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Nutritional Status of Vegetable Cultivators of West Bengal, India

Jagannath Ghosh[1], Shruti Agrawal[2], Pratiti Ghosh[1]*

Abstract

Background: West Bengal is a major producer of fresh vegetables in India. Despite that the farmers belongs to the low socio-economic group and thus their food insecurity exists, necessitating assessment of their nutritional status. **Methods:** Based on their activity level, a descriptive cross-sectional study was conducted to assess the nutritional status of 333 vegetable cultivators of North 24 Parganas district comprising of both males and females. Using 24-hr dietary recall questionnaire, the daily nutritional intake were evaluated to estimate nutritional insufficiency, including that of vitamin A, thiamin, riboflavin and vitamin C, iron, zinc, calcium and magnesium. The collected data were statistically analyzed using mean, standard deviation and t-test using SPSS (version 22). **Result and Conclusion:** Deficiency of micronutrients is common among the vegetable cultivators, along with excess intake of energy which create imbalance in the nutrient intake irrespective of gender and activity levels.

Keywords: Micronutrient deficiency, Cultivators, Activity level

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Introduction

West Bengal has emerged as the major vegetable producer state in India where the vegetable cultivators are the major group of contributors. Despite the fact that they are predominantly the food producers of the nation, majority of them are still food insecure. The total food intake status of these farmers and the level of productivity are interlinked.[1] Improper nutritional consumption is one of the leading causes of macro and micronutrient deficiency viz., protein, calcium, zinc, folic acid, etc. and chronic diseases such as diabetes and cardiovascular disease. This may result in increase in medical expenses as well as decrease in work capacity which are detrimental to the economy.[2,3]

Indian farmers of many states still use the traditional methods and agricultural equipments thus constituting the heavy labor group. Farmers are exposed to physical, chemical and biological risk factors for which maybe combated with appropriate nutrition.[4,5]

Hence, this study has been undertaken to assess the nutritional status of vegetable cultivators based on their activity level.

Maerials and Methods

Subject Selection

A descriptive cross-sectional study was conducted for the nutritional status assessment of 333 vegetable cultivators of North 24 Parganas district comprising of both male (171) and female (162) workers. These subjects were subdivided into three categories according to their occupational workload, viz., sedentary worker (SW) (normal work in the fields) moderate worker (MW) (work as agricultural labor) and heavy worker (HW) (hard working labors). They were categorized as 55 male SW, 52 female SW, 51 male MW, 60 female MW, 65 male HW, and 50 female HW.

Inclusion Criteria

Only cultivators, who were willing and submitted written consent for participation, were included in the study. The subjects used traditional and mechanized (mixed) technique of farming and toiled on regular basis in the fields for more than 1 year.

[1]Department of Physiology, West Bengal State University, Barasat, West Bengal, India

[2]Department of Food and Nutrition, Budge Budge College, Kolkata, West Bengal, India

Corresponding Author: Pratiti Ghosh, Department of Physiology, West Bengal State University, Barasat, West Bengal, India. E-mail: pratitig@wbsu.ac.in

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Conflicts of interest: None.

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Exclusion Criteria

Vegetable cultivators suffering from chronic disease were excluded from this study. Besides, those who earned from other agricultural fields (paddy/wheat/tea) were also excluded.

Questionnaire Study

Having gained the general demographic questionnaire, the validated 24-h dietary recall questionnaire was completed for three intermittent non-sequential days. The daily nutritional intakes were converted from the domestic scale to grams and the amount of intake of energy, macronutrients and were calculated. To estimate nutritional sufficiency, vitamin A, thiamin, riboflavin and vitamin C, iron, zinc, calcium and magnesium intake were calculated.[6]

Data Analysis

The collected data were analyzed using mean, standard deviation and *t*-test using SPSS (version 22). *t*-test, Chi-square test (for row by columns contingency table) were used to assess the level of significance ($P < 0.05$) between the two groups.

Results and Discussion

Agricultural work is a strenuous, hazardous and accident prone job, so the workers require sufficient amount of nutrients according to their job demands. The workers fulfill their nutritional requirements through the food which may rich in all required nutrients. Hence, if the diet is deficient in pulses, milk and milk products, green leafy vegetables, fruits and other food groups which make them more susceptible to musculoskeletal disorders common being low back pain, upper back pain, shoulder pain, etc.

