

Establish of Color Base Safe Nutrition Garden Model in the Context of Immunity System Improve

M.J. HOSSAIN¹

Senior Scientific Officer
BIRTAN Regional Station, Barishal

FARJANA SIMI

Scientific Officer
BIRTAN Regional Station, Barishal

Abstract

Micronutrient malnutrition affects large amount of children and women (at least 50% of this population) in Bangladesh. The diets of more than 85% of women and children in Bangladesh are inadequate in essential micronutrients such as vitamin A, largely because adequate amounts of foods containing these micronutrients are not available, or the household purchasing power for these foods is inadequate. In Bangladesh nutrition garden are needed to make a significant impact on this overwhelming malnutrition problem and improve health immune system. The study was conducted to determine the color base home gardening to improve family nutrition level as well as improve immune system. Both primary and secondary sources of data were used in this study. Household survey was conducted through questionnaire. Research shows that the target beneficiaries consume an average of 294 g/day of at least three varieties (Color) of vegetables, which is 64 percent more than before. Analyzing the results, it can be seen that the incidence of stomach issues, cold & cough, fatigue, delayed wound healing and frequent infections among the beneficiaries has decreased by 35%, 47%, 20%, 25% and 25% respectively. The results of the Nutrition Garden Model study showed that beneficiaries increased household nutrition by an average of 11% per day. And their average monthly income increased by 17%. In conclusion, it can be said that the production and consumption of different types of colored vegetables through the year-round nutrition garden was meet the families nutritional needs and increase income. And the immunity of family members was increase, as well as establishing a family nutrition garden. Since the study achieved the desired results in the first year, as intended, more trials can be conducted, with a larger number of beneficiaries, to further verify the efficacy.

Keywords: Beneficiaries; Color; Immunity; Garden; Nutrition; Safe

INTRODUCTION:

The vast majority of hungry and malnourished people live in developing countries under sub-standard living conditions and over half a billion of the global population suffer from chronic food insecurity. With the global population expected to reach over 9 billion by 2050, there will be a continuous need to increase food production and buffer stocks to meet the growing demand and efficiently cope with volatilities in food

¹ corresponding author: ssobarisal@gmail.com

production and prices. It has been projected that global food production will need to increase by 70% in order to meet the average daily caloric requirement of the world's population in 2050 (FAO, 2021).

Home gardening is the cultivation of small portion of land which may be at the back of the home or within a walking distance from home. It can also be described as the mixed cropping of fruits, vegetables, arable crops and shrubs that can serve as supplementary sources of food and income. Colored fruits and vegetables have important roles in human health as they contain many essential nutrients and phytochemical that may prevent or reduce the risk of chronic diseases (Steinmentz and Potter, 1996). Naturally brightly colored (Flavonoid, carotenoid, lycopene, anthocyanin, phenolic flavonoid, lutein and zeaxanthin) vegetables and fruits is more antioxidant than dull colored. Promotion of local/indigenous plants is an appropriate strategy for increasing vegetable consumption and improves immune system among the target community. Various local colorful fruits and vegetables have rich antioxidative and anti-inflammatory properties. On the other hands a nutrition garden is to provide the family daily with fresh vegetables rich in nutrients and energy. The concept of nutrition garden aims at continuous supply of fruits and vegetables to cater the daily needs of the family from the available area utilizing household area. Many plant foods with natural red pigments contain lycopene, an antioxidant phytonutrient that may help protect against prostate cancer, according to MayoClinic.com. Red vegetables also contain flavonoids called anthocyanins, which have antioxidant properties that may help boost immunity and reduce your risk of disease. Phenolic flavanoids and ellagic acid are anti-inflammatory compounds that may reduce your risk of cardiovascular disease, prevent some types of cancer and benefit cognitive function. These compounds have antioxidant properties as well and are found in blue and purple vegetables such as eggplant, purple cabbage, purple peppers, purple potatoes and purple onions contain, according to the authors of a study published in the journal "Food Chemistry" in 2012. Brightly colored green vegetables are often rich in lutein and zeaxanthin, antioxidant nutrients deposited in the retinas of your eyes. **Red** fruits and vegetables, such as tomatoes, capsicum, red chili, red amaranth, red beans, red okra, garden beet, and strawberry are packed with vitamin C, vitamin A, potassium and antioxidants. **Yellow/orange** fruits and vegetables, including carrots, squash and, are also loaded with vitamin C, vitamin A and potassium. They can also boost the immune system and enhance vision. Mushrooms, bananas, onions and other **white** fruits and vegetables are good for the heart and help to control cholesterol levels. **Green** means lots of heart-protective potassium and vitamin K, which aids the blood clotting process. Green fruits and veggies also help to maintain vision health and strong bones and teeth. Dark green, leafy vegetables have the highest concentration of antioxidants and fiber. **Blue/purple** fruits and vegetables, including such favorites as turnip and eggplant, boost urinary tract health and memory function and promote healthy aging.

