Estimation of Overall Food Losses and Waste at all Levels of the Food Chain

By

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National Consultation on Food Loss and Waste Management for Productivity Gains, Food Security Nutrition, and Climate-Resilient Agri-Food Value Chains in Bangladesh

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Food and Agriculture Organization of the United Nations

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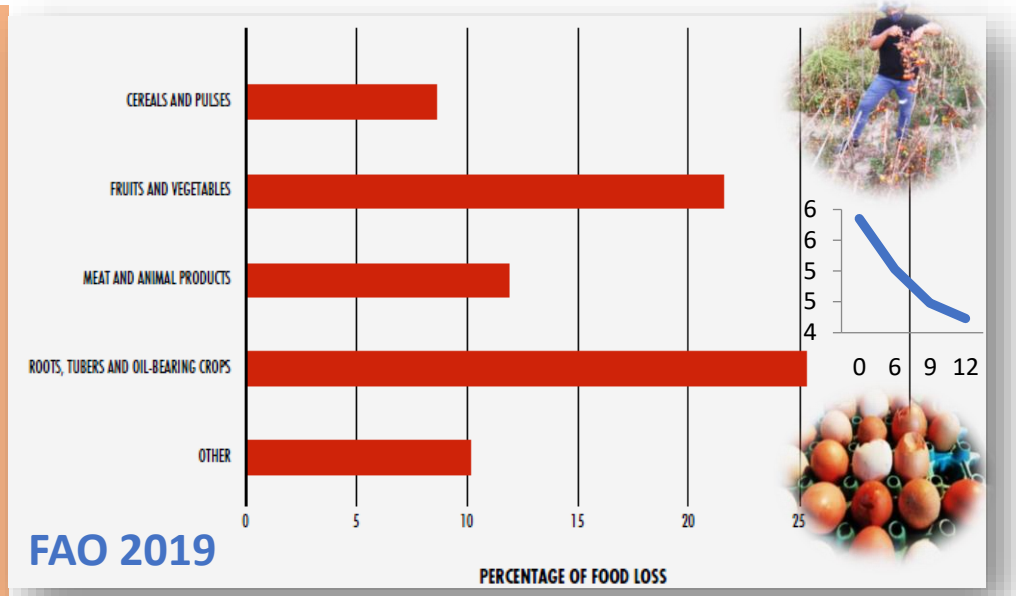
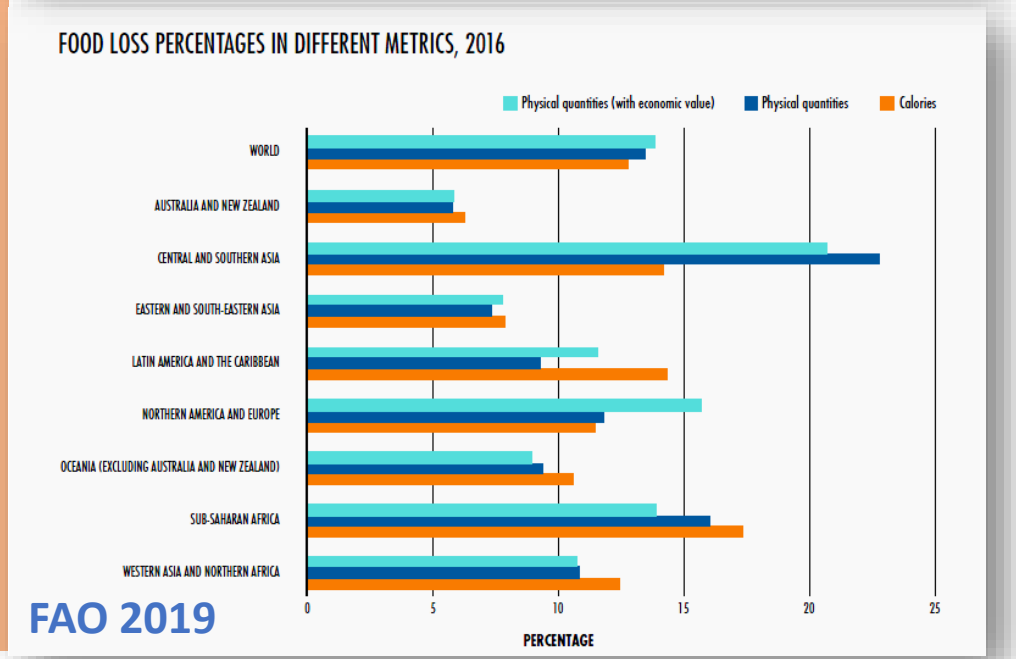
INTRODUCTION & OBJECTIVES

- Recognizing the significance of reducing food loss and waste (FLW), SDG target 12.3 calls for halving per capita FLW by 2030.
- FLW occurs throughout the value chain- from production, processing, distribution to retail and consumption.
- Global FLW amounts to roughly one-third of total production.
- Recent global average postharvest to distribution estimates of losses are 8%, 12%, 22% and 25% for cereals and pulses, meat and animal products, fruits and vegetables, and roots and tubers, respectively (FAO 2019).
- While there is no precise and recent data on the magnitude of FLW in Bangladesh, FAO (2019) found an average estimate of FLW of 7.4% irrespective of food groups with a range 0.2-35.0% based on grey literature and national and sectoral reports published during 2000-2017.
- So far, there is no data on postharvest losses for animal products.
- Information on food waste and micronutrient loss are limited.
- The present study aims to fill these gaps by generating primary data on:
  - ✓ Levels of food loss across the selected food chains
  - ✓ Levels of micronutrient loss
  - ✓ Magnitude of food waste
  - ✓ Identify key factors influencing FLW
  - ✓ Provide recommendations to reduce FLW



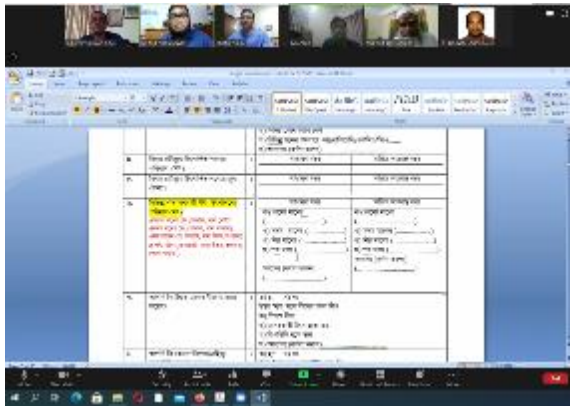


OVERVIEW OF THE METHODOLOGY

FOOD LOSS ASSESSMENT

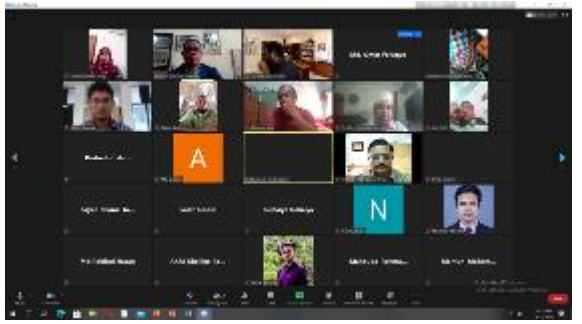
- Quantitative losses of 14 commonly-consumed food selected from the FAO-recommended 5 food groups, were assessed.

FAO FOOD GROUPS	NAME OF SELECTED COMMODITIES
Cereals and pulses	Paddy, wheat
Fruits and vegetables	Mango, banana, tomato, red amaranth
Roots, tubers & oil bearing crops	Potato, carrot
Animal products	Milk, poultry meat, red meat, egg
Fish and fish products	Small fish, carp fish



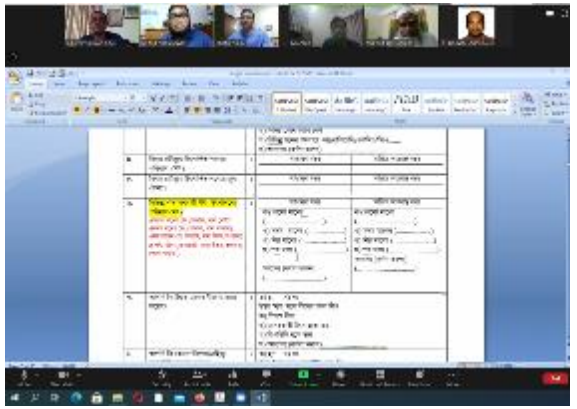
- Quantitative loss across the selected food value chains at the producer and middlemen (Bepari, wholesaler, retailers) levels were estimated following 'Category Method' and 'Self-Reported Method' (Delgado et al. 2017).

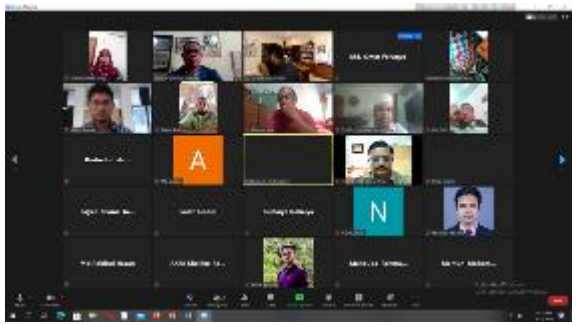
- Food loss- At the producer level (Category method)
  - ✓ Quantitative loss $(WeightLoss_P) = \sum_{i=1}^{I} C_i * QC_{iPH} + (Q_{Prod} - Q_{PH})$
  - ✓ Qualitative loss $(ValueLoss_P) = \sum_{i=1}^{I} (\bar{P}_{ideal} - \bar{P}_{Ci}) * QC_{iPH} + (V_{Prod} - V_{PH})$
- Food loss- At middlemen level (Category method)
  - ✓ Quantitative loss $(WeightLoss_M) = \sum_{i=1}^{I} C_i * (QC_{iSale} - QC_{iPurchase}) + WeightTotLos$
  - ✓ Qualitative loss $(ValueLoss_M) = \sum_{i=1}^{I} (\bar{P}_{ideal} - \bar{P}_{Ci}) * (QC_{iSale} - QC_{iPurchase}) + ValueTotLost$



OVERVIEW OF THE METHODOLOGY

- A total of 2457 questionnaires (Producer- 650; 'Bepari'-650; Wholesalers- 550; Retailers- 550; Husking mills- 10; Semi-automatic rice mills- 10; Automatic rice mills- 2; Flour mills- 10; Fruit processing plant- 1; Milk processing plant- 2; Meat processing plant- 1) were used to collect data.
- The survey was carried out using structured and pre-tested questionnaires through face-to-face interview by trained Data Enumerators.
- Data and information on socio-demographic characteristics; status of pre- and postharvest practices; levels of losses; market access; reasons for loss, etc. were recorded, processed and analysed.
- Stratified random sampling was followed for producer level data collection whereas purposive random sampling was followed for middlemen.
- The collected data were processed and analysed using SPPS (Version 20), and descriptive statistics were used to describe the variables.

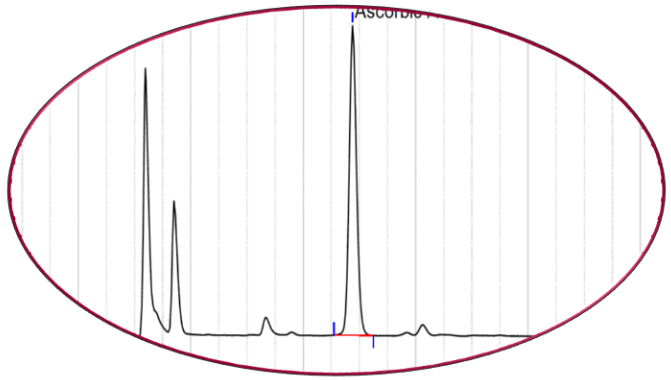


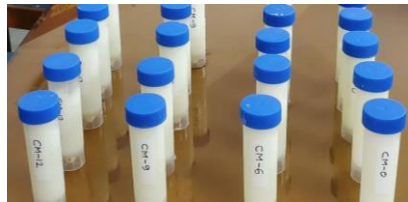


OVERVIEW OF THE METHODOLOGY

MICRONUTRIENT LOSS ASSESSMENT

- For each of the selected commodity, samples were collected at 4-5 stages (depending on the nature of commodity) in triplicate.
- Important vitamins (β-carotene, vitamin C and folate) and minerals (Ca, Na, K, Fe and Zn) were determined.
- Food Safety Lab and Humboldt Soil Testing Lab of BAU; and Food Analysis and Research Laboratory (CARS) of DU.
- AAS (Atomic Absorption Spectrophotometer) for minerals; HPLC (High Performance Liquid Chromatography) for vitamin C and folate; and UV Spectrophotometer for β-carotene.





