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Impact and Analysis of Horticulture and Allied Venture Interventions on Socio- Economic Status, Nutritional and Livelihood Security of Scheduled Caste Communities of District Ludhiana, India

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Abstract: The present study carried out in Punjab Agricultural University, Ludhiana under DST- SCSP project to analyze the impact of horticulture and allied venture, on socio-economic status, livelihood and nutritional security of SC beneficiaries. There is no such study conducted in this context in these areas for SC population. Data to assess the impact of DST Project collected from 83 beneficiaries across the four blocks containing 08 villages from Ludhiana district through a structured questionnaire developed by the department of food and nutrition. The information on respondent's food consumption was collected using (24-hour recall). It was observed that around 70% beneficiaries had poor dietary quality largely based on cereals & pulses. Land holding varies 0.008 ha to 0.10 ha and literacy rate includes 36% illiterate. The unavailability of seed, land and low purchasing powers were major barrier in the vegetable consumption before the intervention period. Dietary Diversity Score (DDS) and Food Variety Score (FVS) was calculated before and after the implementation of horticulture interventions with the same set of respondents. DDS and FVS reached from 5.98 to 8.48 and 17.78 to 26.18 respectively after interventions. In addition to this, mean consumption of green leafy vegetables, roots and tubers and other vegetables increased significantly from 1.5, 1.8, 1.8 to 4.2, 3.1, 5.0 respectively after establishing vegetable nutrition gardens in their home. As a result of interventions around 80 percent of respondents achieved dietary diversity with adequate micronutrient intake.

Keywords: Vegetable nutrition garden, DDS, FVS, NAR, Horticulture interventions, SC beneficiaries

Though India is third largest economy in terms of purchasing power parity, but the people living in rural areas specially scheduled caste communities are deprived of adequate nutrients and minerals, is still a biggest concern (Food and Nutrition Security Analysis India 2019). Despite, India is progressing in economic sector but poor nutrient intake leading to poor socio-economic status and health. Lack of awareness about the importance of nutrient intake, unavailability of seed material and land for cultivation of vegetables, low purchasing power and access to market were the major barriers in nutrient intake. The factors related to the decline of dietary variety among the rural community dwelling Japanese elderly people was examined by (Kwon et al 2006). Any change in the nutrient intake can lead to malnutrition with its potentially serious consequences (Singh et al 2014). Vegetables are good source of antioxidants that reduce the incidence of cardiovascular diseases. Evidences suggested that horticulture based nutrition interventions like establishing vegetable nutrition gardens and nutrition education; offer a potentially sustainable approach to reducing multiple nutritional deficiencies (Jones et al 2005). Studies conducted on food consumption suggest that cereal-based diets are much prevalent among rural people due to the cheapest source of energy (Kaur 2005). Dietary diversity is a measure of the number of individual foods or food groups consumed in a given time period. It can reflect household access to a variety of foods and can also act as a proxy for individual nutrient adequacy. A diverse diet increases the probability of nutrient adequacy among people and leads for positive health outcomes such as reduced complications of diabetes, incidence of several cancers and all- cause mortality. As dietary factors are associated with increased risk of chronic diseases, local and international dietary recommendations promote increased dietary diversity but limiting saturated fats, refined sugar and salt. Dietary diversity has been universally identified as a key element of high quality diets (Rathnayake et al 2012). However, lack of dietary diversity is a major nutritional concern among deprived people from the low income countries. Changing from a monotonous diet to one with varied food types has been shown to improve energy and nutrient intakes in the people from developing countries (Jayawardena et al 2013). The diversity in the diet is important to meet the requirements for energy and other essential nutrients especially for those who are in the risk of nutrition deficiencies. There is direct relation between DDS, production and consumption of

seasonal vegetables however, exotic vegetables do not take in to consideration conducted by World Vegetable Centre in Tanzania during 2006-2007(Gudrun and Bruce Cogill 2011. Moreover, increasing food production and crop diversification can only cure malnutrition when it reaches to vulnerable and poor rural people. Therefore, there is need to implement agriculture-based interventions for the nutritional and livelihood security of poor people. Establishing nutrition garden is a direct approach to fulfil the requirement of minerals and nutrients and to ensure the food security as it allows the harvesting of seasonal vegetables on regular basis. The main oobjectives of study was ccollection of baseline data on present socio-economic status, land holding, cropping preference of Scheduled Caste community in the selected villages and beneficiaries and to impart the training.

