



Research Article

Marketing System of Broccoli in Selected Areas of Mymensingh District in Bangladesh

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ARTICLE INFO	ABSTRACT
<p>Article history Received: 02 October 2023 Accepted: 13 December 2023 Published: 31 December 2023</p> <p>Keywords Broccoli, Marketing Channel, Cost, Margin, Mymensingh</p> <p>Correspondence Sarah Yasmin ✉: jesy099@bau.edu.bd</p>	<p>Broccoli, a member of the cabbage family and a popular winter vegetable, is the focus of our study. We aimed to investigate the marketing system for broccoli in specific areas of Mymensingh district. We gathered data through face-to-face interviews with 100 respondents, selected using purposive sampling. Our study identified four distinct marketing channels within the region, involving various market participants such as farmers, Aratdar, wholesalers, Aratdar cum wholesalers, retailers, and consumers. Furthermore, our study revealed that most farmers considered the cost of production as their primary challenge, while intermediaries cited a lack of market information as their main issue. Notably, we found that wholesalers incurred the highest marketing cost per piece of broccoli (Tk. 2.46), while retailers had the lowest cost (Tk. 1.58 per piece). Transportation costs accounted for the largest share of expenses (52.14%), with electricity bills being the smallest (0.59%). When it came to net margins, retailers emerged as the highest earners (Tk. 3.43 per piece), while wholesalers received the lowest net marketing margin (Tk. 1.66 per piece). Therefore, policymakers should consider implementing policies to address these challenges and promote overall development in the broccoli marketing system in Bangladesh, including raising awareness about broccoli consumption among the population.</p>
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Introduction

Vegetables hold a vital role in agricultural production in Bangladesh. It offers promising economic opportunities to alleviate rural poverty and unemployment, playing a pivotal role in agricultural diversification strategies (Schreinemachers et al., 2018). Both the production and marketing of vegetables require labor-intensive efforts, providing income-earning opportunities (Islam, 2020). Still, vegetables contribute significantly to enhancing food, nutrition, and economic security for the people of Bangladesh (Hoq et al., 2014). In Bangladesh, over 60 different types of vegetables, both indigenous and exotic, are cultivated, primarily in flood-free homestead areas (Weinberger and Genova II, 2005). Furthermore, growing winter vegetables like broccoli (*Brassica oleracea* var. *italica*) and cauliflower (*Brassica oleracea* var. *botrytis*) offers economic benefits in terms of land, time, and nutritional investment. Broccoli, a widely consumed cruciferous vegetable globally, derives its name from the Italian word "broccolo," referring to the flowering top of a cabbage (Li et al., 2019). Despite its

resemblance to cauliflower, broccoli stands apart with its large flower heads, stalks, and small leaves. It belongs to the cabbage family and is primarily valued for its florets and sprouts, while the stalks and leaves are typically discarded during harvesting (Li et al., 2022).

Nutritionally, one cup of broccoli contains approximately 4.78 grams of carbohydrates, 2.5 grams of protein, and 1.8 grams of fiber. According to Mukaila et al. (2021), carrots and cucumbers are also highly nutritious, rich in minerals and vitamin A, and considered safe and healthy choices. Broccoli plays a role in regulating blood pressure and reducing cholesterol levels due to its potassium and chromium content. It is a low-calorie vegetable, providing only 31 calories per cup (91 grams) (Jahan et al., 2010). Broccoli's carbohydrate content primarily consists of sugars and fiber, including glucose, fructose, sucrose, and trace amounts of maltose and lactose. Its consumption is associated with a decreased risk of cardiovascular disease, type 2 diabetes, stroke, certain

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cancers, and various chronic health conditions, including dementia and cognitive decline (Moore et al., 2015; Nugrahedhi et al., 2015; Becker and Juvik, 2016; Aune et al., 2017; Appleton et al., 2019).

The demand for broccoli has been on the rise globally, and in 2019, worldwide production of broccoli (combined with cauliflower) reached 27 million tonnes, with China and India contributing significantly at 73 % of total production (FAOSTAT, 2019). Broccoli is not only rich in nutrients but also offers various health benefits, making its flowers, leaves, stems, sprouts, and seeds valuable for addressing certain health conditions (Li et al., 2022). However, it's worth noting that like cabbage and cauliflower, broccoli is highly perishable and requires swift marketing. Due to existing marketing challenges and inadequate transportation facilities, a substantial volume of broccoli is lost during the marketing process annually. Nonetheless, as consumers become increasingly health-conscious and demand for broccoli grows (Stables et al., 2002), more farmers and middlemen are entering the production and marketing of this nutritious vegetable, contributing to its rising commercial demand across the country.

