Reducing Dietary Related Risks associated with Non-Communicable Diseases in Bangladesh (RDRNCD)

Technical Report

Promotion of Fruits and Vegetables Intake: A Population-Based Survey in Rural Areas of Bangladesh

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Supported by: IDRC | CRDI
International Development Research Centre
Centre de recherches pour le développement international

Partners: NCDC, University of Manitoba, CHANNEL, Work for a Better Bangladesh Trust, HARMONY

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Introduction

Global communicable disease disability-adjusted life-years declined from 1.19 billion in 1990 to 769.3 million in 2013; at the same time, global non-communication diseases(NCDs) increased, affecting from 1.08 billion people in 1990 to 1.43 billion in 2013[1]. NCDs resulting from dietary patterns include obesity, diabetes, cardiovascular disease (CVD), hypertension, stroke, and esophageal, stomach, and lung cancer, among others [2,3]. As part of this shift in dietary patterns, a significant global disease burden approximately 1.7 million deaths is attributed to inadequate fruits and vegetables (FV) consumption (<400g/day); furthermore, inadequate consumption is among the top 10 selected risk factors for global mortality[4,5,6]..While the country-specific NCD burden due to inadequate FV consumption may vary, one study found that overall, 77.6% of men and 78.4% of women from 52 mainly low and middle-income countries (LMICs) geographically representing the six WHO regions, consume less than the minimum WHO recommended 400g of combined FVs per day [7]. In 2010, a systematic analysis of 187 countries found that only 2 such countries Jamaica and Malaysia (0.4% of the global adult population) had a mean fruit consumption of at least 300g/day. The same analysis found that only 4 of 187 countries (again, 0.4% of the global adult population) had vegetable intake levels of at least 400g/day [8]. This WHO recommendation is with reason there is “convincing evidence” that increased FV consumption reduces risk of hypertension, coronary heart disease, and stroke [3,9]. Studies also support a significant reduction in the risks of esophageal, lung, stomach, and colorectal cancer with increased FV intake; breast cancer with vegetables, but not fruit; and bladder cancer with fruit, but not vegetables [10].

Given evidence supporting the intersection of FV consumption and global NCD burden, public health policies that aim to reduce NCDs should place special emphasis on increased FV intake in all forms fresh, frozen, canned, dried, and juiced and in both raw and cooked methods. To increase fruit consumption, emphasis should be on eating whole fruit. While 100% fruit juice can contribute to overall fruit intake, it is lower than whole fruit in dietary fiber and, when consumed in excess, can contribute extra calories. A variety of vegetables from all culturally appropriate vegetable subgroups should be consumed for example, in the United States, dark green, red and orange, legumes (beans and peas), and starchy[11,12].

The development challenges and priority problems increasing trend of NCDs in Bangladesh: With a population exceeding 160 million, Bangladesh is undergoing a rapid demographic and epidemiological transition. More than 51% are dying due to non-communicable diseases (NCDs) and other chronic health conditions, and the trend of NCDs is rising. During 1986-2006, NCDs, primarily cardiovascular diseases, diabetes, chronic obstructive pulmonary disease, and cancers, increased by 60% [13]. Research findings revealed that such an increasing

trend in NCDs is primarily associated with changes in dietary patterns, food insecurity and poverty, and lifestyle and urbanization. In Bangladesh, the overall population's dietary habits are highly imbalanced (≥80% consists of rice and cereals and only 3% consists of vegetables), lacking vitamins and minerals required for healthy living [14]. As a result, more than 40% of the population suffers from vitamin A and 91% from vitamin D deficiency, while more than 30% lack sufficient minerals. Such deficiencies are more acute among children and poor or pregnant women [15]. Two recent changes in the food intake of the population are noticeable: i) the share of processed food is already more than 70% among urban consumers while it is also as high as 59% among rural consumers, the fast and junk food consumption rate is increasing alarmingly as the, revealed that during 2001-2010, consumer expenditure on fast and junk food had increased at a rate of 15.5% per year. The Risk Factor survey for NCDs has identified "low vegetable and fruit intake" as one of the major risk factors for NCDs in Bangladesh; the 2010 WHO-STEP study found that the overall daily per capita consumption of vegetables was 2.3 servings against the minimum daily requirement of 5 servings [16,17]. This is partly attributable to insufficient knowledge and lack of sensitivity about the health impact of poor nutrition intake.