OVERVIEW OF THE METHODOLOGY

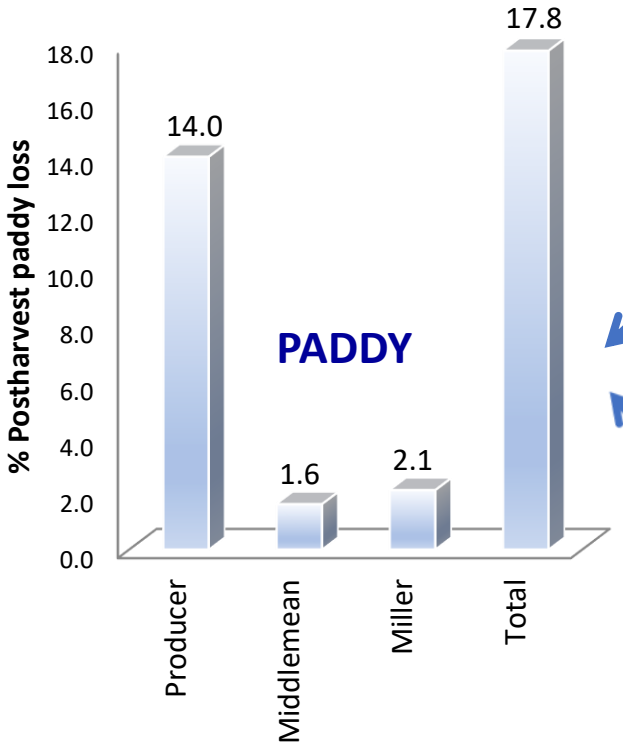
FOOD WASTE ASSESSMENT

- **HOUSEHOLDS-** Data were collected from 175 purposively-selected households of different income groups (Dhaka and Mymensingh).
  - ✓ The income groups were determined based on Gross National Income (GNI-Annual capita^{-1} income) as suggested by World Bank (Low-Income < 1026 $; Middle-Income 1026-12375 $; High-Income- > 12375 $) (World Bank Data Team 2020).
- **RESTAURANTS-** 15 restaurants (5 each of small, medium and large) from Mymensing City were selected. From Dhaka, 15 restaurants were selected from those of BFSA-categorized restaurants (A+, A, B and C).
- **COMMUNITY CENTRE-** 10 community centres (5 from each of Dhaka and Mymensingh) were also included to assess food waste.
- Structured and pre-tested questionnaires were used for food waste assessment through trained Data Enumerators.

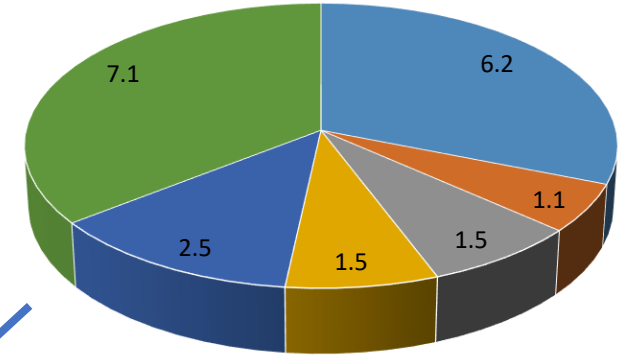
RESULTS- CEREALS (PADDY-ENTIRE VALUE CHAIN)

- Postharvest paddy loss across the selected value chains (farmers to processors)- 17.8%
  - Farmers level- 14.0%
    - ✓Transportation loss- 1.4%
    - ✓Threshing loss- 1.7%
    - ✓Winnowing loss- 1.5%
    - ✓Drying loss- 2.6%,
    - ✓Storage loss 6.8%)
  - Middlemen level- 1.6%
  - Millers' level- 2.1%
- Ghana- (Appiah et al., 2011) - postharvest loss 4.6-17.9% (harvesting loss- 3.0-12.1%; threshing loss was 0.5-4.1%; drying loss- 1.6-1.8%).
- Philippines- postharvest rice loss 5-16% (IRRI 2007).
- Bangladesh- postharvest loss of food grains 15% (FAO and APO study 2006)
- South Asia- 10-37% (FAO, 2007)
- India- 25% cereal loss

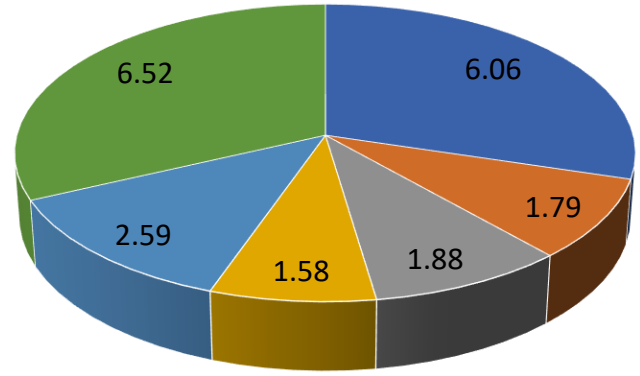
  - Goyal et al. (2017)



PRODUCER, PHULPUR- MYMENSINGH (N=25)

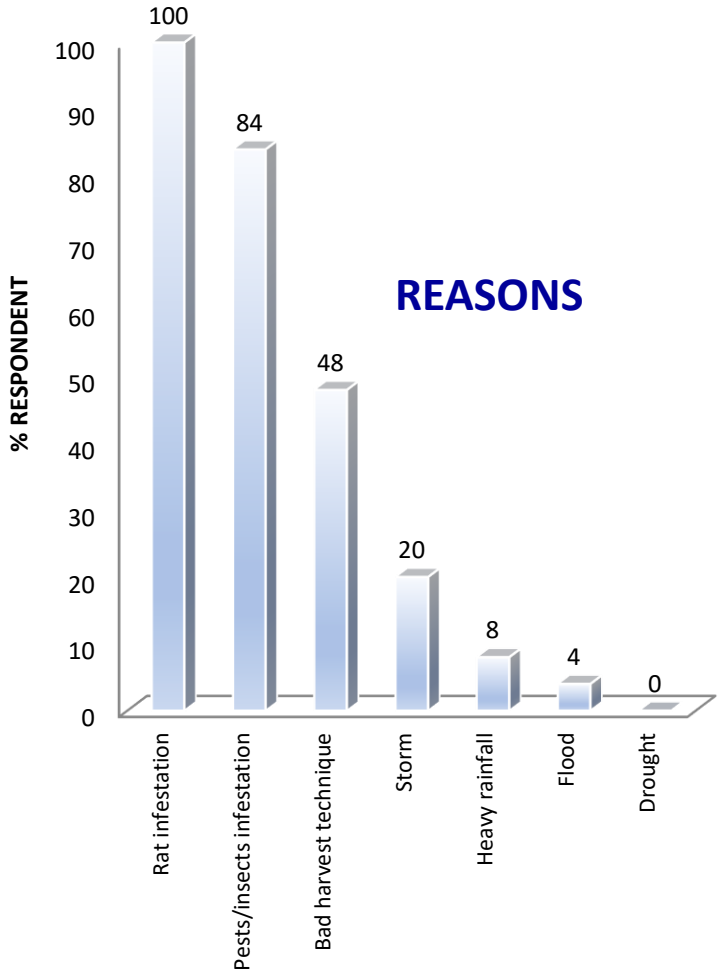


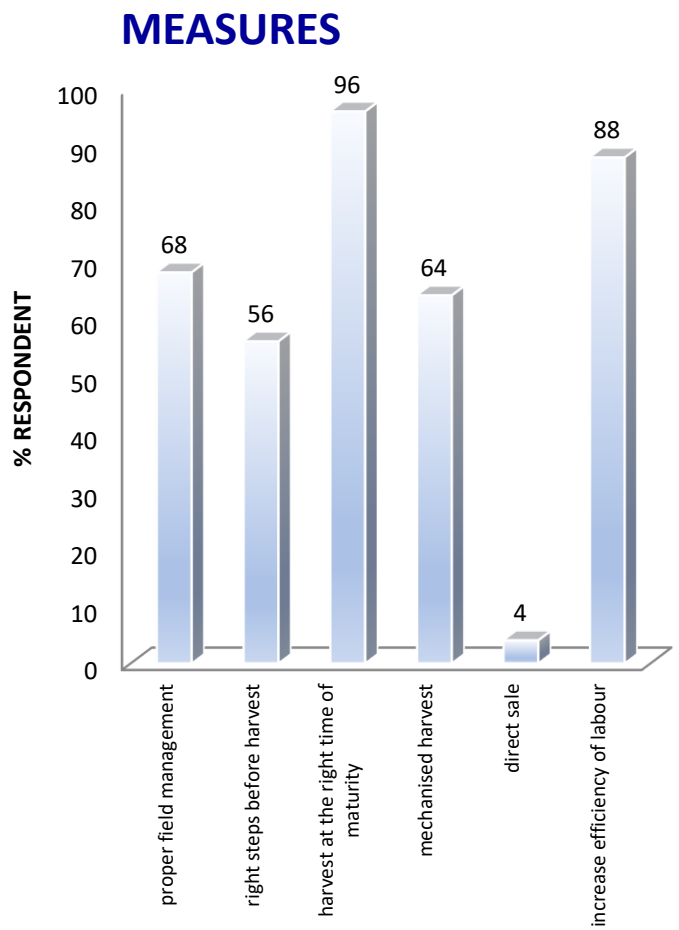
PRODUCER, MAHADEBPUR- NAOGAON (N=25)



RESULTS- CEREALS (PADDY-ENTIRE VALUE CHAIN)

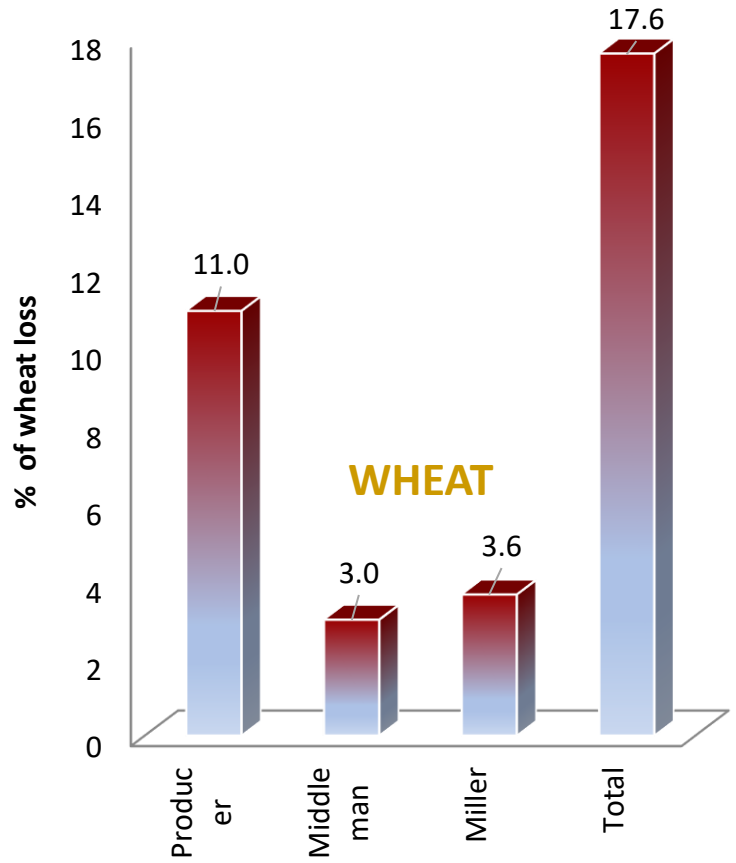
- Rodent (rat) damage has been identified as the critical factor followed by insect and pest damage and improper harvest techniques.
- To minimize losses, harvesting at proper maturity, employ efficient/trained labours and proper field management have been suggested.