MATERIAL AND METHODS

Selection of Subjects

Location, time and respondents: For this study, 3 surveys were conducted i.e. one survey was conducted to collect the baseline data of selected beneficiaries to collect information about their socioeconomic status and dietary food habits before the implementation of project during March- April 2019 and remaining two surveys were conducted in different season in whole year i.e. summer season (April to September) and winter season (November to March) 2020-2021 from 83 Scheduled Caste farmers consisting of 50 farm women and 33 farmers across the 4 block containing 8 villages i.e. Block Doraha Latitude: 30° 48' 59.99" N, Longitude: 76° 00' 60.00" E (Village: Rampur & Begowal), Block Khanna Latitude 30° 42' 19.69" N, Longitude: 76° 13' 19.06" E (Village: Bijja & Mandiala Kalan), Block Samrala Latitude 30° 50' 24.00" N , Longitude: 76° 11' 24.00" E (Village: Chawa & Ajlaud) and Block Dehlon 30.7425° N, 75.8461° E (Village: Jaspal Banger & Tibba) in Ludhiana district of Punjab through structured questionnaire developed by the Department of Food & nutrition PAU. In the selected villages, land holding of all farmers ranges from 0.008 ha to 0.10 ha and 80 % of beneficiaries belongs to labour class and below poverty line (BPL) families.

Data collection: During surveys, 24 hour recall method (for three consecutive days was used to collect detailed information regarding daily food habits. Dietary diversity questionnaire includes 12 groups of food like cereals, pulses, green leafy vegetables, roots ,tubers, fruits, vegetables, milk & milk products, egg, fat, sugar, meat and miscellaneous. In addition to this, demographic questions included to determine socio-economic status were about their age, education, monthly and subsidiary income, occupation, family type, livestock, agriculture land and land for vegetable production.

Dietary survey: Dietary intake of subjects was recorded for the three consecutive days by "24 hour recall method" to assess the food intakes of the subjects. Dietcal software was used to calculate Nutrient Adequacy Ratio (NAR) for protein, energy and 5 different micro-nutrients such as β-carotene, vitamin C, folate, iron, calcium (Kaur 2014 and Singla et al 2017). The average raw amount in grams of each and every item of food consumed for three consecutive days for each subjects was fed in the software and nutritive value of the diets was recorded and compared with RDA. Nutrient intake was compared with recommended dietary allowances (RDA) of ICMR (2010).

Nutrient adequacy ratio: To estimate the nutrient adequacy of the diet, a Nutrient Adequacy Ratio (NAR) was calculated for the energy, protein, fat intake and nine micronutrients (vitamin A, vitamin C, folic acid, thiamine, riboflavin, niacin, calcium and iron)

NAR%= Intake of nutrients/ Recommended dietary allowance (RDA) x 100

NAR were classified as adequate (100% and above); marginally adequate (75 to 99.9%); inadequate (Below 50%); marginally inadequate (50 to 74.9%) (Jood et al 1999).

Food variety score: Food variety score (FVS) is defined as the number of food items consumed over a period of seven days. A list of 49 food items commonly consumed by the studied community was prepared. One point was given for each food category eaten either once or at any frequency throughout the week and each food category was scored only once. Points were added and the resultant score represented the Food variety score (FVS) of the respondent. Average FVS for was calculated by dividing the sum of FVS with total number of respondents and the relation between food variety score (FVS) and dietary adequacy was determined using the following classification given by (Savige et al 1997):

Table 1. Relationship between food variety score (FVS) and dietary adequacy

Total food variety score/week	Dietary adequacy
>30	Very good
25-29	Good
20-24	Fair
<20	Poor
<10	Very poor

Dietary diversity score: DDS were calculated using a set of 12 food groups .The choice of 12 food groups was based on outcomes of Food and Nutrition technical assistance (FANTA) project (Swindale and Bilinsky 2006). Information

on respondent's food consumption was collected using the previous 24-hours as a reference (24-hour recall). One code was given for food group consumed during the previous 24-hour and '0' code was given for food group not consumed. DDS was calculated by summing the number of different food groups. Average DDS was calculated separately for consumption of green vegetables pre and post project interventions by dividing the sum of DDS with total number of respondents.

