mean values of RBC and MCV were improved by 0.44 percent and 4.00 percent. The highest increment was noted with respect to MCH content (23.67 percent) followed by MCV (14.89 percent).

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INTRODUCTION

Anemia continues to be a major public health problem worldwide with the highest prevalence in developing countries. Anaemia affects half a billion women of reproductive age worldwide. In 2011, 29% (496 million) of non-pregnant women and 38% (32.4 million) of pregnant women aged 15–49 years were anaemic (WHO, 2011). Nutritional anemia is a disease syndrome caused by malnutrition in its widest sense. According to WHO, anemia is defined as a condition in which the hemoglobin content of blood is lower than normal as a result of a deficiency of one or more essential nutrients, regardless of the cause such deficiency (Park, 2015). Green leafy vegetables (GLV) are micronutrient dense nature's gift to mankind that provides more vitamins per mouthful than any other food. GLV are known to be rich sources of micronutrients such as vitamin A, iron, β -carotene, etc. and utilizing them is one way of ensuring the micronutrient intake. They also contain an immense variety of bioactive, non-nutritive health enhancing factors such as antioxidants, phytochemicals, essential fatty acids and

dietary fiber. Being rich in nutrients the leaves of the vegetables may be utilized for the purpose of enrichment of nutritional inferior/deficient products. These vegetables if not preserved within few days after harvest will begin to decay. In an attempt at preserving these vegetables from being decayed, drying as one of the oldest methods of food preservation is often used (Omojola and Olusola, 2009). The present research work was carried out with the aim to develop value added product by utilizing uncommonly consumed leafy vegetables and assessed the impact of these product on hematological status of adult women.

MATERIALS AND METHODS

The various uncommon green leafy vegetables were procured from local market of Nanded city i.e. *Drumstick Leaves*, *Amranthus Spinousus*, *Amranthus Paniculatus*, *Cauliflower Leaves*, *Mustered Leaves*, *Bathua Leaves* and *Beetroot Leaves*. Cleaned vegetables were washed chopped and oven dried at 80 °C for 8 to 10 hours and powder was prepared till it ground to pass through a 40 mesh sieve and stored.

Table 1. Proximate composition of uncommon green leafy vegetables as is basis

Leafy vegetables	Moisture (gm/100gm)		Protein (g/100 g)		Fat (g/100 g)		Fiber (g/100 g)		CHO (g/100g)		Ash (gm/100gm)	
	Fresh L.	Dry L.	Fresh L.	Dry L.	Fresh L.	Dry L.	Fresh L.	Dry L.	Fresh L.	Dry L.	Fresh L.	Dry L.
Drumstick Leaves(<i>Moringo Oleifira</i>)	75.45	13.78	4.04	16.55	1.50	2.41	1.01	4.40	15.73	50.4	2.28	9.52
AmranthusSpinousus (<i>Amranthus S.</i>)	83.59	12.91	3.62	13.94	0.61	2.43	1.21	5.68	13.46	48.67	2.56	10.44
AmranthusPaniculatus (<i>Amranthus P.</i>)	78.72	14.79	4.93	16.77	1.20	2.78	2.10	6.21	12.46	42.44	3.59	12.16
Cauliflower Leaves (<i>Brassica Oleraceabotrytis</i>)	79.49	13.37	5.36	21.87	1.42	2.12	2.23	7.59	9.74	42.04	3.61	13.52
Musteredseed Leaves (<i>Brassica Gulcea</i>)	88.19	12.48	3.55	12.40	0.82	2.02	0.10	3.57	18.83	58.95	1.63	5.60
Bathua Leaves (<i>Chenopodium album Linn</i>)	88.21	11.77	4.11	17.40	0.83	1.91	0.91	4.89	7.36	51.58	2.63	10.46
Beetroot Leaves (<i>Bata Vulgaris</i>)	85.56	12.80	2.95	12.43	0.92	1.72	0.71	4.54	11.68	54.04	2.21	10.47