RESULTS- CEREALS (WHEAT-ENTIRE VALUE CHAIN)

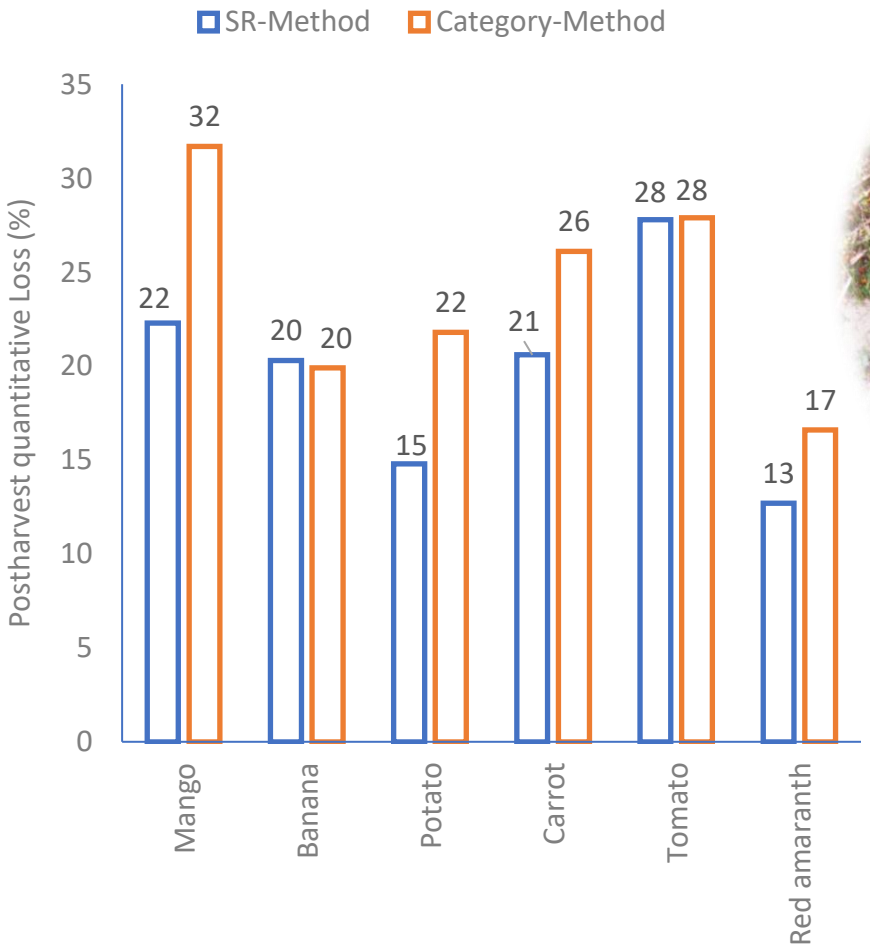
- Loss also occurs in the wheat value chains (Iswardi, Pabna and Dinajpur).
- Average postharvest wheat loss was 17.59% (producer- 11.0%; middlemen- 3.0% and miller- 3.6%).

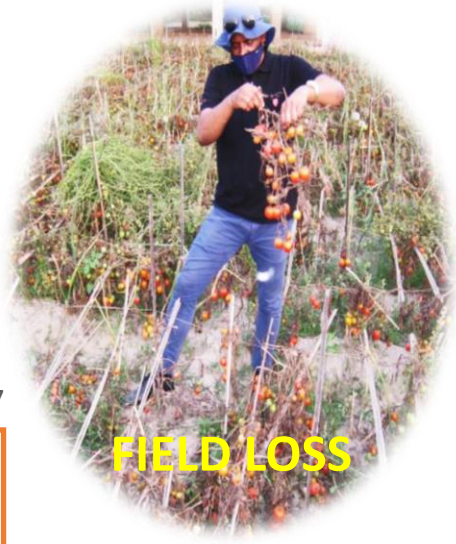


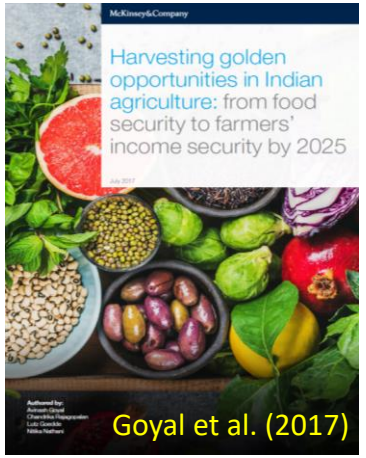
RESULTS- HORTICULTURE (ENTIRE VALUE CHAIN)

- There were wide-ranging postharvest losses for horticultural produce.
- 13-28% with Self-Reported Method- Delgado et al. 2021)
- 17-32% with Category-Method (Delgado et al. 2017).
- Loss occurs throughout the value chain including growers and intermediaries.
- Reasons for loss varies with commodity.
- However, improper postharvest handling, mechanical and microbiological damage, lack of storage and agro-processing, are predominant.
- Present result (e.g. potato) is in agreement with Delgado et al. (2017), where 12.87 and 19.86% losses were reported with Self-Reported Method and Category-Method, respectively.
- Mango PHL in Bangladesh 28-37% (Rahman et al. 2019).
- Fruits and vegetables loss in India- 37% (Goyal et al. 2017)

N=200 (50 for each of growers, Bepari, wholesalers and retailers) for each commodity

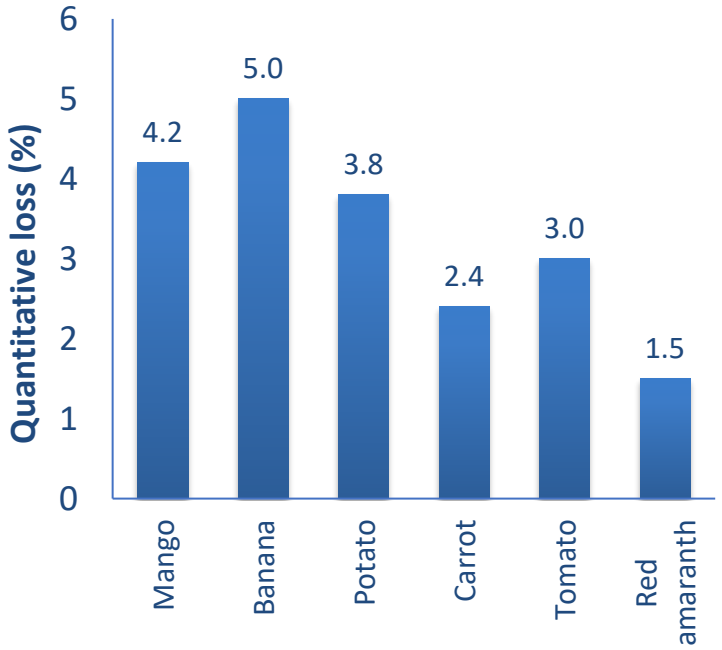






RESULTS- HORTICULTURE (SUPERSHOP)

Commodity	Purchase day^{-1} (N=5)	Sale day^{-1} (N=5)
Mango	88 kg (stdev 22.8)	78 kg (stdev 17.2)
Banana	116 Piece (stdev 35.8)	103 Piece (stdev 29.4)
Potato	158 kg (stdev 42.7)	143 kg (stdev 43.2)
Carrot	68 kg (Stdev 35.6)	58 kg (Stdev 29.1)
Tomato	34 kg (stdev 13.4)	29.4 kg (stdev 11.9)
Red amaranth	22 kg (stdev12.1)	20 kg (stdev10.1)



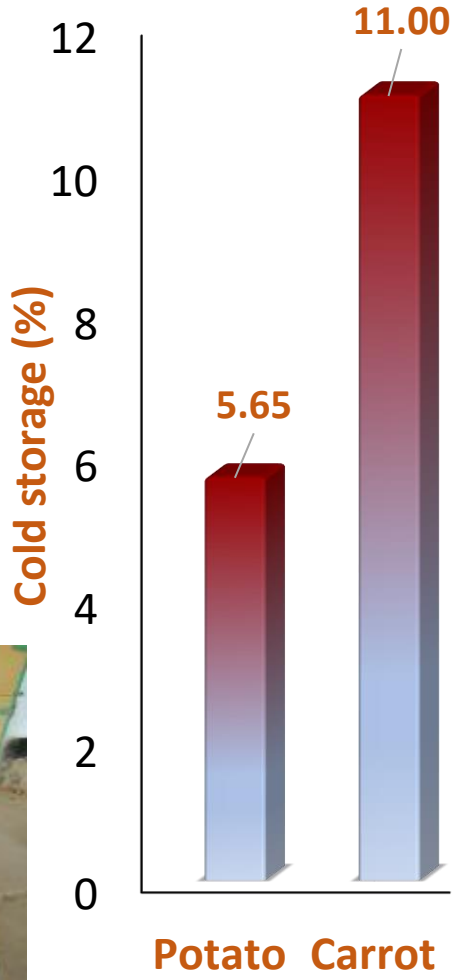
LOSS IN SUPERSHOP (N=5)

- Commodity purchase from super shops is in increasing trend in urban settings
- Business duration ranges from 8-21 years
- There exists considerable losses (2-5%) of the perishables in the super shops surveyed in Dhaka
- Atmospheric conditions in the most supers hops: 20°C and 50% RH
- Horticultural produces are physiologically different from each other and require specific temperature and RH for longer shelf life. Low RH in particular greatly deteriorates product quality and results in loss
- Reasons for loss:
  - ✓ Rots
  - ✓ Bruises
  - ✓ Products remained unsold
  - ✓ Lack of technical knowledge on product handling
  - ✓ Lack of technology for shelf life extension
  - ✓ Lack of value food processing options
  - ✓ Rough handling by the customers

RESULTS- HORTICULTURE (PROCESSING LOSS)

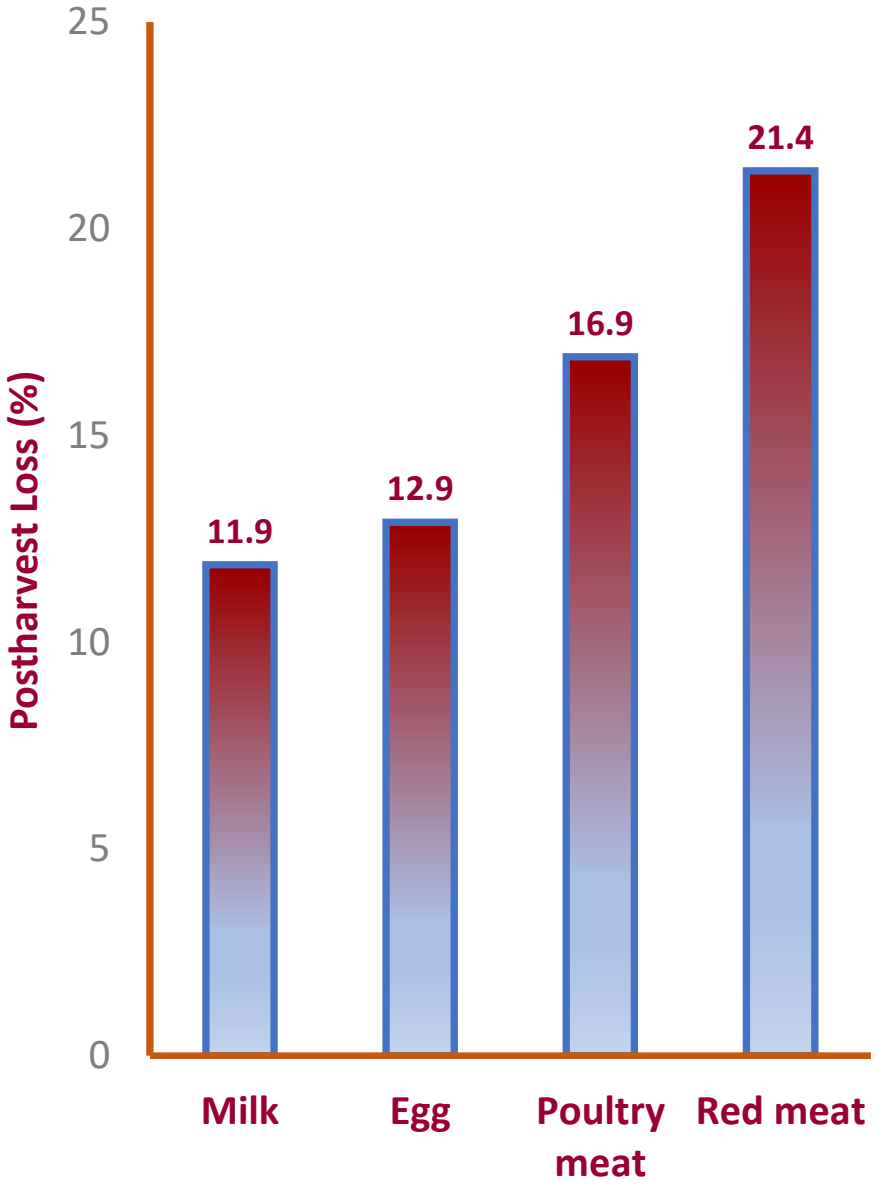
- Loss also occurs at processors' levels. For example, in large-scale mango processing plants, 13 to 17% of raw materials are lost during sorting, grading, de-sapping, washing and crushing.
- 2 to 4% loss occurs during internal transportation and storage of the transformed mangoes. Loss is also observed in large-scale processing of tomatoes.