RESULTS AND DISCUSSION

General demographic details: The demographic and socio economic characteristics of 83 SC beneficiaries are presented in Table 2.

Assessment of the nutritional status: There was significant increase in consumption of different nutrient after growing vegetables in their kitchen garden during the project period (Table 3). Beneficiaries were used to grow one or two vegetables like bottle gourd, fenugreek, spinach, mustard before the intervention. Due to low purchasing powers, less quantity of other vegetables was purchased from the market that does not provide essential nutrients in sufficient amount. Mushroom production was one of the components of the project for landless beneficiaries and mushroom was a new food item for beneficiaries. Training for mushroom production was provided to the beneficiaries for consumption to meet their protein requirements and commercial purpose.

Table 2. Socio economic and demographic details of beneficiaries selected under the project: n=83

Particulars	Category	Percentage
Gender	Female	60.32
	Male	39.71
Education	Illiterate	36.14
	Middle	40.90
	High school	12.01
	Secondary	8.432
	Graduate and above	2.42
Occupation	Working (DPLs)	79.82
	Non-working	20.21
Monthly income	0-10,000	53.05
	10,000-20,000	12.50
	20,000-30,000	15.64
	30,000-40,000	12.03
	40,000-50,000	4.84
	50,000 above	2.45
Family type	Nuclear	62.62
	Joint	37.32
Livestock	Yes	19.23
	No	80.74
Agriculture	Farming	6.02
	Non farming	93.91
Dietary habit	Vegetarian	44.53
	Non vegetarian	34.92
	Eggitarian	20.44
Average land holding size		0.02ha

Nutrient intake: Before the project, Nutrient adequacy ratio (NAR) of calorie intake in Scheduled Caste population was 1290kcal with percent adequacy of 57.8 that was marginally inadequate and increased significantly to 1370Kcal with 61.4% percent adequacy and 1781 Kcal with 79.8% marginally adequate after the implementation of horticulture intervention. With the increase in the consumption of mushrooms and pulses, daily protein intake inclined from 57.8 percent adequacy to 94.7 and 108.1% which is perfectly adequate after the implementation of intervention. However, amount of fat intake is 30.6 g day^{-1} was higher than RDA (25 g day^{-1}) due to the higher use of vanaspati ghee to make vegetables. The major source of carbohydrates is the intake of cereals (wheat and maize) in the form of chapattis and no significant difference has been reported in daily intake of carbohydrates before and after the project. The mean daily intake of β carotene was extremely less (3.6 g day^{-1}) in comparison to RDA, but after the intervention intake of β carotene (27.2 g day^{-1}) increased by 86.7%. The percent adequacy of riboflavin, niacin, folic acid are 76.9, 87.8 and 92 respectively which are marginally adequate after the intervention, however, the mean intake of same was marginally inadequate before the intervention. High consumption of green leafy vegetables increased the amount of iron intake drastically with percent adequacy 68% to 96% during the intervention period. Rahman et al (2008), Nandal et al (2009) and Biswas et al (2009) also reported the similar results. and shows strong interrelationship among DDS and FVS and can be used as effective indicators of food security. The food group consumed by the elderly during the previous 24hr period was scored '1' and the food not consumed was given '0'.