Table 2. Mineral and vitamin content of uncommon green leafy vegetables as is basis

Leafy vegetables	Calcium (mg/100 g)		Iron (mg/100gm)		Ascorbic Acid (mg/100g)		β-Carotene (mg/100 g)	
	Fresh L.	Dry L.	Fresh L.	Dry L.	Fresh L.	Dry L.	Fresh L.	Dry L.
Drumstick Leaves(<i>Moringo Oleifira</i>)	426.57	5620.62	1.12	26.51	200.14	18.21	6240.21	6868.66
AmranthusSpinousus (<i>Amranthus S.</i>)	780.82	7852.02	21.16	196.53	30.35	12.24	3650.45	3966.66
AmranthusPaniculatus (<i>Amranthus P.</i>)	523.87	6610.82	18.33	102.11	78.25	15.24	13458.24	16485.66
Cauliflower Leaves (<i>Brassica Oleraceabotrytis</i>)	620.62	6504.62	37.78	234.12	45.12	12.54	2425.24	2737.33
Musteredseed Leaves (<i>Brassica Gulcea</i>)	150.62	1372.18	16.99	88.27	35.21	08.61	2684.24	2831.66
Bathua Leaves (<i>Chenopodium album Linn</i>)	151.82	1145.22	5.54	99.21	34.34	08.34	1780.21	2454.23
Beetroot Leaves (<i>Bata Vulgaris</i>)	370.70	3731.12	17.10	101.37	68.34	16.31	5984.10	7866.66

Fresh and dehydrated uncommon green leafy vegetables was analyzed for proximate composition and micro nutrient content. Dehydrated *cauliflower green* contained high amount of minerals content than the other leafy vegetables. Five value added products i.e. *Shev, Chakali, Kharapara, Papad and Bundi* were prepared by incorporating different proportion of powdered cauliflower leaves. Highly acceptable variations of each food product was analyzed for nutrient content i.e proximate composition and micro nutrient content. Intervention study was carried out for a period of 90 days on selected 75 women household women who were suffering with anemia, the group were consisted of normal control, experimental control and experimental group. Prior to intervention the HB content was determined. Based on the HB content household women were arranged in descending order. All those women who have higher HB content were categorized under normal control. The remaining women were randomly categorized into two groups. i.e. experimental control and experimental groups. Subjects belonging to experimental group received developed product, experimental control group neither received tablet nor product and normal control group received tablet. After the feeding trail was over the blood sample was collected with the help of trained personnel. The collected blood was immediately analyzed for HB, RBC, MCV, MCH and MCHC content.

RESULTS AND DISCUSSION

Proximate composition of uncommon green leafy vegetables is reported in Table 1. Moisture content of the analyzed samples of fresh green leafy vegetables ranged between 75.45 to

88.21 gm/100gm, with the highest being in *Bathua leaves* (88.21gm/100gm) and lowest in *Drumstick leaves* (75.45gm/100gm). Whereas dehydrated vegetables ranged from 11.77 to 19.80mg/100gm. Highest being in *Amaranthuspaniculatus* and lowest in *Cauliflower leaves*. Dehydrated *Cauliflower leaves* contained high amount of protein (21.87gm/100gm) than the other selected vegetables. Green leafy vegetables are very poor source of fat which ranged 0.61 to 1.50gm/100gm in fresh and 1.72 to 2.78 gm /100gmin dehydrated leafy vegetables. Highest crude fiber values was recorded by Dehydrated *Cauliflower leaves* (7.59gm/100gm) and lowest was found in *mustered leaves* (3.57 gm/100gm). The lower carbohydrate content (7.36/100gm) was noted in fresh *Bathua leaves* and high in dehydrated *Mustured leaves* i.e. 58.95gm/100gm. The values of ash content on dry weight basis ranged between 5.60 to 13.52 gm/100gm however noted highest in *Cauliflower leaves* (13.52gm/100gm) and lowest in *Mustured leaves* (5.60mg/100gm). Table 2. reported the minerals and vitamins content of fresh and dry uncommon green leafy vegetables. Among all selected and analyzed leafy vegetables, fresh and dehydrated *Cauliflower leaves* contained high amount of iron i.e. 37.78 and 234.12 mg/100gm. While *Drumstick leaves* showed poor source of iron i.e. 1.12mg and 26.51 mg/100gm. The other selected leafy vegetables contained appreciable amount of iron. Further, values of calcium content in analyzed fresh and dry vegetables indicated that *Amaranthus spinosus* contained high amount(780.82 and 7852.02mg/100gm) and *Bathua leaves* showed lowest content (151.82 and 1145.22mg/100gm). Further table showed that vitamin- C content of selected vegetables ranged from 30.35 to 200.14.Highest values were depicted by *Drumstick leaves* 200.14 mg/100gm .The values for ascorbic acid in dehydrated leafy vegetables were low than the fresh leaves which ranged from 08.34mg/100gm