The vegetable consumption gap among the population is significant because the present per capita vegetable intake is 70gram per day while the standard need is 220 g per capita per day [18]. The below standard vegetable consumption is attributed to 5 major constraints. Imbalanced traditional dietary habit is not only deficient in energy and protein intake, it is also extremely imbalanced, as ≥80% stem from rice and cereals and only 3% from vegetables, Low level of consumer preference to vegetables is reflected in the household expenditure pattern: only 13% of total expenditure for food is allocated to purchase vegetables. Similarly, the expenditure (income) elasticity of vegetables is 0.583, indicating that a 10% increase in household income and expenditure would increase the demand for vegetables by 5.83%. Serious deficiency in dietary and nutritional knowledge and consumer behavior favoring carbohydrate and processed food among the population leads to poor selection of food items, as reflected among school children in the city of Dhaka: although 68.3% have basic nutritional knowledge, 72.9% of students consume fast and fried food [19,20]. Concerns about food safety limit consumer demand for vegetables. A BARI study [21] revealed that 30% of consumers refrain themselves from purchasing vegetables due to food safety and health concerns. Inefficiencies in the value chain for vegetable crops cause price instability and depress seasonal demand. For example, a 63% price hike of vegetables at the consumer level over the farm level is attributed to such inefficiencies. Seasonal price variation is another major constraint, as observed 35-65% variation between off and peak season prices of eggplant [22,23].

There is also a considerable deficiency in vegetable production, estimated at 2.9 million metric tonnes, as opposed to the national requirement of 11 million MT [24]. This massive shortfall is attributed to 5 major constraints. i)Poor production technologies are resulting in poor yields. Technological advancement offers immense opportunity to increase the yield and improve the quality of indigenous vegetables ii)Lack of quality seeds of high yielding varieties hinders farmers from enhancing production. The government (i.e., Bangladesh Agricultural

Development Corporation) produces 5% of the national requirement of seeds while the remaining 95% are produced by farmers and seed companies or are imported and mostly of poor quality iii)Market distortion due to inadequate communication among small-scale farmers and the private sector's limited capacity in providing knowledge and information to farmers limits investment in vegetable production iv)Post-harvest losses of up to 44% of primary production volume are attributed to sub-standard handling, perishability, and poor storage facilities v)Lack of knowledge and awareness on the nutritional benefits of the indigenous vegetables constrains consumer demand for them[25,26,27]. Considering the above circumstances the study was undertaken for better understanding of fruits and vegetable consumption, and to promote fruits and vegetables consumptions of rural people of Bangladesh.

Methods

The study was designed within the Ifakara Urban Health and Demographic Surveillance System (IU-HDSS) [28]. The IU-HDSS is a longitudinal database that collects information non demographic and vital events. Community sensitization activities were conducted and these included meetings with community leaders, pamphlets, sensitization at community events. Door-to-door visits, following prior notification by the ten-cell leader, the lowest level of local administration, were conducted. Eligible participants' were18-45 years, willing and able to give informed consent and resident in the study areas. In the study round, a total of 7379 participants were recruited from June to December 2017 from 16 upazila of 8 districts of Bangladesh. Community members in the study area are a mix of indigenous inhabitants and local.

Data Collection

Interviews were conducted at participants' homes between June to December 2017 by trained interviewees using a structured questionnaire. The interview tool was translated from English into Bengali and back translated to English and was piloted. Interviewers used tablet personal computers programmed with the open-source Open Data Kit. Automated validation and skip patterns were programmed to minimize faulty data entries. Interviewers also kept field diaries for problems that occurred during data collection. These sheets were reviewed by the supervisor, who made suggestions for improvement, at the end of each day.

Participants were asked questions on their grown fruits and vegetables in studied year, land cultivated land area of fruits and vegetables in studied year, farmers followed good agricultural practices (GAP) in production process of fruits and vegetables, usage of fruits and vegetables produced by farmers, marketing channel where farmers sell fruits and vegetables, types of vegetables variety cultivated in farmers' fields, production of vegetables in farmers land.

Statistical Analyses

Using the adjusted socio-demographic model data were analyses excluded participantswith missing data as well as all above characters. All statistical analyses were done using STATA Version 14(STATA Corporation, Texas). Associations were considered significant at p value < 0.05.