The physical characteristics, age, work experience, and working hours have been compiled in Table 1, wherefrom it may be derived that, the Body Mass Index (BMI) of both groups are normal (20–25) according to the World Health Organization (WHO) classification.[7]

Table 1 represents the physiological and anthropometric parameters such as height, weight BMI, waist circumference, and hip circumference waist-hip ratio of the vegetable cultivators comprising of both male and female groups.

According to the result, there is a significance difference ($P < 0.05$) between the height and weight of the two groups and obviating significance difference ($P < 0.05$) between their BMI. There is no significant difference between the waist hip ratios of the two groups.

The Table 2 represents the food consumption level of the vegetable cultivators per capita per day. Inadequate consumption was noted for all food groups except for cereals when compared with ICMR recommended values for moderately active male and females.[8]

Male vegetable cultivators consumed 556.6 ± 52.3 g cereals/day per person where female vegetable cultivators consumed 448 ± 42.9 g cereals daily and there is a significant difference between the intake levels of the two groups P <0.001. The male and female vegetable cultivators consumed 28.1 ± 7.9 g and 24.9 ± 6 g of pulses daily where the recommended level is higher (male: 90 g, female: 75 g).

In a related study on Shivashankar and Revanna (2018), the respondents consumed more cereals than recommended dietary allowances (RDA) when compared to other food groups. The probable reason may be their cropping pattern and food habit of the respondents in the study area of Hassan District of Karnataka. The consumption of pulses, sugar and jaggery, fish and fleshy foods, fats and oils were fairly good. This trend may be due to the socio-economic condition and cultural pattern of the respondents. Consumption of milk, green leafy vegetables, roots, tubers, other vegetables, fruits, was less compared to RDA and there is significant difference between consumption levels of those food groups.[9]

According to Prabhat and Khyrunnisa (2012) non-vegetarian food type had effect on consumption of pulses and sometimes on green leafy vegetables. Considering income of the family difference in consumption of all food groups was meager.[10] According to Jain, and Singh, 2013 cereals form the bulk of the daily diet (328–397 g). Consumption of other food items was low in case of pulses (20.8 g) and green leafy vegetables (6–8 g) in rural women.[11]

Table 3 denotes the nutritional consumption levels of the male sedentary vegetable cultivators based on the recommendation levels (ICMR for Indians, 2020). According to the table, the subjects consumed 2503.4 ± 114.3 kcal energy/day which is approximately 19% higher than their recommendation level ($P < 0.0001$).

The male vegetable cultivators consumed approximately 31% excess protein (70.7 ± 18.3 g) than recommended value ($P < 0.05$).

The male vegetable cultivators consume approximately same amount of iron daily (18.9 ± 4.9 mg) compare with their daily requirement (19 mg) as a result there is no significant difference.

The male subjects also suffer from calcium deficiency, they consume approximately 45 % deficient amount of calcium than

Table 1: Physiological and anthropometric parameters of the vegetable cultivators (Mean±SD) (P<0.05)

Parameters	*Male (n=171) (Mean±SD)*	*Female (n=162) (Mean±SD)*	*t-value*	*P value*	*Remarks (P<0.05)*
Age (years)	40.29±10.87 (20–60 years)	38.64±10.93 (20–60 years)	1.38	0.08	S
Height (cm)	159.52±9.18	150.30±6.69	9.26	<0.0001	S
Weight (kg)	57.23±8.10	50.18±8.70	7.63	<0.0001	S
Body Mass Index (kg/m^2)	22.18±2.86	22.02±2.96	2.38	0.009	S
Waist Circumference (cm)	82.80±8.78	82.83±10.41	0.02	0.49	NS
Hip Circumference (cm)	86.46±6.26	87.52±10.41	–0.77	0.22	NS
Waist Hip Ratio (WHR)	0.95±0.05	0.93±0.06	1.22	0.11	NS
Working Hours	8.93±1.03	8.13±1.09	4.85	0.27	NS
Working Experience (Years)	20.00±8.07	19.58±8.11	0.73	0.23	NS

Significant (S); Non Significant (NS)