The increased consumption of vegetables plays a crucial role in our daily diets, helping combat malnutrition (Rai et al., 2019). However, the availability and pricing of broccoli depend on the effectiveness of the marketing system. It's essential to have an efficient and well-functioning marketing system to ensure fair prices for producers and affordable access for consumers. Unfortunately, the current broccoli marketing system falls short, resulting in dissatisfaction for both producers and consumers. Price fluctuations are primarily attributed to the lack of proper preservation methods, forcing farmers into risky sales practices (Mukaila et al., 2021). Efficient marketing is vital to reduce losses, risks, and uncertainties and ensure the timely delivery of quality, safe products at reasonable prices. Establishing suitable marketing channels and employing skilled market personnel play crucial roles in bridging the gap between farmers and consumers (Hasan et al., 2007). The absence of proper storage, transportation, and processing facilities further adds uncertainty to broccoli production. To improve agricultural marketing, it is essential to focus on market information and the effective application of relevant principles (Rahman and Neela, 2018). Consequently, an efficient marketing system becomes imperative for the distribution of broccoli from growers to consumers.

Numerous studies worldwide have explored the marketing system related to vegetables. For instance, Mustafiz et al. (2021) identified constraints in the vegetable seed market, such as the lack of market

information, inadequate marketing infrastructure, transportation systems, and unfair profit distribution among value chain actors. Research by Pavithra and Singh (2020) revealed income levels among cauliflower producers and their share in the consumer rupee across different marketing channels. Lutfa et al. (2019) demonstrated the profitability of cucumber production and highlighted the varying marketing costs and margins among traders, retailers, and other actors in the supply chain. Furthermore, Rahman and Neena (2018) analyzed the total costs incurred by traders, dealers, wholesalers, and retailers in the marketing of specific products. While numerous studies have delved into the marketing of various agricultural products, this particular study stands out as a unique exploration into the marketing aspects toward broccoli. The demand for novel vegetables like broccoli continues to grow steadily. Consequently, this study was designed to investigate the marketing channels, functions, and challenges encountered by farmers and intermediaries in the production and marketing of broccoli. Additionally, it aimed to capture their recommendation regarding the production and marketing of broccoli in selected areas of Mymensingh district in Bangladesh. Furthermore, the research was undertaken to examine the marketing cost and margin of broccoli intermediaries.

Materials and Methods

Selection of the Study Area and Period of Data Collection

The current research focused on studying the marketing system toward broccoli in specific areas within the Sadar Upazilla of Mymensingh district in Bangladesh. Specifically, the following markets were deliberately chosen for the study: Markets of Seshmore Bazar, Boyra, Char area, Sutiakhali Bazar, Kweatkhal, Mechua Bazar, Mintu Collage Road Bazar, Notun Bazar, K.R Market, and the Bangladesh Agricultural University Campus. The duration of primary data collection for the study covered two months from January to February 2022.

Selection of Sample and Sampling Technique

In this study, two groups of participants – farmers and intermediaries were surveyed using a purposive sampling technique. To achieve the research objectives, a total of 100 respondents were purposively selected. Among them, 45 retailers were chosen from markets including K.R market, Seshmore Bazar, Kweatkhal market, Mechua bazar, Mintu collage road bazar, and Notun bazar. Additionally, 20 Aratdar cum wholesalers from Mechua bazar, 15 wholesalers from Mechua bazar, 10 Bepari from Sutiakhali bazar, Boyra, and 10 farmers from Boyra, Sutiakhali Bazar, and char area were included in the study. A small number of farmers were

selected for investigation to find buyers for their broccoli because few farmers in the study area cultivated broccoli.

Methods of Data Collection

Upon a meticulous review and refinement process of the preliminary draft schedule, an intricately designed final interview schedule emerged as the pivotal tool for gathering indispensable data in this research endeavor. The face-to-face interview methodology was selected as the primary means of data acquisition, allowing for in-depth, nuanced insights from the participants. In addition to this primary data collection approach, our research strategy was fortified by the inclusion of secondary data. These secondary data sources encompassed a diverse array of references, including scholarly books, peer-reviewed journals, and authoritative documents sourced from the prestigious repository of the Bangladesh Bureau of Statistics. This multifaceted data collection approach ensured the comprehensiveness and depth necessary for a rigorous and insightful study.