Table 3. Nutritional composition of traditional food products with incorporation of dry Cauliflower leaves

Nutrient	Shev	Chakali	Kaharapara	Papad	Boondi
Moisture (g/100 g)	10.32	12.19	5.16	8.35	10.07
Protein (g/100 g)	20.95	12.52	12.12	14.23	20.42
Fat (g/100 g)	8.42	8.21	11.24	13.45	8.29
Fibre (g/100 g)	4.96	4.34	3.15	4.09	8.94
Carbohydrate (g/100g)	51.43	59.91	66.59	56.76	48.36
Ash (g/100gm)	3.92	2.83	1.74	3.12	3.92
Iron (mg/100 g)	28.87	28.36	43.57	26.63	28.87
Calcium (mg/100 g)	724.36	708.36	720.10	780.67	724.36
Ascorbic Acid (mg/100g)	3.16	1.88	1.98	2.01	3.16
β -Carotene (mg/100 g)	401.02	317.68	297.17	323.93	401.02

Table 4. Haematological status of selected women belonging to experimental control group.

Particular	Before Intervention	After Intervention	't' values	Percent improvement
Hb (gm/dl)	14.38±0.38	14.61±0.48	0.03NS	1.59
RBC	4.49±0.29	4.84±0.52	0.01NS	7.23
MCV	84.2±5.48	86.9±5.10	0.29NS	1.50
MCH	29.65±1.81	32.83±2.34	1.13NS	10.72
MCHC	34.07±1.08	34.99±1.99	0.02NS	3.10

NS - Non significant, *- Significant at 5 per cent, **-Significant at 1 per cent

Table 5. Haematological status of selected women belonging to normal control group

Particular	Before Intervention	After Intervention	't' values	Percent improvement
Hb (gm/dl)	13.09±0.50	13.73±0.33	1.29NS	4.88
RBC	4.46±0.48	4.49±0.29	0.40NS	0.67
MCV	82.16±11.49	83.78±6.46	0.29VS	1.97
MCH	30.44±11.02	32.21±6.50	0.24NS	5.81
MCVC	33.19±1.40	35.29±3.34	0.01NS	6.32

NS - Non significant, *- Significant at 5 per cent, **-Significant at 1 per cent

Table 6. Haematological status of selected women belonging to experimental group

Particular	Before Intervention	After Intervention	't' values	Percent improvement
Hb (gm/dl)	11.51±1.37	11.48±1.01	1.20NS	2.95
RBC	4.46±0.55	4.48±0.36	0.44NS	0.44
MCV	74.13±14.29	77.10±15.98	0.24NS	4.00
MCH	26.99±9.6	33.38±3.45	0.01NS	23.67
MCVC	32.16±2.64	36.95±11.22	0.02NS	14.89