The research presented here explores increase family nutrition level through color base nutrition home gardening and the scope to which gardening is seen as a health intervention as well as improvement of the health immune system.

METHODOLOGY:

This field study was conducted in the financial year 2020-2021 at BIRTAN Regional station, Barishal, under which 5 (green; white; yellow; red and purple) color and 31 types of vegetables (Okra; Cabbage; Broccoli; Chili (G); Cauliflower; Eggplant (W) ;

Radish; Red cabbage; Eggplant ;Turnip; Tomato ;Garden beet ;Capsicum; Carrot; Squash), fruits (Papaya ; Ginger; Strawberry), species (Chili, Zinger) and medicinal plant (Holy balsam) were cultivated throughout the year and the produced vegetables and fruits were fed to 12 family members (60). The study included pre- and post-assessment of socio-economic, physical and dietary habits of the beneficiaries through questionnaires. Yield and yield attribute data was collected from research field. Research has been done on organic methods of pest and disease management. Color meter apps have been used to measure the color percentage of different types of vegetables and fruits. Research design: RCBD with six replications. Data analysis was done through SPSS 20 software. Treatment size: 7X6. Total plot size: 7x10 sqm., Unit plot size: 6x1sqm.

Components of a Nutrition Garden

Papaya +Ginger+ Holy balsam +Strawberry
Green: Okra\Cabbage\ Broccoli\Chili (G)
White: Cauliflower\Eggplant (W) \Radish
Indigo: Red cabbage\Eggplant (Indigo)\Turnip
Red\Ora: Tomato \Garden beet + Capsicum(R)\Chili(R)\Carrot
Yellow: Squash(Y)\Capsicum(Y)\QPM
Kangkong\Indian Spinach\Red amaranth\Green amaranth\Pattshak
Leafy Aroid+ Sugar cane+ Sweet potato

Border crop: Dragon fruit, Bitter gourd, pointed gourd, Long yard bean (G), Long yard bean(R)

RESULT AND DISCUSSION:

Numerous human observational studies report that high intakes of fruits and vegetables are linked with a lower risk of chronic human diseases including cancer, vascular disease and diabetes. While, many global organizations (WHO) and national government initiatives encourage consumers to consume a minimum of five portions or 400 g of fruit and vegetables per day, recommendations for intake vary globally. A recent meta-analyses of 95 prospective studies reported a significantly reduced relative risk for CVD, stroke, total cancer incidence and all-cause mortality with fruit and vegetables intakes in excess of 200 g daily.

Green vegetables are a blessing for a safe and healthier life and have been in use for centuries. They are considered as an essential part of the diet to meet the daily nutrient requirements. GVs can be used fresh as a salad or can be cooked/processed as per the interest of the consumer. These are becoming more popular for the masses day by day due to the increased awareness of consumers about natural and organic foods. These possess a high place in the food pyramid and are an essential part of a balanced diet. The low caloric value of leafy vegetables makes them ideal for weight management. GVs are a rich source of nutrients, high in dietary fiber, low in lipids, and

rich in folate, ascorbic acid, vitamin K, Mg, and K. They also carry plenty of phytochemicals such as β -carotene flavonoids. Vegetables are also loaded with antioxidants and other beneficial plant compounds that help fight free radicals that damage cells. Diets rich in antioxidants are often linked to slower aging and a lower risk of disease (Food Sci Nutr. 2013). The good nutrition profile of GV is beneficial in lowering the risk of cardiovascular diseases and cancer. GVs are also valued for individuals with type 2 diabetes due to their high Mg content, high fiber content, and low glycemic index. These contain a good blend of polyphenols and antioxidants, which render them unique for therapeutic values. They also possess antimicrobial activity and can be used in different food products to extend storage life (Handbook of Fertility, 2015). Research shows that through NMG, 147.3 kg of green vegetables are available every year and maximum green color percentage was found in Broccoli lowest in green amaranth. Here, 83.5, 45.5, 21, 35.8 kg of red, yellow, white and purple vegetables are available throughout the year through NMG (fig- 1 and 2). Among the red vegetables, garden beet is the highest at 82% and papaya is the lowest. Eggplant is the highest among white vegetables and radish is the lowest. Capsicum has the highest mean and QPM is lowest among the yellow colored vegetables. Red cabbage is the highest among purple vegetables and turnip is the lowest.