The DDS & FVS reached from 5.98 to 8.48 & 17.78 to 26.18 respectively. Gitagia et al (2019) and Renu Jethi et al (2020) reported low DDS of 3.78and 3.9among women of reproductive age as 69.8 percent were found to be consuming less than five food groups in their diet. However, DDS reached to 5.5 and more than ninety percent of women achieved minimum dietary diversity and they are more likely to have higher (more adequate) micronutrient intake after the implementation of horticulture interventions. The lower mean

of the diversity score was related to the non-vegetarian sources, other vegetables and fruits and the higher one was for cereals, and milk and milk products. The data showed a trend with a higher food variety and dietary diversity with good mean adequacy ratio among selected beneficiaries. A study conducted in Sharpeville, South Africa where food and dietary diversity as indicators of the dietary adequacy and health status of 170 elderly randomly selected respondents calculated and observed low dietary diversity score (3.41) and food variety score (4.77) compared with poverty parameters confirmed household food insecurity in selected elder population. Although three daily meals were

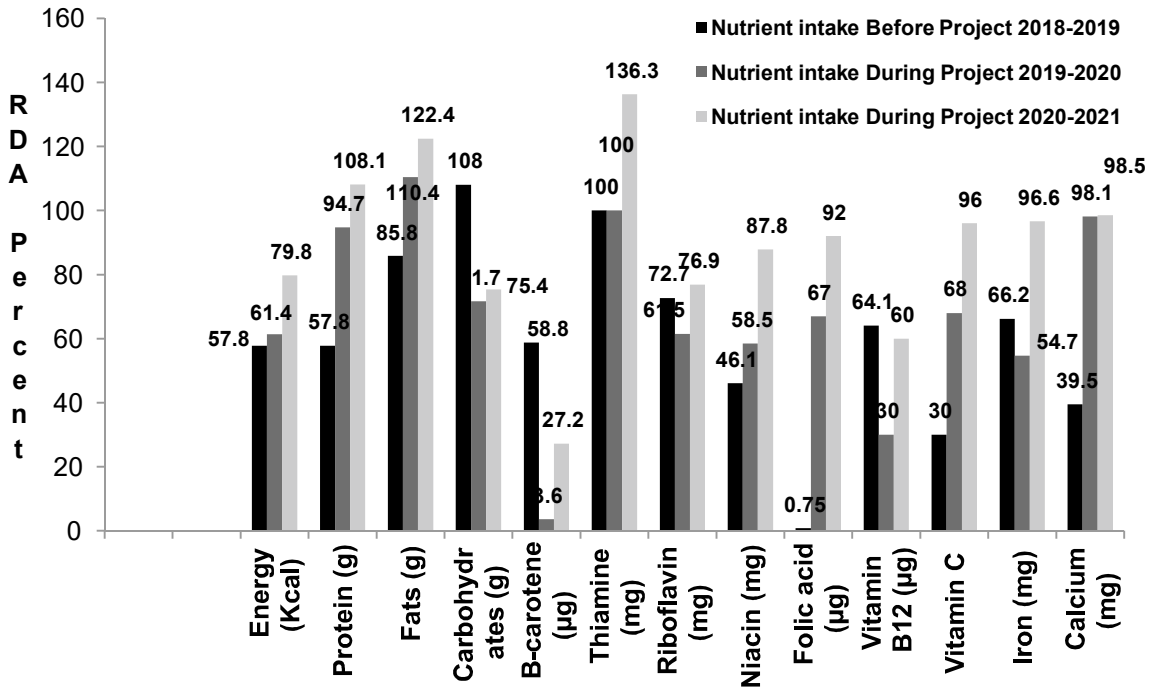

Fig. 1. Nutrient adequacy ratio (NAR) of SC beneficiaries before and after the intervention

Table 3. Average daily nutrient intake before the implementation and after the implementation of project (Mean±SD)