COMMODITY	STEPS OF PROCESSING	LOSS (%)
Tomato	Before processing (sorting and grading)	5-6
	During processing (crushing- fibre, seed, skin)	7-9
	Loss of raw materials	**12-15**
	Transportation (within factory)	1-2
	Storage	1-2
	Loss of transformed tomatoes	**2-4**
Mango	Before processing (sorting and grading)	6-7
	Manual desapping	0.5-0.8
	Washing	1
	During processing (crushing- fibre, seed, skin)	5-8
	During mixing in tank	0.2-0.5
	Loss of raw materials	**13-17**
	Transportation (within factory)	1-2
	Storage	1-2
	Loss of transformed mangoes	**2-4**



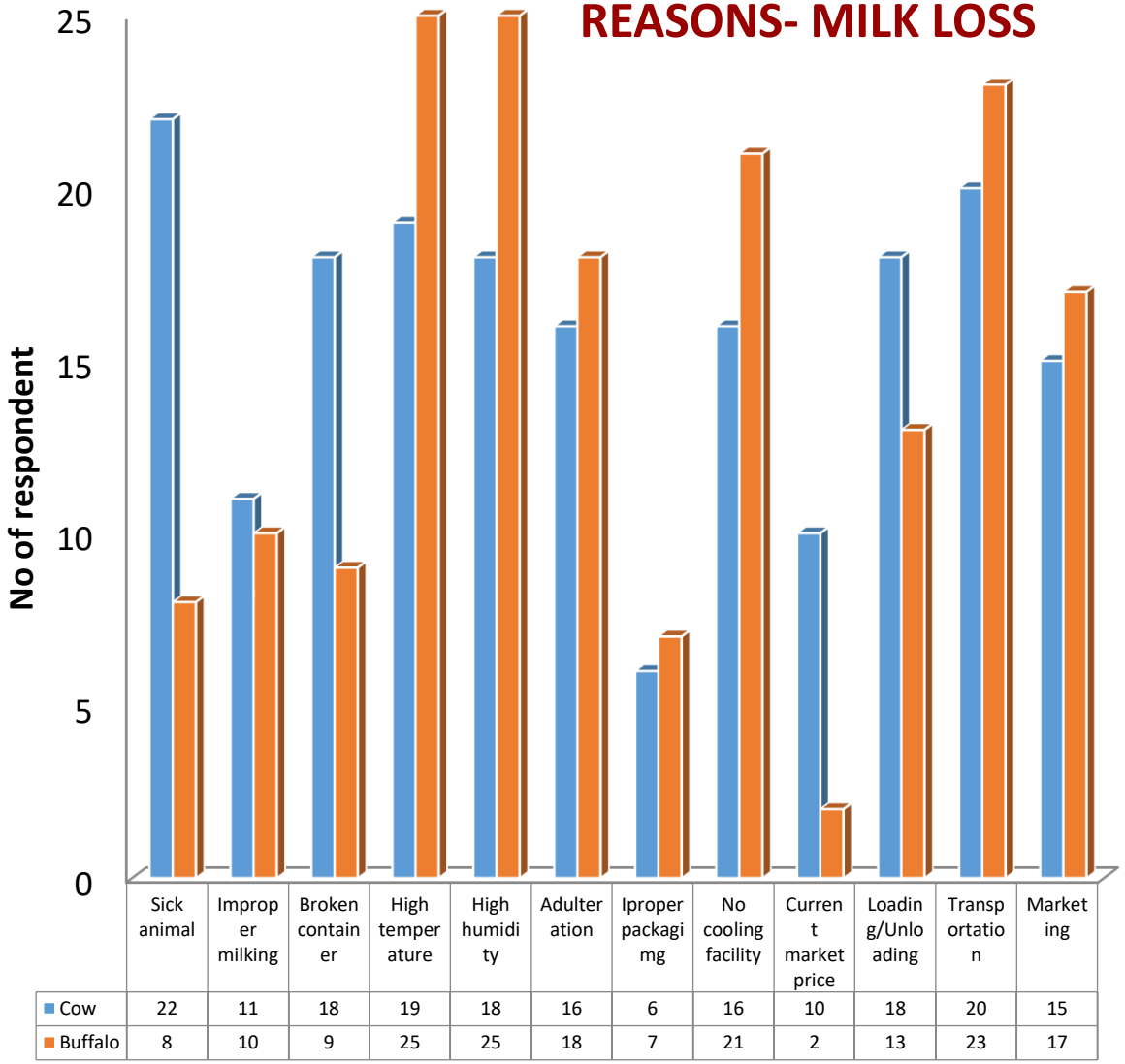
RESULTS- ANIMAL PRODUCTS

- This is important to note that there is no early study in Bangladesh to indicate the magnitude of loss of animal products.
- This is possibly the first study where losses of animal products including milk (cow and buffalo), eggs, poultry meat and red meat at different levels of value chains (producers and middlemen including Bepari, wholesalers and retailer) have been assessed.
- Total postharvest losses of milk (cow and buffalo), eggs, poultry meat and red meat were 11.9, 12.9, 16.9 and 21.4%, respectively.
- The processing losses of meat and meat products and milk and milk products were in the range of 5-9 and 8-12%, respectively.



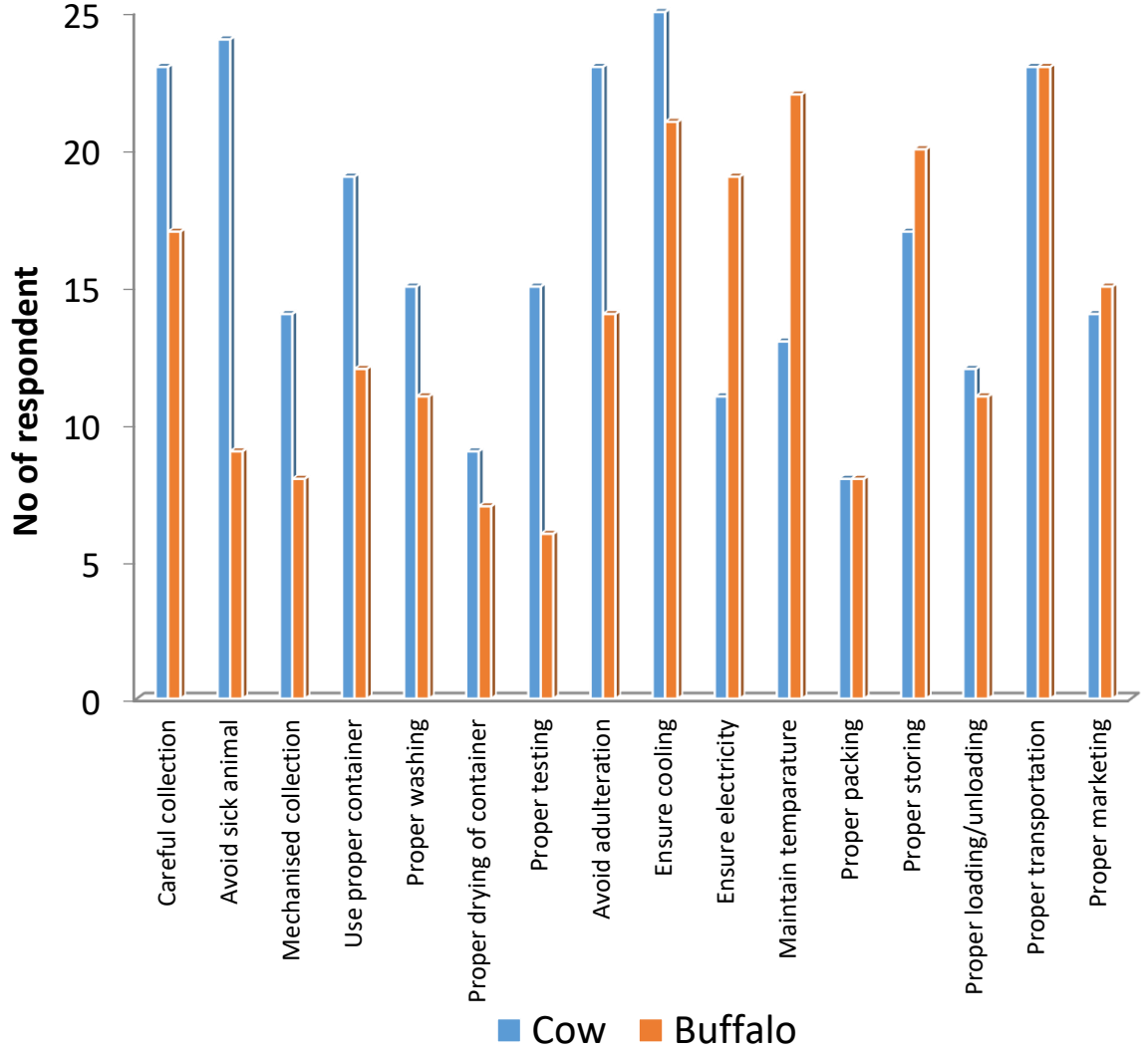
RESULTS- ANIMAL PRODUCTS

REASONS- MILK LOSS



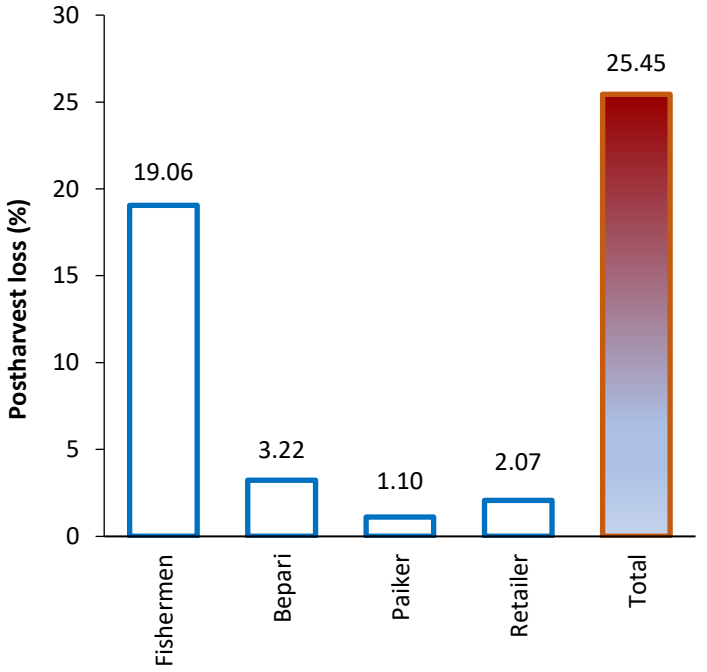
	Sick animal	Improper milking	Broken container	High temperature	High humidity	Adulteration	Iproper packagimg	No cooling facility	Current market price	Loading/Unloading	Transportation	Marketing
Cow	22	11	18	19	18	16	6	16	10	18	20	15
Buffalo	8	10	9	25	25	18	7	21	2	13	23	17