Results

A total of 7379 farmers of 8 districts namely Moulvibazar, Sunamgonj, Sherpur, Jamalpur, Pabna, Satkhira and Munshigonj were bringing the present analyses (Table 1). It was observed that fruit cultivation was highest in Satkhira (79.63%) and followerd by Munshigonj (78.21%), Khulna (76.67%), Sherpur (76.86%) and lowest was Sunamgonj (64.84%). There was signification difference among the farmers of 8 districts in case of cultivated fruits in their homestead or commercial purposes. Among the 7379 participants highest participants (36.54%) was from Moulvibazar districts and then Sunamgonj (12.37%) followed by Satkhira (12.30%) Khulna and Munshigonj (10.57%) and lowest is Sherpur (5.27%).

Out of 7379 participants for vegetable cultivation highest was in Moulvibazar (77.05%) and then Satkhita (66.08%) followed by Sherpur (63.50%), Khulna (62.18%) of the farmers cultivated vegetables in homestead or commercial purposes among the studied 8 districts. The highest participant was observed in Moulvibazar (36.54%) and followed by Sunamgonj (12.37%), Shatkhira (12.30%), Munshigonj (10.57%) and lowest in Sherpur (5.27%).

Farmers were categorized in three groups i, e, 1-99 decimal, 100-249 decimal and more than 250 decimals cultivated land. Out of 1309 participants of 8 districts the highest in 1-99 decimal group in Moulvibazar (85.99%), then Sunamgonj (78.02%) and lowest was in Munshigonj (51.16%) for cultivated fruit land (Table 2). There was significance difference among the 8 districts and average 76.91% of total farmers owner less than one acre of land. Rest of 22.44% of farmers was owner less than one hectare of land. In 8 districts out of 1702 farmers, highest was in Moulvibazar (42.77%), then Jamalpur (14.04%) followed by Sherpur (12.51%), Sunamgonj (10.69%) and lowest in Munshigonj (2.52%).

Table 1. Farmers grown fruits and vegetables in studied year

District	Cultivated fruits						Cultivated vegetables					
	Description				Total		Description				Total	
	Yes		No		No.	(%)	Yes		No		No.	(%)
	No.	(%)	No.	(%)			No.	(%)	No.	(%)		
Moulvibazar	1803	66.85	894	33.15	2697	36.54	2078	77.05	619	22.95	2697	36.54
Sunamgonj	592	64.84	321	35.16	913	12.37	467	51.15	446	48.85	913	12.37
Sherpur	299	76.86	90	23.14	389	05.27	247	63.50	142	36.50	389	05.27
Jamalpur	380	73.36	138	26.64	518	07.01	319	61.58	199	38.42	518	07.01
Pabna	287	72.84	107	27.16	394	05.33	214	54.31	180	45.69	394	05.33
Khulna	598	76.67	182	23.33	780	10.57	485	62.18	295	37.82	780	10.57
Satkhira	723	79.63	185	20.37	908	12.30	600	66.08	308	33.92	908	12.30
Munshigonj	610	78.21	170	21.79	780	10.57	403	51.67	377	48.33	780	10.57
Total	5292	-	2087	-	7379	100.0	4813	-	2566	-	7379	100.0
Mean	-	71.72	-	28.28	-	12.49	-	65.23	-	34.77	-	12.49
LS	-	*	-	*	-	**	-	*	-	*	-	*
LSD(0.05)	-	2.21	-	1.41	-	1.10	-	1.72	-	1.43	-	1.10

*** Significant at 1% level* ** Significant at 5% level*

Table 2. Cultivated land area of fruits and vegetables in studied year

District	Fruits cultivated area								Vegetables cultivated area							
	Land Size (decimal)						Total		Land Size (decimal)						Total	
	1 - 99		100 - 249		250 +		No.	(%)	1 - 99		100 - 249		250 +		No.	
	No.	(%)	No.	(%)	No.	(%)			No.	(%)	No.	(%)	No.	(%)		
Moulvibazar	626	85.99	99	13.60	3	0.41	728	42.77	1024	98.94	10	0.97	1	0.10	1035	48.86
Sunamgonj	142	78.02	40	21.98	0	0	182	10.69	227	98.27	3	1.30	1	0.43	231	10.85
Sherpur	153	71.83	59	27.70	1	0.47	213	12.51	130	100.00	0	0	0	0	130	06.10
Jamalpur	175	73.22	64	26.78	0	0	239	14.04	153	100.00	0	0	0	0	153	07.18
Pabna	26	57.78	19	42.22	0	0	45	02.64	46	97.87	1	2.13	0	0	47	02.20
Khulna	98	66.22	48	32.43	2	1.35	148	08.69	241	97.97	5	2.03	0	0	246	11.56
Satkhira	67	64.42	33	31.73	4	3.85	104	06.11	202	100.00	0	0	0	0	202	09.49
Munshigonj	22	51.16	20	46.51	1	2.33	43	02.52	76	90.48	3	3.57	5	5.95	84	03.94
Total	1309	-	382	-	11	0.65	1702	100.00	2099	-	22	-	7	-	2128	100.00
Mean	-	76.91	-	22.44	-	-	-	12.49	-	98.64	-	1.03	-	0.33	-	12.52
LS	-	*	-	*	-	-	-	**	-	*	-	-	-	-	-	*
LSD(0.05)	-	2.15	-	1.36	-	-	-	0.93	-	1.54	-	-	-	-	-	0.84