Analytical Techniques

Different methods of analysis were used in the study to meet objectives and understand the actual outcomes.

Marketing Channel, Functions, Problems and Suggestions

Graphical figure were employed to visually represent the marketing channel and descriptive statistics like frequency analysis were applied to elucidate the marketing functions carried out by broccoli marketing actors. This study applied frequency, percentage and graphical figure to explore the problems and suggestions by broccoli farmers and intermediaries during production and marketing. Analyzing frequency, percentage and graphical figure in this study enables a detailed investigation into identified problems and enhances the clarity of presenting potential solutions.

Marketing Cost and Margin

For analyzing marketing cost of different intermediaries, formula which was used is given below:

TM_c=C_a + C_w+ C_b+ C_r [1]

Where, TM_c=Total Marketing Cost of all intermediaries,

C_a = Summation of all marketing cost of Aratdar cum wholesaler,

C_w = Summation of all marketing cost of Wholesaler,

C_b = Summation of all marketing cost of Bepari,

C_r = Summation of all marketing cost of Retailer

Marketing margin of intermediaries was calculated by using the formula which is given below:

MM=SP-PP [2]

Where, MM=Marketing margin, SP=Selling price, PP=Purchase price

The net marketing margin of intermediaries was calculated using the formula given below:

NMM=MM-MC [3]

Where,

NMM=Net Marketing Margin,

MM=Marketing Margin,

MC=Marketing Cost

Results and Discussion

Marketing Channels of Broccoli and Function Performed by Different Market Actors

The diagram in the Figure 1 illustrated the marketing channel of broccoli distribution in the study area. During its distribution within the study area, five types of market participants were found such as farmer, Aratdar cum wholesaler, wholesaler, Bepari, retailer. Similarly, Tanha (2018) observed different types of market participants in cauliflower marketing channel viz, Faria, Aratdar, wholesaler, Bepari, retailer which is almost consistent with the present findings. Furthermore, present result represented the four marketing channel of broccoli distribution such as Channel 1: Farmer → Retailer → Consumer; Channel 2: Farmer → Aratdar cum wholesaler → Retailer → Consumer; Channel 3: Farmer → Wholesaler → Aratdar cum wholesaler → Retailer → Consumer, and Channel 4: Farmer → Bepari → Aratdar cum wholesaler → Retailer → Consumer; which is consistent with the findings of Paudel et al. (2021) who revealed that producers → wholesalers → retailers → consumers were the effective marketing channel during major vegetables supply in Parsa district, Nepal.

The marketing process has been divided into several marketing tasks such as, buying, selling, grading, packaging, transportation, financing and market information, and this breakdown is intended to shed light on the functions of broccoli participants that have been performed and discussed. Table 1 represented that among the all market participants, 35% of Aratdar cum wholesaler bought broccoli from farmers, and another 35% from wholesaler, while the remaining 30% purchased it from Bepari. Moreover, it is worth noting that wholesaler and Bepari collectively acquired their total amount of broccoli supply from farmers. Furthermore, the majority of the retailer (46.67%) sourced the highest share of broccoli from Aratdar cum wholesaler, with the lowest proportion (20%) procured directly from farmers. This outcome is in accordance with the study conducted by Susaad et al. (2022), wherein it was demonstrated that Faria, Bepari, and Aratdar acquired winter vegetables within Char regions directly from farmers at their farms.