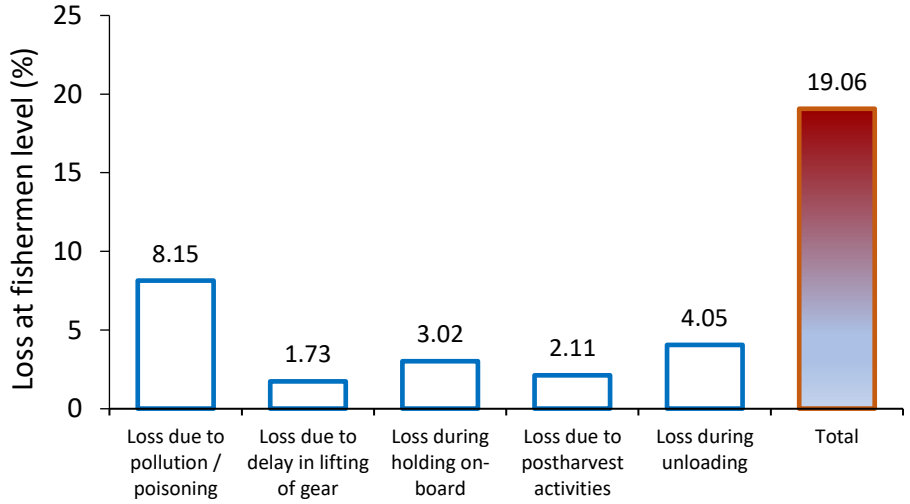
MEASURES – TO REDUCE MILK LOSS



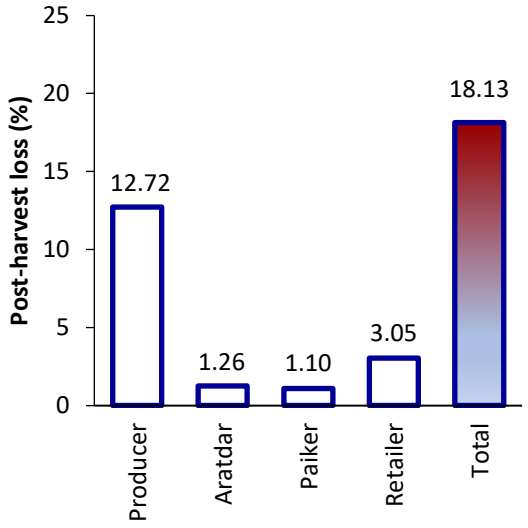
RESULTS- FISH AND FISH PRODUCTS (SMALL FISH VALUE CHAIN)

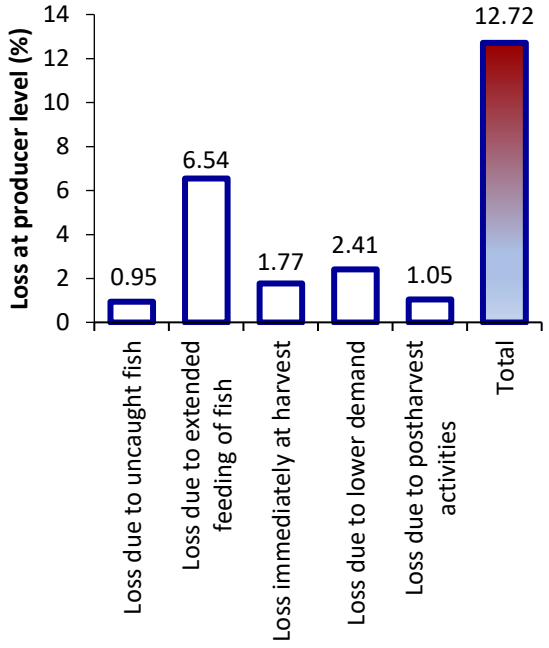
- Quantitative loss of small fish was estimated along the selected value chain following Category-Method (Delgado et al. 2017).
- Total loss for small fish was 25.45% of which, fishermen reported the highest level of postharvest loss of 19.06 ± 3.56%.
- In developing countries, the degree of postharvest fish losses ranges from 10-59% of total catch (Ibengwe and Kristófersson, 2012; Maulu et al. 2020).
- Institute of Fisheries Technology (CIFT) of India- 10-30% of fish landed were of poor quality that fetched price loss between 45-75% (Papadopulos, 1997).





RESULTS- FISH AND FISH PRODUCTS (CARP FISH VALUE CHAIN)



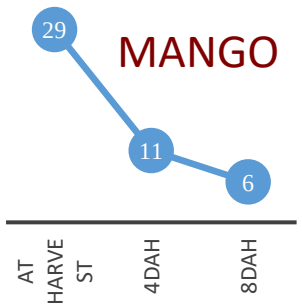


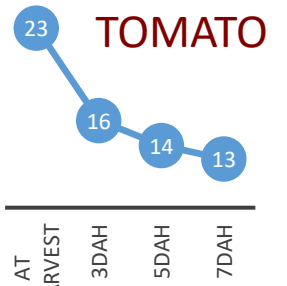
- Total loss for carp fish was 18.13%. Of this loss, fishermen reported the highest level of loss (12.72%).
- The amount of postharvest loss for carps estimated in the present study is slightly lower that that reported by previous study conducted back in 1983 (Ahmed, 1983). He reported that quantitative losses accounted for about 19-26% for carps.
- A study conducted by Alam (2010) reported that wet fish in Bangladesh incurred 7-19% loss across the value.

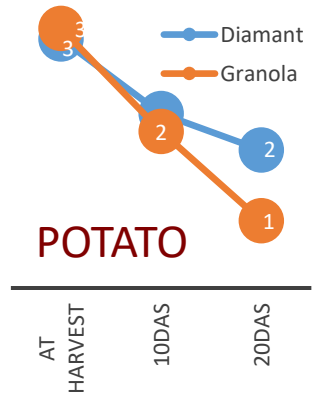
Reasons of postharvest loss	Respondent (%)			
	Producer	Bepari (Aratdar)	Paiker (Wholesalers)	Retailer
Adopt good aquaculture practice	72	-	-	-
Mechanization of aquaculture	80		-	-
Adopt modern harvesting practice	20	-	-	-
Expansion of domestic market through product diversification	44	-	-	-
Proper handling of fish	-	8	68	20
Proper Icing	-	8	28	16
Protect from sunlight	-	20	36	40
Use of clean water	-	48	40	20
Use of clean utensils	-	32	40	60
Improved preservation facilities	-	40	72	40
Improved marketing infrastructure	-	60	80	-
Immediate sale of fish	-	80	48	48
Others	-	-	-	4

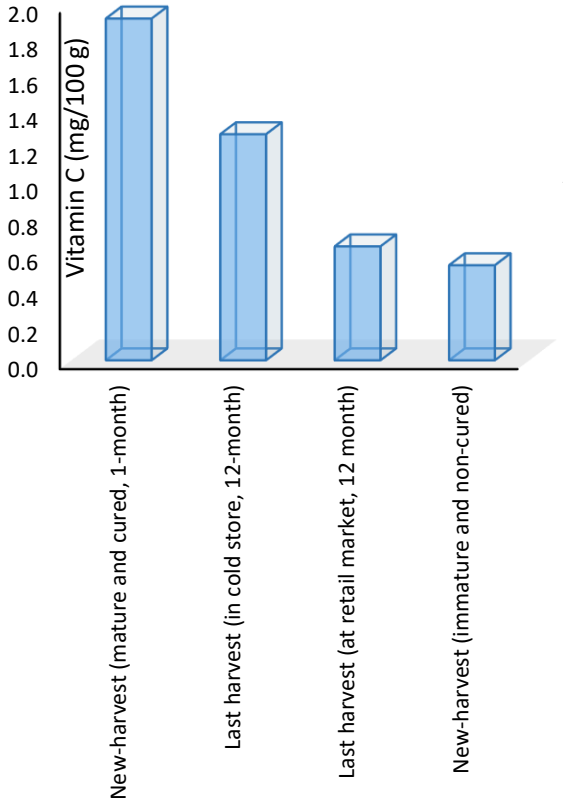
RESULTS- MICRONUTRIENT LOSS

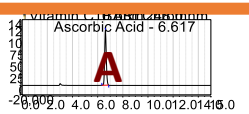
- There is another type of loss, which is often termed as micronutrient loss, and there is paucity of data.
- Vitamin C, a powerful antioxidant with scores of health functions, declines sharply as time progressed after harvesting.
- For example, in mango (cv. BARI Am 4) it declines by 62% and 79% at 4 and 8 days after harvest, respectively.
- Similarly, in tomatoes (cv. Hybrid 1217), the rates of decline were 29% and 40% within 3 and 7 days after harvest, respectively.
- It also greatly varies with postharvest handling practices during marketing and distribution.
- For example, the highest vitamin C content was found in potatoes harvested at the right stage of maturity and prior to cold storage.
- Hence, it is important to conserve micronutrients in food through proper postharvest food handing, preparation, cooking, and consumption practices.
- Vitamin C is susceptible to destruction by heat, light and water, and is unstable.
- Gopalan et al. 1981: Green tomatoes contained slightly higher level of vitamin C (31 mg 100 g^{-1}) as compared to ripe tomatoes (27 mg 100 g^{-1}).
- β-carotene level in carrot showed an increasing trend as time after harvest progressed.
- Level of β-carotene increased to 2825 µg 100 g^{-1} at the 12 days after harvest as compared to 2231 µg 100 g^{-1} as recorded in carrots immediately after harvesting.
- Gopalan et al. (1981) and Islam et al. (2012): In carrot-1890.00 and 1689.43 µg 100 g^{-1} β-carotene.

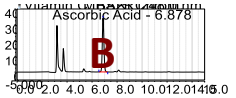




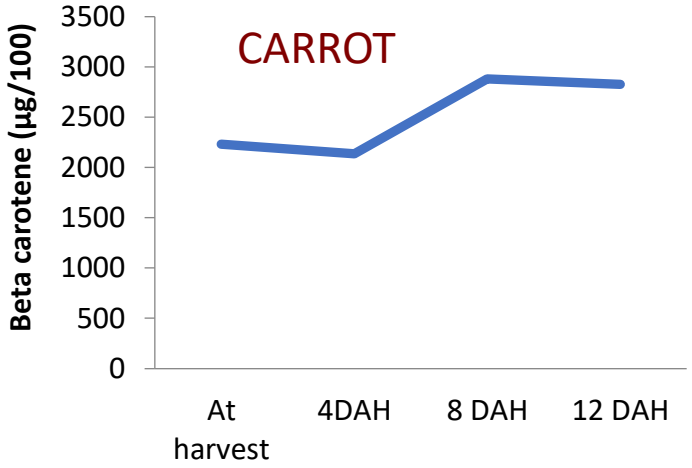






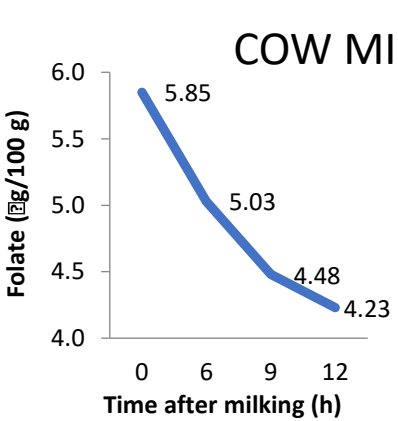


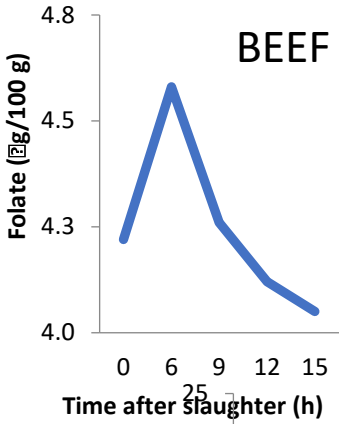
HPLC Chromatograms of vitamin C standard (A) and mango sample (B)