Table 2: Food groups consumed by both male and female vegetable cultivators

Parameters	*Male (n=171) (Mean±SD)*	*Female (n=162) (Mean±SD)*	*t-value*	*P value*	*Remarks (P<0.05)*
Cereals (g)	556.64±52.30	448.05±42.95	16.82	<0.001	S
Pulses (g)	28.16±7.92	24.97±6.01	3.68	<0.001	S
Milk and Milk Product (ml)	175.94±60.84	138.98±44.13	2.59	0.005	S
Green Leafy Vegetables (g)	35.91±13.13	49.94±19.56	–6.95	<0.001	S
Roots and Tubers (g)	92.48±29.12	83.30±22.17	2.62	0.004	S
Other Vegetables (g)	273.88±42.50	264.95±39.33	1.63	0.05	S
Fats and Oils (g)	28.80±22.67	23.92±2.67	2.17	0.15	NS
Sugar and Jaggery (g)	11.18±3.78	9.34±4.96	4.67	0.386	NS

Significant (S); Non Significant (NS)

the recommendation values and there is a significant difference ($P < 0.0001$), they also suffer from vitamin A, vitamin B2 and zinc deficiency and there is a significant difference between the requirement level and consumption level.

According to the Achinihu *et al*. (2016), the nutrient intake of farmers were below the FAO/WHO (1993) recommendations in energy, protein, fat, iron, calcium and vitamin A.[12]

Table 3 shows the daily nutrient intake by the sedentary female respondents. There is a significant difference between the level consumed and recommendation, the female vegetable cultivators consumed 2071.3 ± 95.5 kcal energy daily which is 9% excess than the recommendation levels ($P < 0.0001$).

The female vegetable cultivators consumed 56.3 ± 8.3 g protein daily which is approximately 23% excess than the recommended level of 45.7 g daily and there is a significant difference ($P < 0.0001$).

The result denotes that the female SW have the deficiencies of calcium, vitamin A, vitamin C, vitamin B2, iron, magnesium and zinc ($P < 0.005$). Iron deficiency is the major problem for women and there is a significant difference ($P < 0.0001$).

A related study was done by Halvani *et al*. (2012) which showed that an imbalance in the diet based on cereal, beans and starchy vegetables specially potatoes. Their diet also lacked in fruits, vegetables and dairies thus leading to low intake of micronutrients (vitamins and minerals).[13]

Table 4 comprised of the daily intake levels of male MW with their daily requirements levels (ICMR recommendation, 2020).

According to the results, the subjects consumed excess of macronutrients (energy, protein and fat) daily and there was a significant difference with respect to their recommended values ($P < 0.0005$).

The male moderate vegetable cultivators also consumed excess phosphorus ($P < 0.05$) than the recommended value of 1000 mg. They consumed approximately 3% less calcium (973.3) compared to their recommended value of 1000 mg.

The subjects suffered from vitamin A, vitamin B2 and zinc deficiency ($P < 0.0001$); they consumed approximately same amount of iron daily at par with the recommended levels. The subjects also consumed approximately 76% deficient amount of vitamin B2 than recommended level ($P < 0.0001$) but excess amount of other vitamin and minerals such as vitamin B1, vitamin C, and magnesium.

Table 4 also represents the nutritional requirement of female moderate working respondents. There is a significance difference between the macronutrient and micronutrient consumption level such as energy, fat, carbohydrate, calcium, vitamin A and zinc. The result also showed that calcium and iron deficiency were major health risk for females. The female cultivators consumed approximately 55% deficient calcium daily (446.6 ± 161 mg) than the recommended levels (1000mg) ($P < 0.0001$). The subjects consumed approximately 42% deficient amount of iron daily (16.9 ± 8.4 mg) than the recommended levels (29mg) ($P < 0.0005$). The subjects also suffered from vitamin A, B2 and zinc deficiency, being approximately 61% deficient in vitamin A (330 ± 207.3 µg)

Table 3: Nutritional requirements of the sedentary working vegetable cultivators male (M) and female (F)