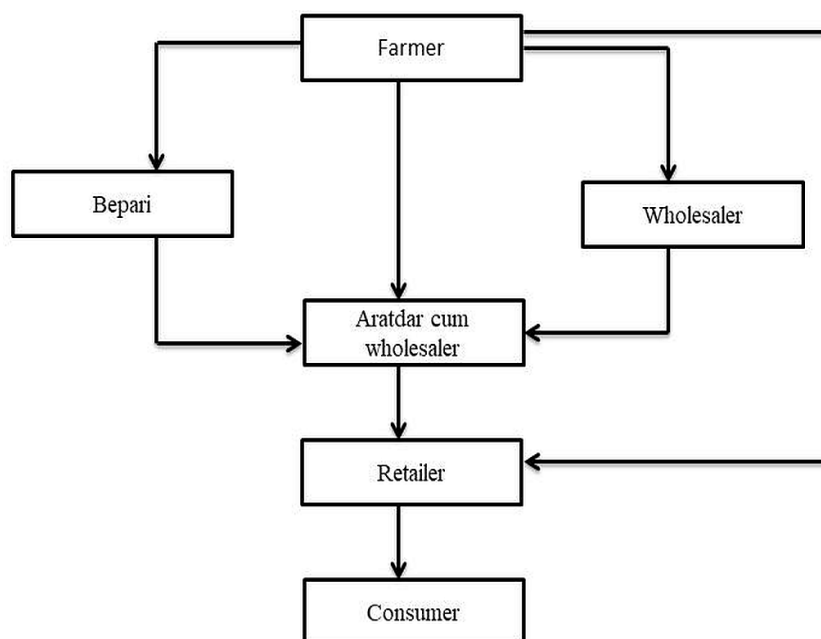


Figure 1. Marketing channels of broccoli in the study area

Table 1. Buying and selling function of broccoli (In percentage)

Buying function					
Buyer	Seller				
	Farmer	Aratdar cum wholesaler	Wholesaler	Bepari	
Aratdar cum wholesaler	35	-	35	30	
Wholesaler	100	-	-	-	
Bepari	100	-	-	-	
Retailer	20	46.67	33.33	-	
Selling function					
Seller	Buyer				
	Aratdar cum wholesaler	Wholesaler	Bepari	Retailer	Consumer
Farmer	20	40	30	10	-
Aratdar cum wholesaler	-	55	-	45	-
Wholesaler	-	-	-	100	-
Bepari	100	-	-	-	-
Retailer	-	-	-	-	100

Source: Field survey, 2022

Among all the intermediaries, farmers distributed 40% of their broccoli to wholesaler, 30% to Bepari, 20% to Aratdar cum wholesaler, and rest 10% to retailers (Table 1). Aratdar cum wholesaler, in turn, supplied the highest portion of broccoli (55%) to wholesaler and the lowest (45%) amount to retailer. Bepari exclusively sold their entire broccoli supply to Aratdar cum wholesaler. Moreover, retailer directly sold 100% of their broccoli to consumers. These findings are in harmony with the study by Susaad et al. (2022), indicating that farmers allocated 30% of their winter vegetable produce to the market and the remaining 70% to traders, namely Faria, Bepari, and Retailers. Bepari exclusively distributed their entire vegetable stock to retailers, who subsequently

marketed 100% of these vegetables to consumers at the market place.

From the Table 2 it was observed that, maximum farmers (40%) used auto rickshaw, 30% by van and rest 30% farmers transported their product by shoulder or head. About 60% Aratdar cum wholesaler transported broccoli by truck while rest of them used pickup. Majority of the wholesaler (46.67%) moved broccoli by truck where minimum of them used pickup and nasimon. Maximum Bepari (60%) transported broccoli by nasimon. Around 45% retailers moved their product by auto rickshaw. In light of the findings presented by Susaad et al. (2022), it is evident that transportation

methods play a significant role in the distribution of winter vegetables within the studied agricultural context. Notably, the study highlights that a substantial proportion of Bepari (40%) preferred the use of boats for transportation, while half of the retailers (50%) relied on vans as their primary mode of transporting

these essential vegetables. This correlation between transportation choices and key marketing actors in the marketing channel underscores the importance of considering logistical factors when analyzing the dynamics of the local agricultural market.

Table 2. Mode of transportation (In percentage)

Market participant	Mode of Transportation					
	Auto Rickshaw	Van	Truck	Pick up	Nasimon	By shoulder /head
Farmer	40	30	-	-	-	30
Aratdar cum wholesaler	-	-	60	40	-	-
Wholesaler	-	-	46.67	26.66	26.67	-
Bepari	-	-	-	40	60	-
Retailer	45	42.22	-	-	-	12.78