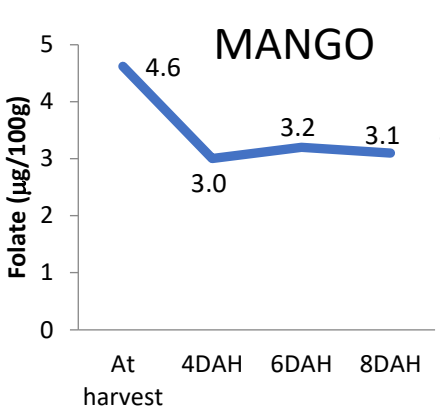


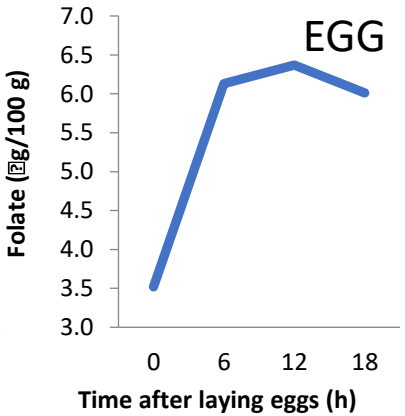
RESULTS- MICRONUTRIENT LOSS

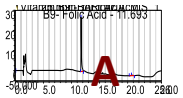
- Folate is an important B complex vitamin, responsible for producing blood cells, and is considered an important micronutrient for pregnant women.
- In recent years, folates have come into focus due to their protective role against childbirth defects, coronary heart disease and certain forms of cancer.
- During the last few years most countries have established increased recommended intakes of folates, for example, between 300-400 µg day-1 for adults.
- In the present study, the folate levels were in the order of wheat (38.70 µg 100 g^{-1}) > chicken meat (15.17-21.78 µg 100 g^{-1}) > rice (11.78 µg 100 g^{-1}) and > tomato (4.60-8.50 µg 100 g^{-1}).
- Its level declines in cow milk, beef and mango and increases in tomato, chicken meat and buffalo milk, and these contrasting behaviours warrant in-depth investigation in the commonly-consumed food items for diet planning and nutrition messages.
- Storage conditions , packaging materials and processing have been associated with folate losses (Dolores Iniesta et al., 2009).

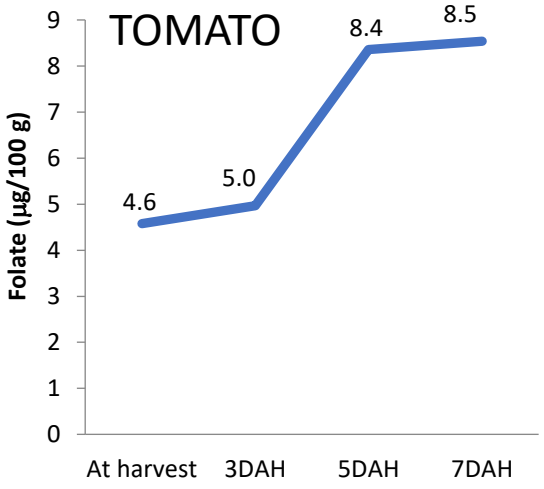


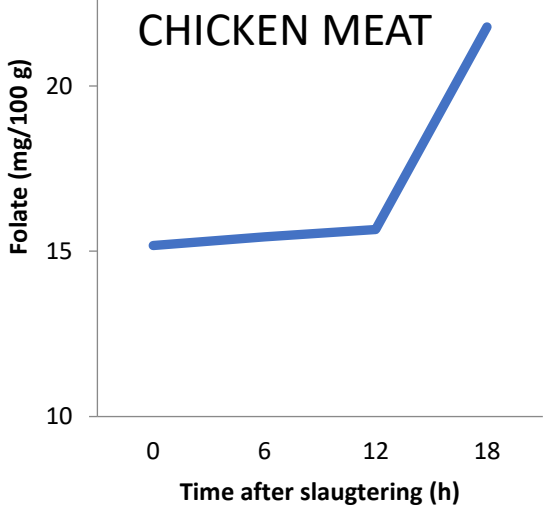


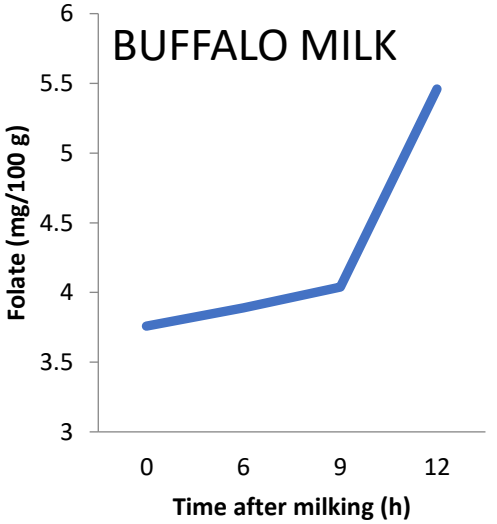


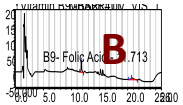








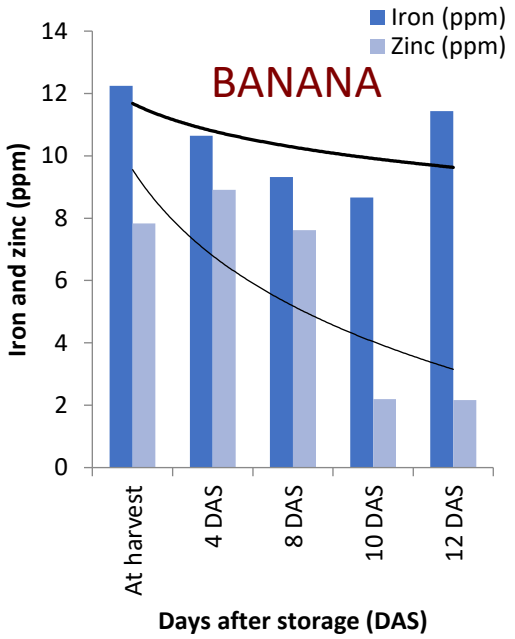


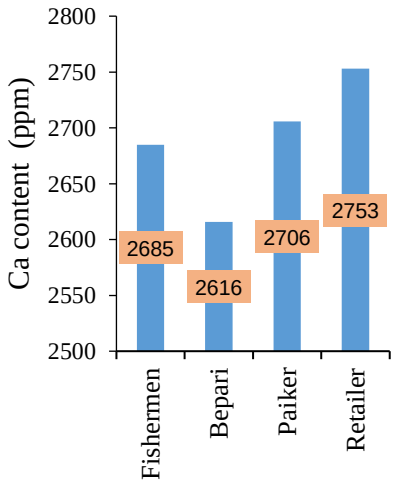


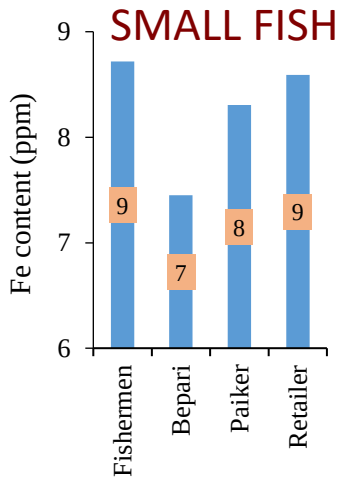
HPLC Chromatograms of folic acid standard (A) and mango sample (B)

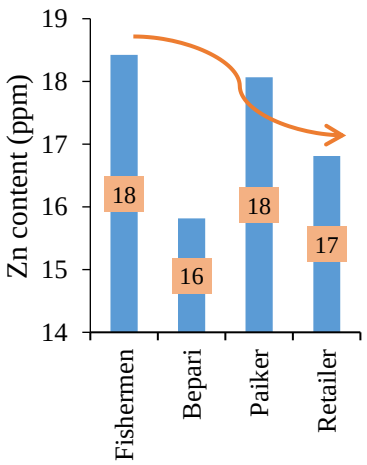
RESULTS- MICRONUTRIENT LOSS

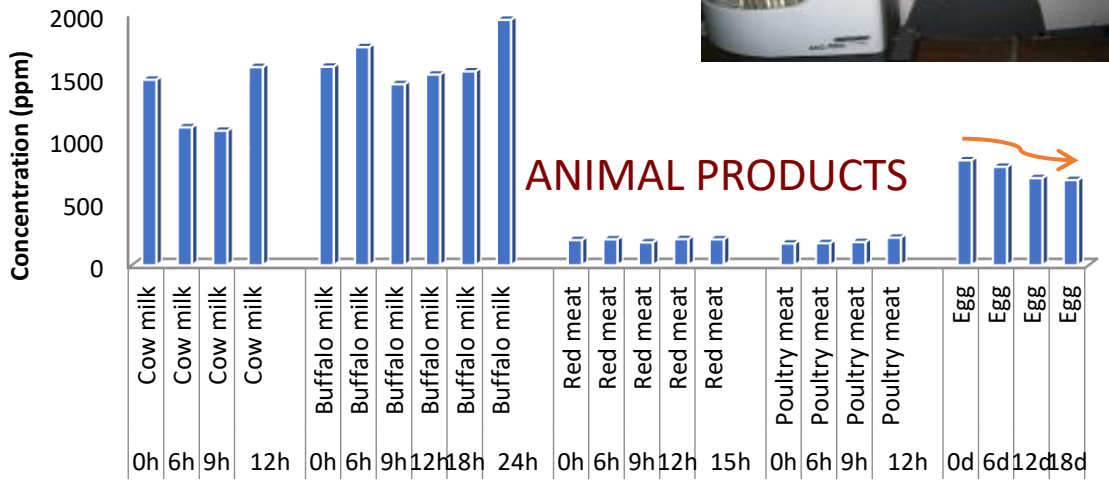
- Like vitamins, mineral contents also vary widely with food types.
- For example, potato variety Diamant contained higher iron and zinc (25.78 and 6.26 ppm, respectively) as compared to Cardinal (only 6.26 and 5.42 ppm, respectively).
- Micronutrient contents of various animal products were also assessed. Calcium content was the highest in buffalo milk followed by cow milk and egg.
- Small fish was also found to be rich in Ca and Zn.
- Amongst the minerals studied, zinc contents in certain crops, meat and milk trended to slightly decrease as time progressed after harvesting or milking or slaughtering.
- In bananas, significant decline in zinc was evident.
- In addition to the currently available food composition tables, there is an imminent need to generate variety and breed-specific data on micronutrient levels of various food products to facilitate preparation of guidelines, policies, code of practices related to nutrition.