Parameters	*Nutrient Consumed (Mean±SD)*		*ICMR Recommendation, 2020*		*t –value*		*P value*		*Remarks (P<0.05)*	
	M (n=55)	*F (n=52)*	*M*	*F*	*M*	*F*	*M*	*F*	*M*	*F*
Energy (K cal)	2503.44±114.38	2071.33±95.50	2100	1660	10.58	16.11	<0.0001	<0.0001	S	S
Protein (g)	70.71±18.37	56.39±8.37	54	45.7	2.73	4.68	0.006	<0.0001	S	S
Fat (g)	38.67±9.11	31.16±8.80	25	20	4.5	4.74	0.0001	<0.0001	S	S
Calcium (mg)	548.86±152.82	440.68±243.12	1000	1000	−8.86	−8.61	<0.0001	<0.0001	S	S
Phosphorus (mg)	1468.63±187.11	1322.07±390.29	1000	1000	7.51	3.09	<0.0001	0.002	S	S
Iron (mg)	18.94±4.90	14.46±4.36	19	29	−0.03	−12.45	0.48	<0.0001	NS	S
Vitamin A (µg)	467.89±200.30	334.34±272.21	1000	840	−7.97	−6.95	<0.0001	<0.0001	S	S
Vitamin B1 (mg)	1.88±0.40	1.59±0.35	1.4	1.4	3.57	2.04	0.001	0.02	S	S
Vitamin B2 (mg)	0.98±0.42	0.71±0.33	2.0	1.9	−7.07	−13.41	<0.0001	<0.0001	S	S
Vitamin C (mg)	109.51±68.55	94.87±58.93	80	65	1.29	1.9	0.10	0.03	NS	S
Magnesium (mg)	334.5±37.63	258.79±41.69	385	325	−4.03	−5.94	0.0003	<0.0001	S	S
Zinc (mg)	6.31±0.56	5.52±0.73	17	13.2	−57.16	−39.14	<0.0001	<0.0001	S	S

Significant (S); Non significant (NS)

Table 4: Nutritional requirements of the moderate working vegetable cultivators male and female

Parameters	*Nutrient Consumed (Mean±S D)*		*ICMR Recommendation, 2020*		*t –value*		*P value*		*Remarks (P<0.05)*	
	M (n=51)	*F (n=60)*	*M*	*F*	*M*	*F*	*M*	*F*	*M*	*F*
Energy (K cal)	3012.36±218.94	2367.12±116.25	2700	2130	4.28	6.12	0.0002	<0.0001	S	S
Protein (g)	73.27±4.92	77.11±24.85	54	45.7	11.74	3.79	<0.0001	0.0007	S	S
Fat (g)	50.88±6.24	35.44±8.51	30	25	10.03	3.68	<0.0001	0.0008	S	S
Calcium (mg)	973.34±263.35	446.66±161.02	1000	1000	−0.3	−10.35	0.38	<0.0001	NS	S
Phosphorus (mg)	1299.03±325.75	1483.45±144.83	1000	1000	2.75	10.01	0.006	<0.0001	S	S
Iron (mg)	18.31±1.29	16.99±8.46	19	29	−1.6	−4.26	0.06	0.0002	NS	S
Vitamin A (µg)	600.75±185.27	330.03±207.32	1000	840	−6.46	−7.38	<0.0001	<0.0001	S	S
Vitamin B1(mg)	1.67±0.22	1.80±0.68	1.8	1.7	−1.6	0.47	0.06	0.32	NS	NS
Vitamin B2 (mg)	0.66±0.16	1.04±0.78	2.5	2.4	34.13	−5.17	<0.0001	<0.0001	S	S
Vitamin C (mg)	59.61±18.38	92.98±64.95	80	65	−3.33	1.29	0.001	0.10	S	NS
Magnesium (mg)	425.18±32.56	469.98±83.09	385	325	3.89	5.23	0.0004	<0.0001	S	S
Zinc (mg)	7.98±0.77	5.80±0.62	17	13.2	−34.96	35.56	<0.0001	<0.0001	S	S

Significant (S); Non Significant (NS)

Table 5: Nutritional requirements of the heavy working vegetable cultivators male amd female