Source: Field survey, 2022

Broccoli was graded by size and color by Aratdar cum wholesaler, wholesaler, Bepari and retailers in the study area. There was no standard grading system and they often did it by their personal assessment and eye sight. They usually grade broccoli for easy selling and command a high price. Generally, farmers did not grade their produce. The number of broccoli growers who have stockpiled is very small. Some retailers kept the broccoli in the open air for only one day. Because of its perishable nature, broccoli rots easily and it quickly changes color to brown which reduces the taste. That's why most farmers and traders don't stock up on broccoli. In this study area, gunny bags, sack bags, plastic bags and polythene bags, bamboo baskets are commonly used for packaging purposes. After arriving in the market, broccoli is sorted, counted and packed in various packaging modes specified by market intermediaries. The present findings are in accordance with Chaudhary's study from 2010, which documented that wholesalers (100%) and retailers (90%) predominantly sorted their winter vegetables, particularly tomatoes, based on their larger sizes. Furthermore, it was observed that 100% of both wholesalers and retailers utilized plastic bags for packaging tomatoes during the transportation process. Therefore, the findings of our study exhibited notable

parallels with Chaudhary (2010) which resonates with our own observations. Moreover, the shared practice of using plastic bags for vegetable packaging during transportation, as observed in both studies, underscores a consistent logistical aspect within the market. These similarities not only validate aspects of our research but also provide insight into enduring trends and practices in the distribution of winter vegetables within Mymensingh Sadar Upazila.

The financial sources for both farmers and intermediaries are depicted in Table 3. Among farmers, the majority (40%) opted for loans from money lenders, while a smaller proportion (30%) were self-financed and received loans from Non-Governmental Organizations, making it the less common choice. In contrast, a substantial percentage of Aratdar cum wholesalers (35%), wholesalers (40%), and retailers (60%) relied on self-financing. Furthermore, a significant portion of Bepari (40%) secured loans from Non-Governmental Organizations, whereas a smaller percentage (10%) turned to banks for financing. The present result is consistent with Susaad et al. (2022) who observed that 70% of the vegetable's producers, 67.67% Bepari and 70% retailer were depended on self-financing.

Table 3. Sources of finance (In percentage)

Market participants	Sources of Fund			
	Bank	Own	Money lender	NGO
Farmer	-	30	40	30
Aratdar cum wholesaler	20	35	25	20
Wholesaler	33.33	40	-	26.67
Bepari	10	30	20	40
Retailer	11.11	60	11.11	17.78

Source: Field survey, 2022

From the Table 4, it was revealed that, maximum farmers and Bepari collected market information by visiting market and using mobile phone while rest of 20% collected information from other intermediaries.

Majority of the Aratdar cum wholesaler (45%) received their market information from personal visit to the market, 35% collected information through mobile phone and rest of 20% received information from other intermediaries. The largest number of wholesaler and retailer used mobile phone for collecting market information where the smallest number of them

collected information from the other intermediaries. The present result is consistent with Hasan et al. (2007) who found maximum Bepari, wholesaler and retailer collected information by personal visit to the market followed by fellow trader, neighbor or friends, telephone or mobile for marketing the vegetables.

Table 4. Sources of information (In percentage)

Market Participants	Sources of Information		
	Personal Visit to Market	Mobile Phone	From other Intermediaries
Farmer	40	40	20
Aratdar cum wholesaler	45	35	20
Wholesaler	33.33	46.67	20
Bepari	40	40	20
Retailer	28.88	46.67	24.44

Source: Field survey, 2022

Problems and Suggestions provided by Broccoli Farmers and Intermediaries during Production and Marketing

Broccoli producers encounter a range of challenges in their endeavors. These challenges are visually depicted in Figure 2. In Figure 2, it becomes evident that the largest proportion of broccoli farmers, constituting 80% of the sample, grapple with elevated production costs as a predominant concern. Interestingly, the data also revealed that natural disasters rank as the least problematic factor for these farmers. This finding aligns

with the observations made by Akter et al. (2016) in their research. In their study, they similarly emphasized the significance of high fertilizer and insecticide prices as prominent obstacles encountered by farmers engaged in the production of winter vegetables. Thus, the findings in the present study substantiate with the findings reported in Akter et al. (2016) research, reaffirming the challenges faced by broccoli farmers in the context of production costs and input prices.