*** Significant at 1% level* ** Significant at 5% level*

For vegetable cultivated area, out of 2099 participants 98.64% of were 1-99 decimal groups and the highest was in Sherpur, Jamalpur and Satkhira (100%) of which all participated farmers were cultivated vegetable in homestead or commercial purpose (Table 2). Rest of 1.03% of farmers cultivated commercially in less than one hectare area of land group. Out of 2128 farmers of 8 districts vegetable cultivation in one hectare of land group was highest in Moulvibazar (48.86%), then Khulna (11.56%) and followed by Sunamgonj (10.85%) and lowest in Pabna (3.94%).

It is revealed that farmers cultivated local and hybrid vegetable varieties in their field (Table 3), but most of the farmers (82.92%) cultivated local varieties. Out of 3955 farmers maximum (93.22%) farmers of Munshigonj were cultivated local varieties, rest of few (17.08%)

cultivated high yielding vegetable varieties, it may be hybrid or open pollinated varieties. Among the 8 districts highest farmers (93.22%) produced vegetables by using local varieties followed by Khulna (89.41%), Satkhira (85.61%), Jamalpur (85.52%), Sherpur (84.61%), Sunamgonj (84.52%) and lowest in Moulvibazar (77.91%). The farmers of Moulvibazar used hybrid varieties higher (22.09%) in respect of other districts.

Out of 7962 farmers highest (2146) practiced indigenous vegetables in Moulvibazar and followed by Satkhira (1804), Khulna (1245), Sunamgong (818), Munshigong (689), Jamalpur (513), Sherpur (442) and lowest in Pabna (305). The indigenous vegetable were Brinjal(*Solanammelongena*L.), Ash gourd(*Benincasahispida*Thumb.), Pointed gourd (*Trichosanthesdioica*Roxb.), Ridge gourd (*Luffa acutangula*), Snake gourd (*Trichosanthesdioica*Roxb.), Bitter gourd (*Momordica charantia*), Hyacinth bean(*Lablab purpureus*), Okra (*Abelmoschus esculentus*), Indian spinach(*Basella alba* L.), Kang kong (*Ipomoneaaquatica*), Stem amaranth(*Amaranthus tricolor*), Red amaranth(*Amaranthus gangeticus*), Jute leaf *(Corchorus olitorius*) and Ariods*(Colocasia spp.)* Fruit varieties were in the studies viz. Jackfruit, Pummelo, Satkara, Taikar, Lemon, Lime, Hogplum, Golden Apple, Guava, Jamun, Wax Apple, Wood apple, Litchi, Elephant Foot Apple, Carambola, Pineapple, Jujube, Olives, Tamarind, Elephant Apple, Karonda, Custard Apple, Aonla, Mango, Banana and Coconut.

In indigenous vegetables group, the average yield of these vegetables was range from 24.71-42.61 kg/decimal and showed significant variation among the 8 districts. The highest yield was in Sherpur (42.61 kg/decimal) and followed by Munshigonj (41.81 kg/decimal), Shatkhira (40.52 kg/decimal), Khulna (38.24 kg/decimal), Jamalpur (37.21 kg/decimal) and lowest in Moulvibazar (24.71 kg/decimal). Average yield of indigenous vegetable was 36.41 kg/decimal but, 47.23 kg/decimal yield was found from non indigenous vegetable which may be hybrid or open pollinated varieties of different vegetables cultivated in Bangladesh.

Generally farmer's practiced traditional procedure of vegetable in their field. Some of them were followed standard production procedure GAP (good agricultural practices). There were significant variation were observed among the farmers of 8 districts. Average 15.29% of the farmers among 8 districts were followed GAP in their production process. Highest GAP practiced was found in Jamalpur (22.81%) and followed by Pabna (20.12%), Sherpur (19.01), Khulna (15.22), Sunamgonj (12.42%), Moulvibazar (11.41%), Munshigonj (11.31%) and lowest was in Satkhira (10.62%).