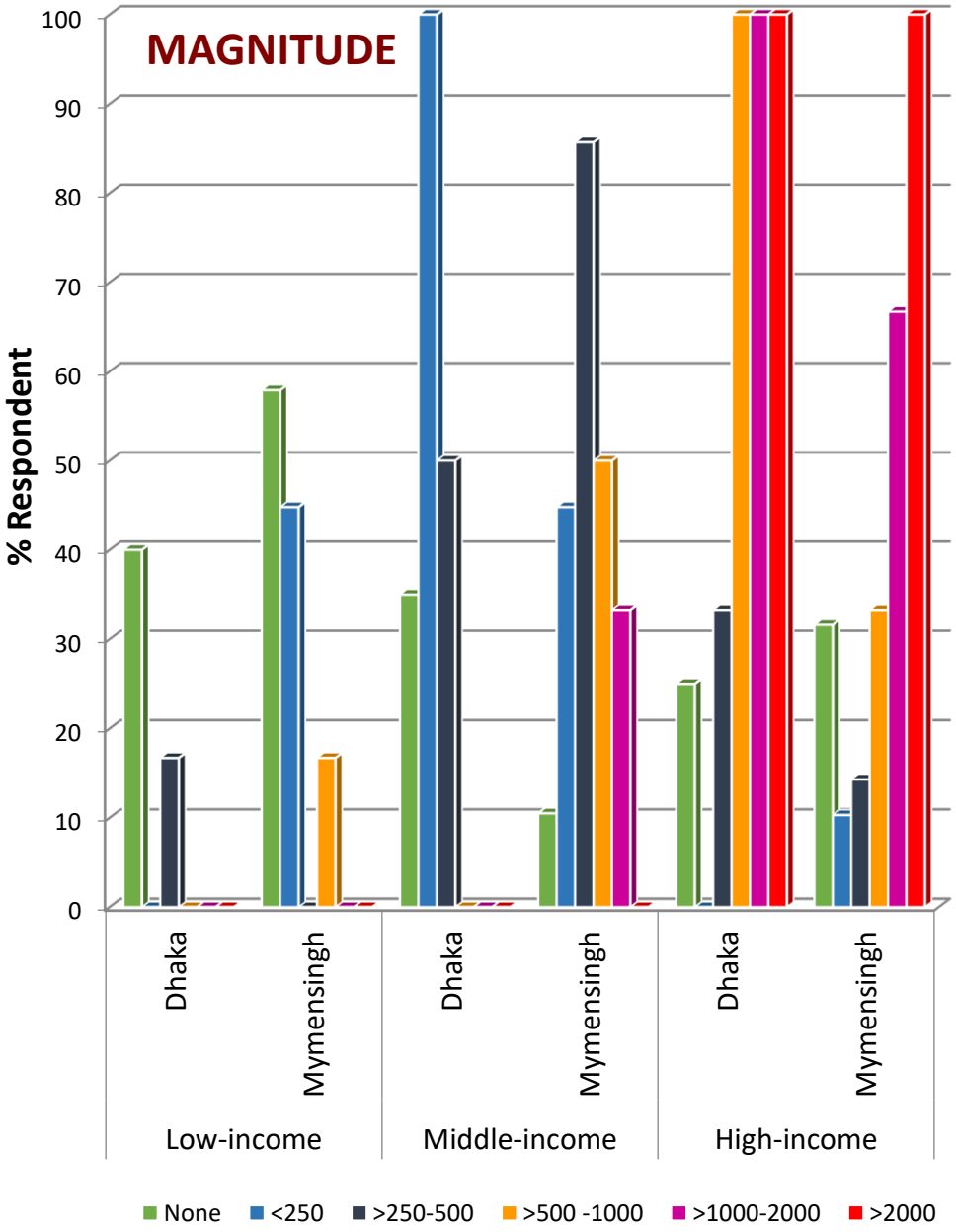






RESULTS- FOOD WASTE (HOUSEHOLDS)

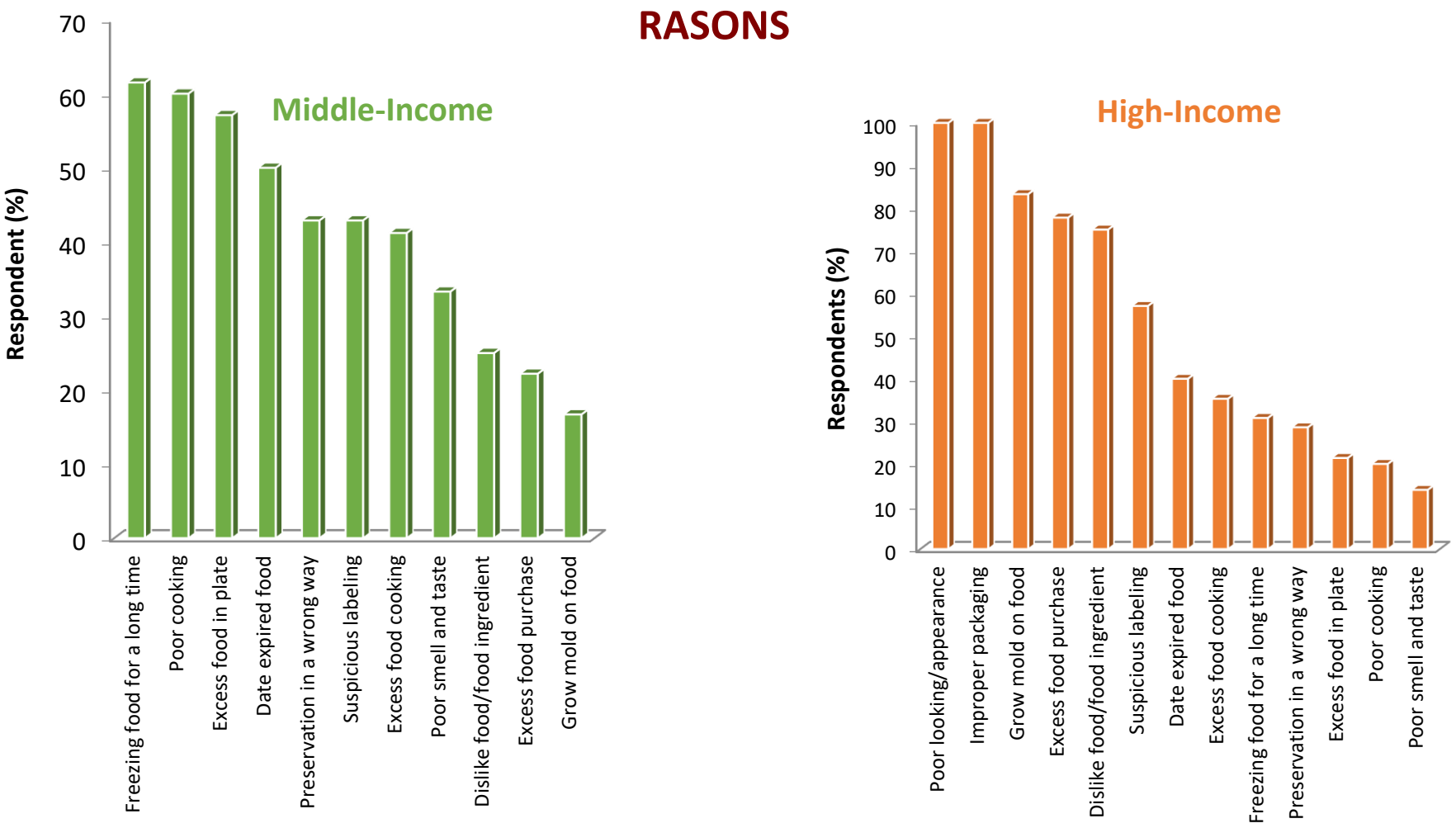
- Finally, the food waste, a global crisis, and linked with greenhouse gas emission, food insecurity, loss in biodiversity and environmental pollution.
- There is lack of data on the magnitude of food waste- which occurs at retail and consumption levels.
- This study reveals that food waste is highest for richer families and lowest for poorer ones.
- Strikingly, > 2 kilograms of food is thrown away per week by high-income households.



LIHH: < BDT 7182 head^{-1} month^{-1}
MIHH: BDT 7182-87000 head^{-1} month^{-1}
HIHH: > BDT 87000 head^{-1} month^{-1}

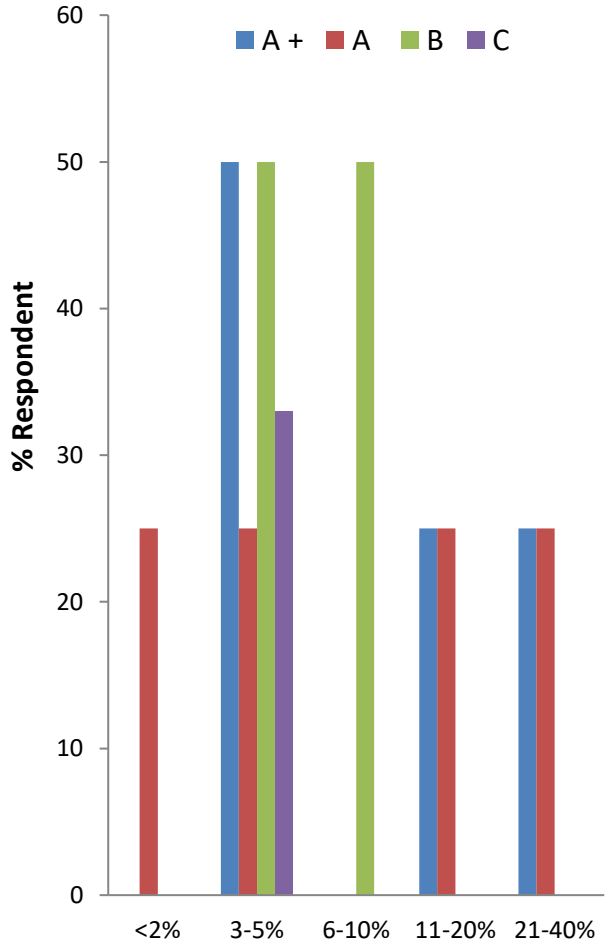
(N=25 for each of Low, Middle and High-Income Households)

RESULTS- FOOD WASTE (HOUSEHOLDS)

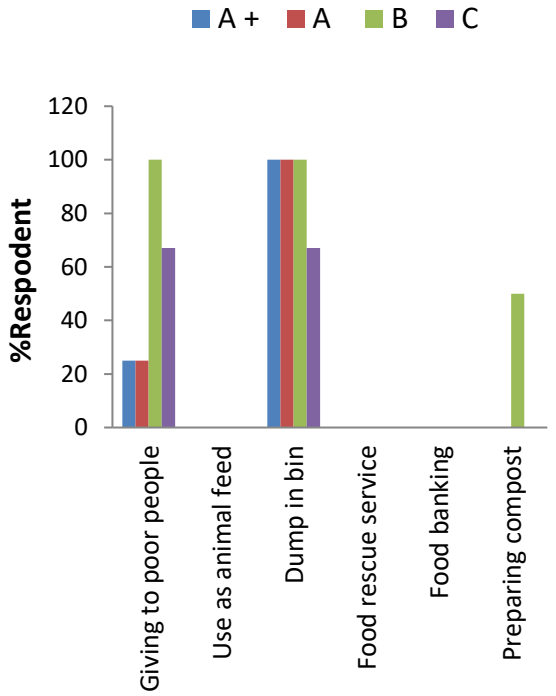


RESULTS- FOOD WASTE (RESTAURANTS)

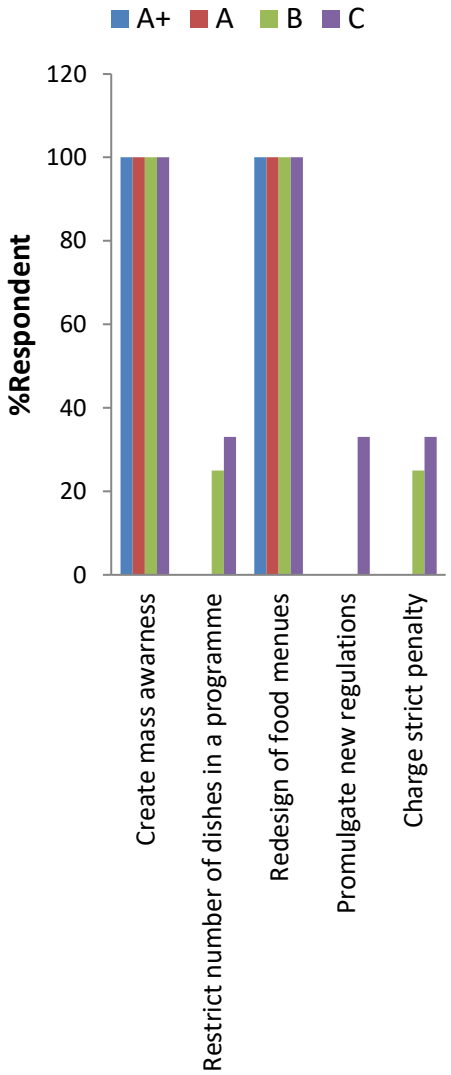
- For restaurants, among those categorized as A+ and A by BFSA (Bangladesh Food Safety Authority), one quarter record between 21 to 40% food waste, and another quarter between 11 to 20%.
- In contrast, the B and C category restaurants record only 6 to 10% and 3 to 5%, respectively.
- Excess food order and tendency to taste all foods are critical factors for food waste in restaurant.
- In community centres, food waste (as leftovers) ranges from 5 to 30%.