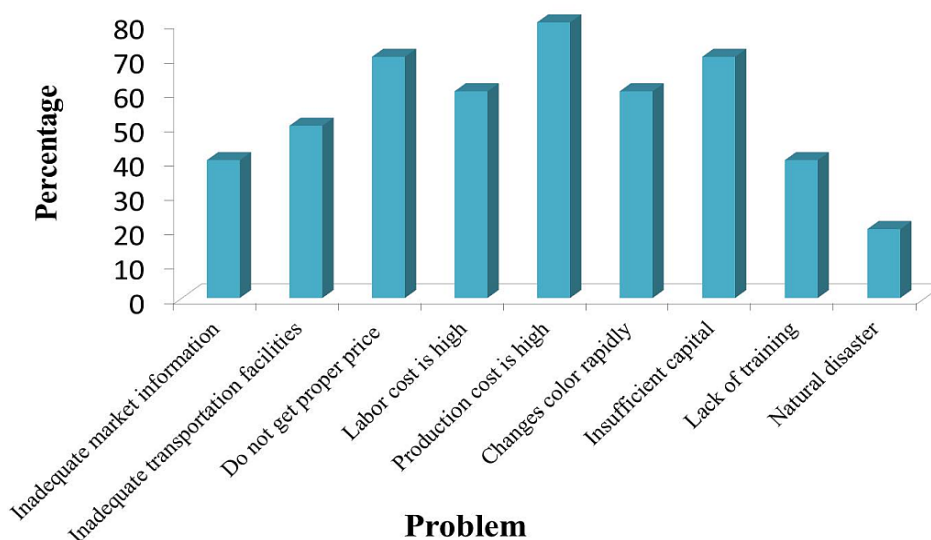


Figure 2. Problems faced by broccoli farmers

Within the study area, intermediaries involved in broccoli marketing encountered a multitude of challenges. A significant majority of these intermediaries, accounting for 76.66% of the sample (as depicted in Figure 3), identified the lack of access to market information as their foremost concern. This

observation corroborates findings from Hoq et al. (2014) where they highlighted prevalent issues faced by middlemen, including price instability, barriers to entry in terminal markets, delays at ferry wharves, and product wastage. Additionally, the study by Pokharkar et al. (2020) underscored the prominent issue of high

price fluctuations, reported by a substantial 93.33% of intermediaries, which significantly hindered the efficient marketing of beets. Furthermore, a noteworthy 28.88% of intermediaries in our study noted a secondary issue, namely, the rapid discoloration and spoilage of broccoli, as a minor yet impactful problem they encountered.

Therefore, the consistent identification of challenges such as price instability, market access barriers, and perishability issues highlighted the reliability and relevance of our results while drawing meaningful associations with established literature on related agricultural marketing challenges.

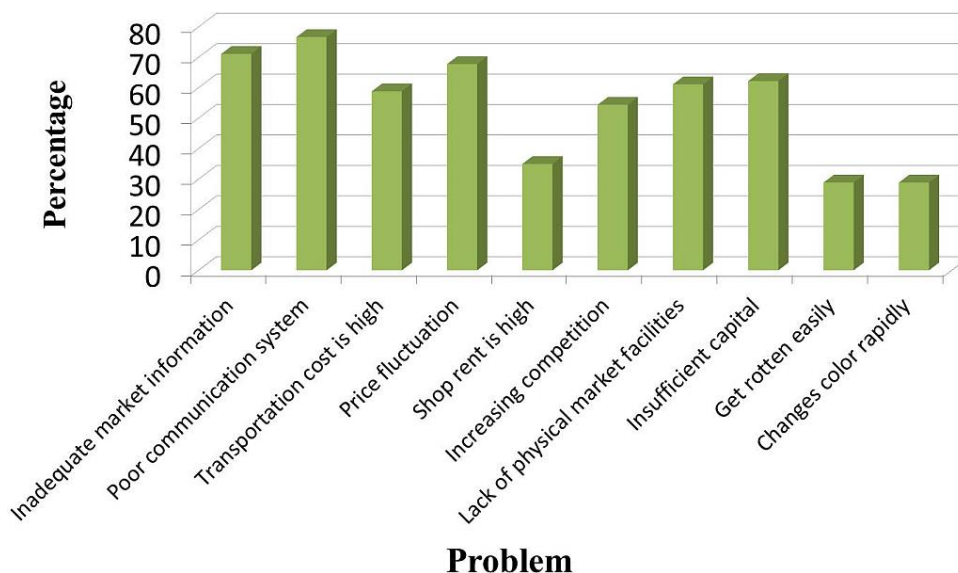


Figure 3. Problems faced by broccoli intermediaries

Within the context of bolstering the existing broccoli marketing system, farmers provided a series of insightful suggestions, as outlined in Table 5 of the research findings. A significant and noteworthy observation from this data is that a substantial majority of farmers, accounting for 80% of the respondents,

emphasized the critical need for receiving fair and just pricing as an integral component of the proposed improvements. This indicates a strong consensus among farmers regarding the paramount importance of proper pricing in their pursuit of overall system enhancement.