A total of 3483 farmers were participated to sale of fruits and vegetable which they produced in the market or other places among the studies (Table 3). About 75.30% of farmers sale their product in the local market, others were sale in big or hole sell market. Maximum farmers who sale their produces in local market were Pabna (89.40%) and minimum in Sherpur (51.20%).

Table 3. Production of vegetables, used varieties, sales and GAP practiced by the farmers

District	Indigenous		Non-indigenous	Vegetables variety cultivated			Followed GAP		Sale in local market of fruits and vegetables	
	No	Yield (kg/decimal)	Yield (kg/decimal)	Local (No)	Local (%)	HYV (%)	No	(%)	No	(%)
Moulvibazar	2146	24.71	42.31	1612	77.91	22.09	650	11.41	1313	72.80
Sunamgonj	818	29.92	45.62	387	84.52	15.48	57	12.42	256	69.60
Sherpur	442	42.61	48.72	209	84.61	15.40	47	19.01	109	51.20
Jamalpur	513	37.21	46.22	266	85.52	14.52	71	22.81	368	83.40
Pabna	305	36.23	35.93	170	80.22	19.78	104	20.12	160	89.40
Khulna	1245	38.24	53.62	430	89.41	10.39	198	15.22	505	77.50
Satkhira	1804	40.52	46.31	511	85.61	14.39	272	10.62	587	80.40
Munshigonj	689	41.81	59.31	370	93.22	6.78	160	11.31	185	78.40
Total	7962	-	-	3955	-	-	1859	-	3483	-
Mean	-	36.41	47.23	-	82.92	17.08	-	15.29	-	75.30
LS	-	*	*	-	*	*	-	*	-	**
LSD(0.05)	-	1.53	1.12	-	1.10	0.89	-	1.81	-	0.96

*** Significant at 1% level* * *Significant at 5% level*

Table 4. Usage, sales and consumptions of fruits and vegetables by farmers

District	Own consumption fruits		Sale fruits	Own consumption vegetables		Sale vegetables	Vegetable consumption (g/person/day)		Fruit consumption (g/person/day)	
	No	%	%	No	(%)	(%)	No	g	No	g
Moulvibazar	4960	96.60	9.40	8424	90.40	17.90	410	63.50	410	50.50
Sunamgonj	1802	96.20	6.50	1699	97.40	24.10	410	70.21	410	54.20
Sherpur	1112	99.60	9.00	848	98.70	25.30	401	85.52	401	65.20
Jamalpur	1321	99.20	13.9	1040	99.20	42.20	309	84.20	309	55.20
Pabna	736	96.80	13.0	515	97.90	35.00	305	84.10	305	65.20
Khulna	2291	98.50	13.6	2255	99.30	26.90	302	90.20	302	71.30
Satkhira	2910	99.10	12.1	3430	98.90	21.80	300	91.20	300	70.23
Munshigonj	2066	98.10	2.70	1596	98.90	14.60	380	56.20	380	65.33
Total	17198	-	-	19807	-	-	-	-	-	-
Mean	-	97.80	9.80	-	95.00	21.80	-	78.14	-	62.14
LS	-	*	*	-	**	*	-	*	-	*
LSD(0.05)	-	0.94	0.59	-	1.43	0.88	-	1.32	-	1.10

*** Significant at 1% level* * *Significant at 5% level*

Uses, sales and consumptions of fruits and vegetable were presented Table 4. About 97% farmers that produced fruits in their own land consumed their own product. Out of 17198 farmers highest was in Moulvibazar (4960), of which 96.60% of the farmers consumed fruit which they produced. The highest percentage was in Sherpur (99.60%) and followed by Jamalpur (99.20%), Satkhira (99.10%) and lowest was in Sunamgonj (96.20%). Average

97.80% of the farmers of 8 districts consumed fruits which they produced fruit in their own land.

Own consumptions of vegetable of the farmers of 19807 from 8 districts were studied (Table 4). There was significant variation among the farmers of 8 districts. Most of the farmers (95.0%) were consumed vegetable from their own land. The highest (99.30%) of the farmers of Khulna districts consumed vegetables which produced in their own land followed by Jamalpur (99.20%), Satkhira and Munshigonj (98.90%), Sherpur (98.70%) and lowest was in Moulvibazar (90.40%).