NS - Non significant, *- Significant at 5 per cent, **-Significant at 1 per cent

(Bathua leaves) to 18.21mg/100gm (Drumstick leaves). The β -carotene content of analyzed greens shows that highest content was recorded for *Amaranthus paniculatus* (13458.24) followed by Drumstick leaves, Beetroot leaves and *Amaranthus spinosus* (6240.21, 5984.10 and 3650.45). Further the levels of β -carotene in the dehydrated leafy vegetables ranged between 2454.23ug/100gm. (Bathua leaves) to 16485.66ug/100gm (*Amranthus Spinosus*). Nutrient composition of developed products with incorporation of dehydrated cauliflower leaves in various traditional products i.e. *Shev, chakali, Kharapara, Papad and Bundi* is presented in Table 3. The result showed that the proximate composition of developed products ranged from moisture (5.16 to 12.19gm/100gm), protein (12.12 to 20.95 gm/100gm), fat (8.21 to 13.95gm/100gm), fiber (3.15 to 8.94 gm/100gm), carbohydrate (51.43 to 66.59gm/100gm) and ash (1.74 to 3.92 gm/100gm). However, the minerals and vitamin content for iron, calcium, ascorbic acid and β -carotene ranged from 26.63 to 43.57 mg/100gm, 708.36 to 780.67mg/100gm, 1.88 to 3.16mg/100gm and 297.17 to 401.02 ug/100gm respectively. The change in hematological parameters of adult women selected as experimental group for intervention is presented in Table 4. The experimental group women were neither received tables nor developed products. The hemoglobin level of selected women increased from 14.38±0.38 to 14.61±0.48 with 1.59 percent improvement. In case of RBC 7.23 percent improvement was noted. The increment was highest for MCH (10.72 percent) and lowest in MCV (1.50 percent).

Though the percent improvement was noted statistically non-significant difference was observed, for all hematological parameter. The findings also support all the respondents in the study were found to be anemic. Table 5. Explains the hematological status of selected women as normal control group for intervention. The selected women recorded highest increment with respect to MCH (6.32 percent) and MCHC (5.81 percent) followed by hemoglobin (4.88 percent). The least increment was noted with respect to RBC and MCV. The women of normal control group were received one tablet of iron and ferrous sulfate for 3 months. Though it was there, non-significant difference was noted between the values of all hematological parameters after before and after intervention. The hematological status of selected women belonging to experimental group is reported in Table 53. These women were received developed products for experimental period of 90 days.

The women recorded the mean hemoglobin of 11.51±1.37 to 11.48±1.01, which was increased by 2.95 percent after intervention. Further, the mean values of RBC and MCV improved from 4.46±0.55 to 4.48±0.36 and 74.13±14.29 to 77.10±15.98 which increased by 0.44 percent and 4.00 percent after intervention. The highest increment was note with respect to MCH content (23.67 percent) followed by MCVC (14.89 percent). Statistically non-significant difference as noted after intervention in all hematological parameters.

Conclusion

It can be concluded from the study that among all selected vegetables dehydrated cauliflower leaves exhibit highest mineral content in dehydrated form i.e. iron (234.12 mg/100gm) and calcium (6504.62 mg/100gm). The nutrient content of products was ranged for protein (12.12 to 20.95 gm/100gm), fiber (3.15 to 8.94 gm/100gm), iron (26.63 to 43.57 mg/100gm), calcium (708.36 to 780.67 mg/100gm), ascorbic acid (1.88 to 3.16mg/100gm) and β -carotene (297.17 to 401.02ug/100gm) respectively. Among all products *Chakli* was highly accepted and nutritious hence selected for intervention. The experimental women exhibited 2.95 percent increment for hemoglobin. Mean values of RBC and MCV were improved by 0.44 percent and 4.00 percent. The highest increment was noted with respect to MCH content (23.67 percent) followed by MCVC (14.89 percent). The study concluded that selected uncommon green leafy vegetables are good source of macro and micro nutrients. They are good source of iron, calcium, ascorbic acid, β -carotene. It can be recommended that regular consumption of these uncommon green leafy vegetables will be helpful for nutritional requirement to overcome the micro nutrient malnutrition at

household's level with minimum cost. Cauliflower leaves which are normally wasted can be used as a valuable source of micronutrient like, iron, calcium.

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