Magnitude of food waste



Present practice of food waste management



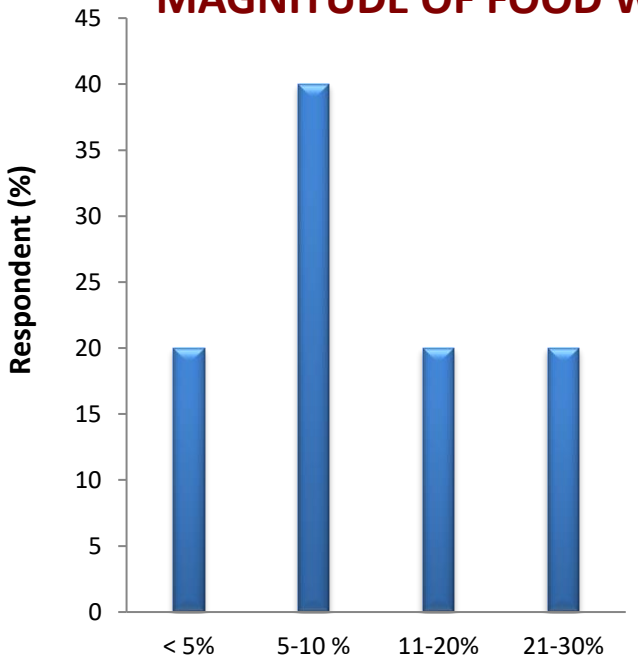
Ways to reduce food waste

Source: Anthony Bennet (FAORAP)

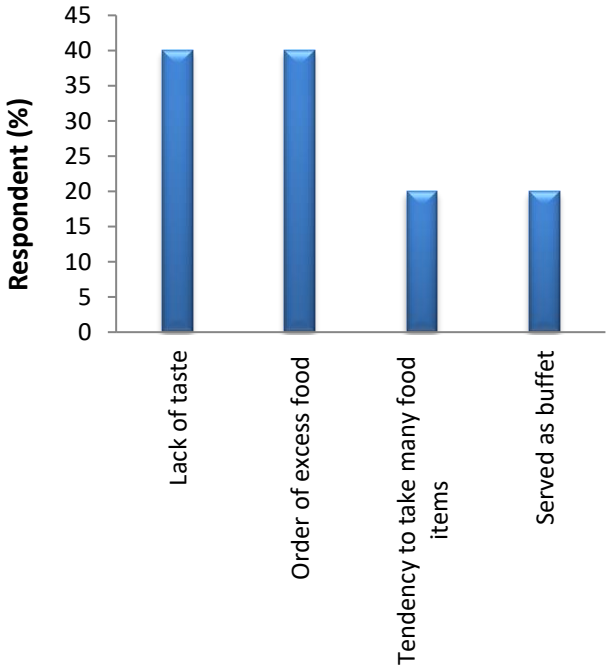
RESULTS- FOOD WASTE (COMMUNITY CENTRE)

- In community centres, food waste (as leftovers) ranges from 5 to 30%.

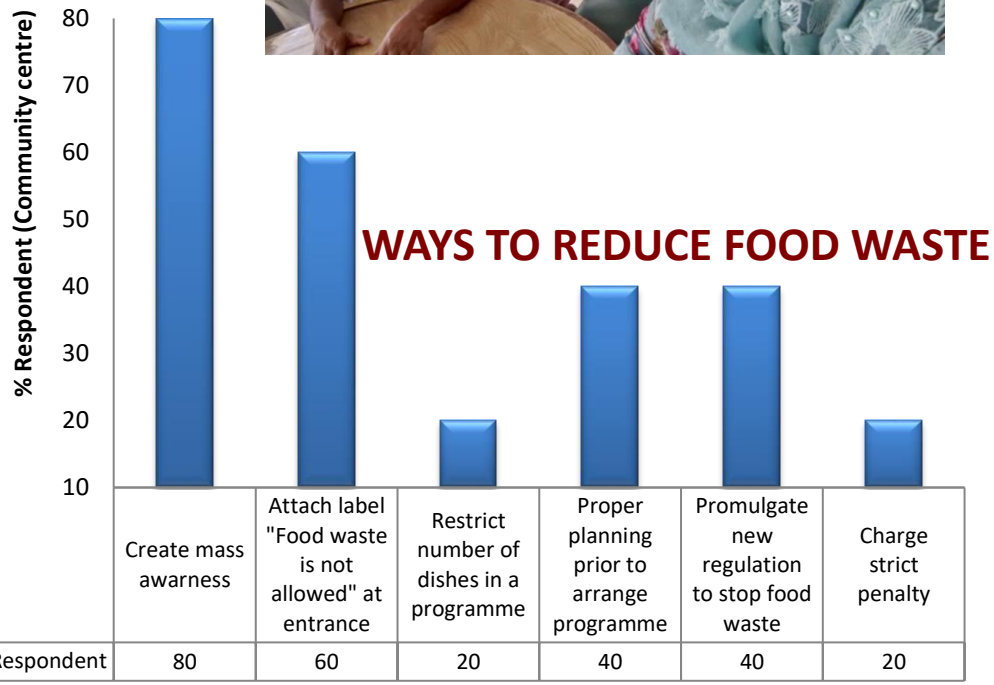
MAGNITUDE OF FOOD WASTE



REASONS FOR FOOD WASTE



WAYS TO REDUCE FOOD WASTE



CONCLUSIONS

FOOD LOSS

- Postharvest loss was substantial across the selected value chains and ranged from 12-32% irrespective of food groups. In case of cereals, average postharvest paddy loss (farmers to processors) was 17.80% in which the losses at the producers, middlemen (Bepari) and millers were 14.02%, 1.62% and 2.12%, respectively. Lack of proper storage was the main reason for postharvest loss at the producers' level, while the damage due to rodent pests was identified as the main cause of pre-harvest loss. Average postharvest wheat loss was estimated as 17.59%.
- Postharvest losses of horticultural produce ranged from 17-32%. Losses were due to rots, bruises, advanced ripening and senescence, lack of storage and agro-processing. Loss also occurs at the processors' levels (13-17% of raw materials received while 2-4% for the transformed mangoes) and at the super shop (2-5%).
- Total postharvest losses of animal products ranged from 8-21%. The processing losses of meat and meat products and milk and milk products were in the range of 5-9 and 8-12%, respectively.
- Total quantitative losses of small fish and carp fish were also assessed along the value chains, and were 25.45 and 18.13%, respectively.

MICRONUTRIENT LOSS

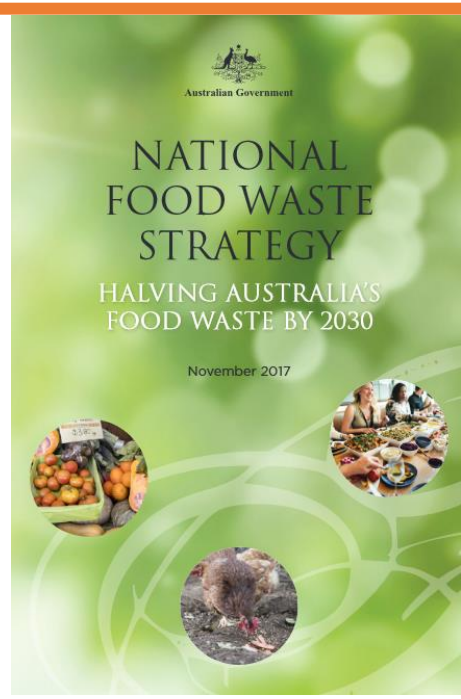
- Levels of vitamin C declines sharply as time progressed after harvesting of fruits and vegetables. For example, in mango (cv. BARI Am 4) it declines by 62% and 79% at 4 and 8 days after harvest, respectively. Vitamin C loss is also associated with postharvest management and storage.
- Folate levels were in the order of wheat (38.70 μg 100 g^{-1}) > chicken meat (15.17-21.78 μg 100 g^{-1}) > rice (11.78 μg 100 g^{-1}) and > tomato (4.60-8.50 μg 100 g^{-1}).
- Decline in folate was observed in cow milk, beef and mango
- Mineral contents also vary widely among crop varieties, and their patterns of change or losses also vary.
- For example, Diamant potato contained higher iron and zinc (25.78 and 6.26 ppm, respectively) as compared to Cardinal (only 6.26 and 5.42 ppm, respectively).
- Calcium content was the highest in buffalo milk followed by cow milk and egg.
- Iron content was found to be the highest in red meat followed by egg and chicken meat.
- Zinc content was found the highest in red meat followed by egg.
- Amongst the minerals studied, zinc contents in certain crops, meat and milk trended to slightly decrease as time progressed after harvesting or milking or slaughtering.

FOOD WASTE

- There is lack of data on the magnitude of food waste- which occurs at retail and consumption levels- in Bangladesh.
- This study reveals that food waste is the highest for richer families and lowest for poorer ones.
- Strikingly, >2 kilograms of food is thrown away per week by high-income households.
- For restaurants, among those categorized as A+ and A by BFSA, one quarter record between 21 to 40% food waste, and another quarter record 11 to 20%. In contrast, the B and C category restaurants record only 6 to 10% and 3 to 5%, respectively. Excess food order and tendency to taste all foods are critical factors for food waste in restaurant.
- In community centres, leftovers range from 5 to 30%.

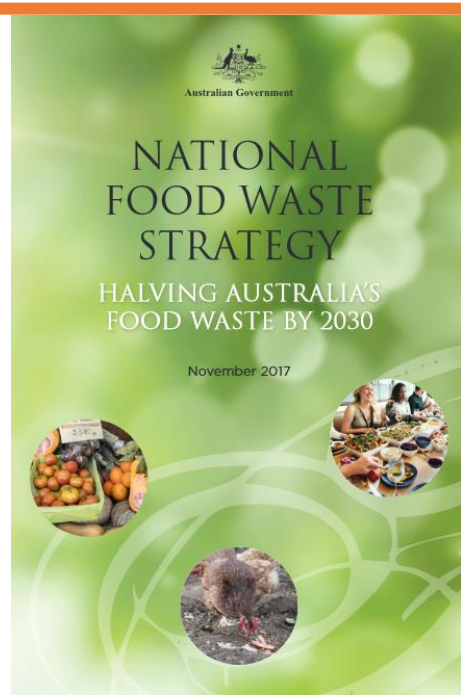
ACTIONABLE RECOMMENDATIONS FOR POLICY

- The Government of Bangladesh needs to develop and implement a national strategy to reduce FLW towards achieving SDG target 12.3. Similar national strategy has been developed by many countries like Australia, China, Japan, Singapore and Thailand.
- Irrespective of food groups, substantial loss occur across value chains.
- In the case of cereals, adoption of improved pre-harvest practices at the producers' level and modern storage technology (hermetic storage) at the producers, middlemen and millers' levels would have substantial impact on reducing loss of paddy, the staple food of the nation.
- In the case of perishable products, significant improvements may occur by creating modern harvesting (mechanical harvesting) and postharvest facilities (sorting, grading, storage, packaging, cooling, refrigeration, transportation, slaughterhouses and abattoirs), encouraging civil society dialogues, and promoting public-private partnership.



ACTIONABLE RECOMMENDATIONS FOR POLICY

- Adoption of improved pre- and postharvest practices, namely GAP, GAqP, GHP, GMP and HACCP across the food value chains are needed to improve food quality and safety, retain micronutrients and reduce food losses.
- Capacity building in education, research & human resource development;
- Food waste occurs at the tail end of the food value chain.
- Significant waste of food is observed at the middle and high income households, as well as in restaurants and community centres. To deal with food waste, a number of actions can be taken:
  - Create mass awareness;
  - Improvement of cooking and consumption habits of consumers through enhanced food and nutrition literacy;
  - Preparation of guidelines and code of practices (CoPs) for value chain actors including consumers;
  - Promulgation of legislations especially to stop food waste;
  - Increase in capacity of waste recycling;
  - Promotion of public and private sector food rescue and food banking services; and
  - Engagement of civil society.



SUGGESTED FURTHER STUDY

- Conduct research on recycling of food waste.
- Establish food banking on pilot basis.
- Assessment of micronutrients of the commonly-consumed food of plant and animal origin in terms of variety, breeds and stage of harvesting/marketing.
- Develop and optimize postharvest technology to reduce FLW.
- Appropriate coking practice to minimize micronutrient loss.
- Value-added product development (fresh-cut, minimal processing and processing).

Acknowledgement

- FAO
- EU
- USAID
- FPMU, MoF
- BAU

SAVE FOOD
Thank You