The World Health Organization (WHO) recommends consuming at least 400 g each day to reap their health and nutrition benefits. In 2017, some 3.9 million deaths worldwide were attributable to not eating enough fruit and vegetables (WHO, 2019). Insufficient intake of fruit and vegetables is estimated to cause around 14 percent of deaths from gastro-intestinal cancer worldwide, about 11 percent of those due to ischemic heart disease, and about 9 percent of those caused by stroke (Afshin *et al.*, 2019). Analyzing the results, it can be seen that the incidence of stomach issues, cold & cough, fatigue, delayed wound healing and frequent infections among the beneficiaries has decreased by 35%, 47%, 20%, 25% and 25% respectively (Table-5). Research shows that the target beneficiaries consume an average of 294 g/day of at least three varieties (Color) of vegetables, which is 64 percent more than before (Table-1,2,3 and 4).

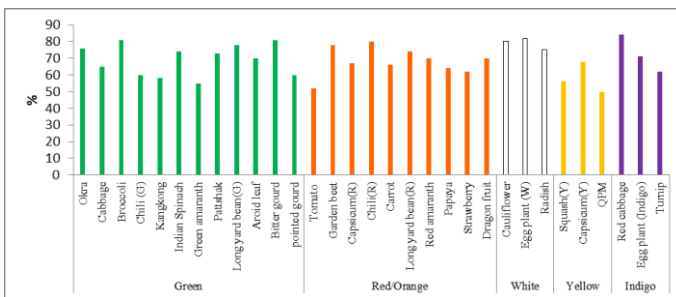


Fig-1: Percentage of 5 colors of different vegetables produced in NMG field throughout the year.

Table-1: Previous vegetable production status of beneficiaries.

	Name of major vegetable						Total
	Bottle gourd	Sweet gourd	Indian spinach	Egg plant	Papaya	Okra	
Area of veg. pr ⁿ (Decimal)	0.54	0.41	0.3	0.15	0.13	0.2	1.73
Pr ⁿ (kg/yr.)	16.5	13.4	18.2	9.5	25.7	3.9	87.2

n=60

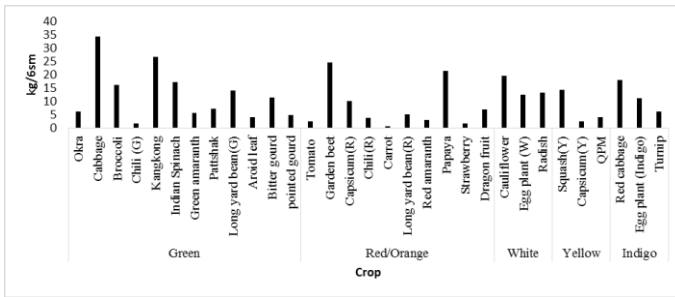


Fig-2: Total production of various vegetables during the year in NMG field.

Table-2: How much vegetables purchase from market before research

	Name of major vegetable								
	Eggplant	Sweet gourd	Bean	Cabbage	cauliflower	Radish	Tomato	Bitter gourd	Total
Kg/yr	6.4	12.1	6.7	14.1	11.4	14.3	13.5	4.1	82.6

Table-3: How much average vegetable consumption gram per day per head

	Breakfast	Lunch	Dinner	Total(gm.)
Pre	27	42	38	107
Post	81	123	92	294

n=60

Table-4: How many color variation vegetable consumption per day (last 7 days assessment)

Period	Intake rate of vegetables of different colors.					
No. of color	1	2	3	4	5	
Before (% of beneficiaries)	62	30	8	0	0	
After (% of beneficiaries)	0	22	70	8	0	