Vegetable consumptions per day per person were reviewed and found significant different among the farmers of 8 districts (Table 4). Average vegetable intake per day per person was 78.14g. Maximum intake was in Satkhira (91.20g/person/day) followed by Khulna (90.20g), Sherpur (85.52g), Jamalpur (84.20g), Pabna (84.10g), Sunamgonj (70.21g), Moulvibazar (63.50g) and lowest was in Munshigonj (56.20g). On the other hand fruit consumption per day per person was relatively less than vegetable consumption. The highest fruit intake was in Khulna (71.30g) followed by Satkhira (70.23g) and lowest aws in Moulvibazar (50.50g). Average intake of fruits per day per person was 62.14g among the farmers of 8 districts.

Discussion

The study revealed that about 7379 farmers were participated from the 16 Upazila of 8 districts of Bangladesh. The farmers in rural area cultivated fruits and vegetables in their own land; most of the farmers cultivated fruits (71.72%) and vegetables (65.23%) and there was significant variation among the farmers of the studied area. The farmers cultivated fruits were (76.91%) and vegetables (98.64%) all are marginal farmer, they cultivated in homestead, small land near home and also some commercial cultivation in their own lands. In rural areas, marginal farmers have shown more attachment to vegetables in their source of nutrition, being that they are mostly rural people with a poor of knowledge on vegetable cultivation and use [29,30].

Farmers of the studied area cultivated vegetables some were indigenous and some were non-indigenous. The indigenous vegetables were okra, ash ground, Bitter ground, Snake ground, Brinjal, Stem amaranth, country bean, Ariods, Jute leaf, etc. and non-indigenous vegetables were Tomato, Pumpkin, French bean, etc. The average yield of indigenous vegetables was 36.41 kg/decimal and non-indigenous vegetables were 47.23 kg/decimal. Indigenous vegetables were cultivated in some specific areas which the farmers practiced their own traditional cultivation practice. The indigenous vegetables are adapted and less disease and pest infestation also local demand. The non- indigenous vegetables were mostly hybrid thus the yield of non- indigenous vegetables were higher than indigenous vegetables. The farmers have less knowledge on cultivation procedure following good agricultural practices (GAP). About 15.29% at the rural people followed GAP. GAP following vegetable cultivation procedure is standard and produced vegetable will be safe in health concern.

The study also found that about 97.80% of the farmers consume fruits from their own production and about 95.00% of the farmers consume vegetables from their own land.

Vegetable consumption per person per day varied significantly among the 8 districts and on average was 78.14g. It was quite less from recommendation of FAO (220 g/day/person). The average consumption of fruits of the studied area was 62.14g/day/person; fruits consumption was also less from recommended intake of FAO. The study participants did not meet portions of fruits and vegetable daily. More effort is needed increase the intake of fruits and vegetables as the increase production of fruits and vegetables in their own land. Because of vegetables is a cheap relish that accompanies daily staples like rice, flat bread and others and this may explain to a large extent, the high vegetable consumption [29,31].

Knowledge of dietary and determinants of Non Communication Diseases (NCDs) in urban men women for identify gaps in knowledge that could be the target for future public health nutrition programs. Overall, the findings suggest reasonable overall knowledge concerning fruits and vegetable cultivation, consumptions, dietary and behavior-related causes of NCDs. However, there was particularly poor knowledge of the benefit of earning plenty of vegetables and fruit in preventing Non Communication Diseases in Bangladesh.

Conclusion

The research agenda is based, in an attempt to look systematically at the many issues involved and to bridge gaps in knowledge where required. The suggested conceptual framework for a systems approach to considering fruit and vegetable promotion looks at the continuum from production to consumption with ensuing benefits to health and the prevention of disease, in particular non-communicable diseases. The current experience in the effectiveness of interventions assessed, and the research agenda outlined prioritized with responsible farmers/villagers agreed for the work involved the road map for the fruit and vegetable promotion initiative.

Fruits and vegetables cultivation, production, usages, consumptions in the study setting was associated with farmers practices. Improvement of overall fruits and vegetables consumption of majority of people in rural, resource-poor settings may be attained by promoting daily consumption of vegetables and increase in number of standard portions of vegetables consumed. Improving access to fruits and vegetables by making them more affordable may contribute to improving intake rates. More qualitative and quantitative research are needed to better understand the prevalent knowledge, attitude and perception of fruits and vegetable consumption in local cultural contexts in order to improve their intake rates in their daily consumptions.

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