Parameters	*Nutrient Consumed (Mean±SD)*		*ICMR Recommendation, 2020*		*t –value*		*P value*		*Remarks (P<0.05)*	
	M (n=65)	*F (n=50)*	*M*	*F*	*M*	*F*	*M*	*F*	*M*	*F*
Energy (K cal)	3593.71±124.53	2944.84±59.62	3400	2720	4.67	11.31	<0.0001	<0.0001	S	S
Protein (g)	110.75±38.27	73.82±15.37	54	45.7	4.45	5.49	0.0001	<0.0001	S	S
Fat (g)	56.50±6.36	48.29±5.79	40	30	7.78	9.47	<0.0001	<0.0001	S	S
Calcium (mg)	896.07±353.89	808.03±257.49	1000	1000	−0.88	−2.24	0.19	0.01	NS	S
Phosphorus (mg)	1628.48±346.89	1547.74±238.33	1000	1000	5.44	6.89	<0.0001	<0.0001	S	S
Iron (mg)	28.09±10.24	22.01±7.19	19	29	2.66	−2.91	0.007	0.004	S	S
Vitamin A (µg)	658.66±110.82	648.61±220.15	1000	840	−9.24	−2.61	<0.0001	0.008	S	S
Vitamin B1 (mg)	2.56±0.66	2.58±1.11	2.3	2.2	1.2	1.02	0.12	0.16	NS	NS
Vitamin B2 (mg)	1.80±1.31	1.47±0.98	3.2	3.1	−3.18	−4.95	0.002	<0.0001	S	S
Vitamin C (mg)	149.47±47.71	81.54±30.99	80	65	4.37	1.6	0.0001	0.06	S	NS
Magnesium (mg)	558.48±70.47	457.22±85.17	385	325	7.38	4.67	<0.0001	<0.0001	S	S
Zinc (mg)	9.66±1.28	7.67±0.88	17	13.2	−17.17	−18.79	<0.0001	<0.0001	S	S

Significant (S); Non Significant (NS)

($P < 0.0001$) and the subjects consumed 56% deficient amount of zinc daily ($P < 0.0001$).

In a related study on Chandra *et al*. (2013), the average iron consumption by respondents was 18 mg and 16 mg respectively which is 40 and 46.6% less than recommended level (30 mg).[14-17]

The above table denotes the nutritive values of male HW group. The subjects of this group have vitamin B2 and zinc deficiency as they consumed 43.7% deficient vitamin B2/day than the requirement level (3.2 mg/day) ($P < 0.005$) and 9.6 ± 1.2 mg of zinc/day which is 43.5% deficient than the ICMR recommendation ($P < 0.0001$) the subjects also consume 10.4% deficient amount of calcium daily (896 ± 353.8 mg) than the recommended level (1000mg) but there is no significant difference.

Table 5 also reveals the higher nutritional consumption of the female vegetable cultivators of heavy activity level, than the other working groups. The vegetable cultivators of this group consumed excess amount of energy (8.2%), protein (61.4%) and fat (60.6%) than the recommended values and there is a significant difference ($P < 0.0001$). The subjects also suffer from calcium deficiency, they consumed 19.2% deficient amount of calcium than the recommended value and there is a significant difference ($P < 0.05$) but at the same time the subjects also intake 54.7% excess amount of phosphorus than the recommended value (1000 mg/day) and there is a significant difference ($P < 0.0001$). The female subjects also suffer from iron (24.1%), vitamin A (22.7%), B2 (52.5%), and zinc (41.8%), and there is a significant difference between the consumption level and recommended value ($P < 0.05$).

There is a significant difference between the consumption level of male and female vegetable cultivators. As per ICMR recommendation, 2020 macronutrients along with micronutrients (vitamin C, magnesium and zinc) requirements are quite higher for male rather than female as male vegetable cultivators toiled more than the female.

Conclusion

Finally, it may be concluded from the findings that deficiency of micronutrients is a common difficulties among the vegetable cultivators of North 24 Parganas districts. In contrast, excess intake of energy is leading issue which is creating imbalance in the nutrient intake irrespective of gender and activity levels. Hence, special attention must be paid to this issue along with malnutrition due to deficient intake of nutrients. It is noticed that the diet of the vegetable cultivators are deficient in pulses, milk and milk products, green leafy vegetables, fruits and other food groups such as sugar and jaggery, as a result the micronutrient deficiency is common in them. These micronutrients deficiency creates the vegetable cultivators more susceptible to musculoskeletal disorders common being low back pain, upper back pain, shoulder pain, etc., as muscle quality and muscle strength can be influenced by nutritional status.[18] Iron deficiency anemia is also very common among women vegetable cultivators as their diet is deficient in green leafy vegetables, fruits, sugar and jaggery. Hence, they may request to intake iron reach foods daily to overcome the problems.

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