Nutrients	Nutrient intake (Before project) 2018-2019	Nutrient intake (During project) 2019-2020	Nutrient intake (During project) 2020-2021	RDA*
Energy (kcal)	1290 ±52.0	1370.0±57.4	1781.5±54.7	2230
Protein (g)	47.2±2.1	52.1±2.2	59.5±1.5	55
Fats (g)	27.2±1.2	27.6±1.5	30.6±2.5	25
Carbohydrates (g)	212.4±8.2	258.4±7.9	271.5±7.5	360
B-carotene (µg)	172.0±52.2	176.0±53.2	1309.6±169.5	4800
Thiamine (mg)	1.1±0.1	1.1±0.1	1.5±0.04	1.1
Riboflavin (mg)	0.6±0.03	0.8±0.04	1.0±0.02	1.3
Niacin (mg)	10.5±0.6	8.2±0.7	12.3±0.4	14
Folic acid (µg)	128.3±5.2	134.0±6.8	184.1±7.1	200
Vitamin B_{12} (µg)	0.3±0.02	0.3±0.02	0.6±0.02	1.0
Vitamin C	26.5±6.0	27.2 ±6.2	38.4±4.3	40
Iron (mg)	8.3±0.5	11.5±0.6	20.3±0.6	21
Calcium (mg)	570.2±30.4	589.1±31.4	591.5±38.6	600

mostly consumed but these were mainly carbohydrate-based and nutrient-deficient (Kruger et al 2008). Hoddinott et al (2002) noticed that DDS increased significantly with the increase in household per capita energy intake due to the introduction of micronutrients in the diet. Ruel (2003) and Torheim et al (2003), Steyn et al (2006) show significant and positive associations between *DDS* and micronutrient intake at the individual level. In addition to this, Rathnayake et al 2012 reported the average of the food variety score, dietary diversity score and dietary serving score was 8.4 (2), 4.4 (0.9) and 11.4 (2.5), respectively.

Consumption of green leafy vegetables, roots and tubers and other vegetables increased significantly and consumption of vegetables increased upto around 67 and 89 percent in 2019-2020 & 2020-2021 respectively after the introduction of vegetable nutrition gardens (Table 5). Renu jethi et al (2020) observed the same results that after introducing horticulture interventions, 76.2 percent women have started consuming vegetables on the daily basis in spite of weekly basis. Talukder et al (2010) also reported that establishment of nutrition garden volume and variety of vegetables produce inclined to three to four times approximately. Susana Akrofi et al *(*2010) reported the contribution of food items from the vegetable nutrition garden to the DDS (6.8) was significantly higher in HIV-positive (14.9%) than in HIV-negative households (9.1%) that don't have vegetable nutrition garden in their home and have DDS 6.0. The 24 hour recall method demonstrates the dietary pattern of selected beneficiaries in rural areas which suggests that micronutrient deficiency among the beneficiaries can be compensated by growing green vegetables in their nutrition garden. During the survey all beneficiaries had monotonous diet with less dietary diversity follows the same pattern like chapatti (wheat) with potatoes and pulses and less frequent vegetables with oils/fats. However, after the implementation of horticulture based nutrition sensitive interventions, cultivation of seasonal vegetables introduced dietary diversity in the dietary pattern and helped them to achieve nutritional security.

Table 4. Dietary diversity score (DDS) and Food variety score (FVS) of the selected beneficiaries

Food items	Before intervention	After intervention	p-value
DDS			
Mean ± SE	5.98±0.13	8.48 ± 0.14	0.001***
FVS			
Mean ± SE	17.78 ± 0.39	26.18 ± 0.51	0.001***

*** Significant at 1%

Table 5. Mean Consumption of green leafy vegetables, roots and tubers, and other vegetables before and after intervention

	Before intervention	After intervention	t-value
Green leafy vegetables	1.5	4.2	23.1
Roots and tubers	1.8	3.1	35.8
Other vegetables	1.8	5.0	23.0

t*- tabulated value = 12.7

CONCLUSIONS

The agriculture based interventions have improved nutrient intak of selected beneficiaries have improved their nutrient intake and meet their nutritional requirements. Therefore, future policies and long term interventions focusing on livelihoods and crop diversification should be encouraged to enhance the socio economic status especially in SC population. In addition to this, population belonging to SC category in rural areas should be nutritionally educated about the importance of consuming seasonal vegetables and balanced diet for the supplementation of micronutrients. Furthermore, some food groups that were not usually consumed i.e., mushroom must be prioritized and targeted by the government. This should be done by government agencies to organize training camps at KVKs to SC community for production and consumption of mushroom.

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