Table-5: Low immunity disease susceptibility

No.	Percentage disease susceptibility rate				
	Stomach issues	Cold & cough	Fatigue	Delayed wound healing	Frequent infections
Before	95	100	77	62	68
After	60	53	47	37	43
Difference	35	47	20	25	25

n=60

BMI: Dietary guidelines around the world recommend increased intakes of fruits and non-starchy vegetables for the prevention of chronic diseases and possibly obesity. This study showed that high vegetable consumption no significant change with body mass index (BMI). Pre- Questionnaire data showed that 52% people suffering below 18 BMI, 28 % respondents are 18.1 to 25 BMI (Table-6). The study found that consuming adequate amounts of colorful vegetables throughout the year resulted in an increase in ideal BMI and a reduction in obesity rates among beneficiaries. These data suggest that improving adherence to dietary targets for fruit and vegetables may be a dietary strategy to overcome overweight among men, but that overweight and obese beneficiaries are already adhering to these targets. The association between fruit and

vegetable intake and underweight in adults suggests that improving fruit and vegetables intakes are important for the overall dietary patterns of people in this group.

Table-6: BMI

BMI categories	Before	After
	%	%
Below 18	52	41
18.1-25	28	49
25.1-30	15	10
30.1 above	5	0

Monthly income: The computed monthly income of the respondents ranged from Taka 4000 to above Taka 15,500. The majority percentage respondents monthly income was Taka 5000. Based on their monthly income, the respondents were classified into four categories such as below 5000, 5001-10000, 10001-15000 and 15000tk above presented in Table. The data contained in the Table indicate that majority (60 %) of the respondents had middle income compared to 27 % having low income and only 15 % had high monthly income, the gross monthly income of a respondent was an important indicator of how much he could invest in home gardening (Table-7). Naturally, the fanner who has more income can invest more in farming and as a result he can adopt more modern home gardening. Farmers with low income generally invest less in their home gardening, therefore, it can be inferred that the % of monthly income possessed by majority of the farmers, the higher would be their adaptation to NMG. High income also helps farmers to bear risk and ability towards adaptation in response to malnutrition. On the other hand, low income people were more vulnerable and less adaptation capacity to overcome malnutrition.

Table-7: Monthly income

Income categories (Tk.)	Before		After	
	Total no. population, n=60	%	Total no. population, n=30	%
Below 5000	16	27	4	13
5001-10000	25	42	11	37
10001-15000	11	18	10	33
15000 above	9	15	5	17

Age: Age is an important determinant for socioeconomic status of a population because of its role in the better management of the farming activities and vegetable production. According to The World Bank (WB data 2014), the ages between 15 to 64 could potentially be economically active. The economically active population of Bangladesh was 65.2% of the total population and out of which 4.8% was 65 years and above. According to data, respondents between the ages of 20-50 years old (35%) were involved in home gardening in the study area (Table-8). The average age of the respondents was approximately 43 years where the minimum age was 5 and maximum age was 70. Based on World Health Organization (WHO, 2004) average life expectancy chart 2013 life expectancy at birth for Bangladesh was 71. It can be inferred that among the respondents in the study area 35% were in economically active age and 100% of them are within the life expectancy period (Table-9).

Table-8: Age

Age categories (Year)	Total no. population, n=60	%
5-10	13	22
10 above to 20	17	28
20 Above to 50	21	35
50 above	9	15

Education level: Illiteracy is one of the factors militating against agricultural development in any developing country like Bangladesh. The study shows that 8% of the respondents had no formal education. This suggests extension workers should do more by sensitizing farmers on the importance of formal education. While about 92% respondents have one form of formal education or the other (Table-9). Therefore, it can be said with certainly that introduction of new ideas and adoption of new innovations and technology in the study area will be easy. This will in turn increase vegetable production, income and family nutrition status in general.

Table-9: Education

Education categories	Total no. population, n=60	%
Illiterate	5	8
Under five	19	32
SSC	23	38
SSC above	13	22

CONCLUSION:

Through this study, it can be assumed that if a person consumes at least 294 grams of vegetables of three colors every day, his tendency to develop various types of communicable and non-communicable diseases is reduced. As the susceptibility to disease decreases, it can be said that the immune system of the human body increases. The results of the Nutrition Garden Model study showed that beneficiaries increased household nutrition by an average of 11% per day. And their average monthly income increased by 17%. In conclusion, it can be said that the production and consumption of different types of colored vegetables through the year-round nutrition garden was meet the families nutritional needs and increase income. And the immunity of family members was increase, as well as establishing a family nutrition garden.

RECOMMENDATION:

By establishing a nutrition garden, if family members consume at least 294 grams of vegetables of three colors per day, their body's immune system will increase. Since the study achieved the desired results in the first year, as intended, more trials can be conducted, with a larger number of beneficiaries, to further verify the efficacy.

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