Table 5. Measures suggested by broccoli farmers and market intermediaries

Suggestions from farmers	Number of farmers	Percentage
Should get proper price	8	80
Communication system should be improved	7	70
Proper market information should be available	6	60
Necessary training should be available	4	40
Proper monitoring authority is needed	6	60
Should improve bargaining power	3	30
Government should supply high yielding variety of seeds	4	40
Suggestions from intermediaries	Number of Intermediaries	Percentage
Supply of loan at easy term	54	60.00
Timely market information is needed	64	71.11
Proper monitoring authority is necessary	60	66.60
Reduction of price instability	65	72.20
Improvement of physical market facilities	51	56.60
Communication system should be improved	61	67.71

Source: Field survey, 2022

The measures proposed by market intermediaries, as outlined in Table 5, highlighted a shared concern among

them, with a strong consensus on the importance of addressing price instability and ensuring access to

timely market information. These findings resonate with the insights from Patel and Pundir (2016), who also stressed the significance of market intelligence and logistical support, particularly for cauliflower growers, in order to enhance the existing marketing system. This correlation highlights a common theme in both our research and the referenced study, emphasizing the critical role of market instability and information flow in improving the overall efficiency of the vegetable marketing system. It highlights the relevance and consistency of these factors across different agricultural contexts and their significance in promoting the interests of market participants.

Marketing Cost of Broccoli Intermediaries

The total marketing cost encompassed all expenses associated with various middlemen involved in the broccoli marketing system, as detailed in Table 6. Among these cost components, transportation expenses

stood out as the most substantial, accounting for 52.14% of the total cost, while the electricity bill constituted the smallest proportion at 0.59%. Our findings align with the research conducted by Hajong et al. (2022), which also identified elevated transportation costs incurred by Bepari in tomato marketing. However, it's worth noting that our results diverge from Patel and Pundir (2016), whose research highlighted that the primary marketing cost in cauliflower marketing was the commission held by wholesalers cum commission agents. This discrepancy suggests that factors contributing to higher marketing costs, such as increased commission charges borne by wholesalers when procuring from distant markets, may vary within different agricultural contexts. This observation underscores the need for further investigation into the specific drivers of marketing costs in broccoli distribution within the studied area.

Table 6. Marketing cost of all intermediaries (Tk /piece)

Cost items	Name of the intermediaries				Total cost	Percentage
	Aratdar cum wholesaler	Wholesaler	Bepari	Retailer		
Transportation cost	1.313	1.280	1.047	0.479	4.119	52.14
Loading and unloading cost	0.028	0.050	.0124	0.039	0.129	1.63
Shop rent	0.130	0.116	-	0.374	0.620	7.85
Market toll	0.013	0.002	-	0.143	0.158	2.00
Assembling cost	0.164	-	-	-	0.164	2.07
Wastage	0.009	0.040	0.021	0.160	0.230	2.92
Packaging cost	0.106	0.100	0.118	0.160	0.484	6.13
Commission	-	0.840	0.825	-	1.665	21.07
Electricity bill	0.006	-	-	0.041	0.047	0.59
Personal expenses	0.040	0.020	0.005	0.154	0.219	2.77
Mobile bill	0.020	0.007	0.003	0.030	0.060	0.76
Total	1.829	2.460	2.030	1.580	7.900	100
Percentage	23.15	31.14	25.70	20.00	100	100

Various cost components were analyzed in our study, with commission (21.07%), shop rent (7.85%), packaging expenses (6.13%), wastage (2.92%), personal expenditures (2.77%), assembling costs (2.07%), market toll (2%), loading and unloading expenses (1.63%), and mobile bills (0.76%) all contributing to the overall marketing costs of the broccoli middlemen, as illustrated in Figure 4. Notably, our research revealed that among all intermediaries, wholesalers incurred the highest marketing costs (31%), while retailers bore the lowest costs (20%) in the distribution of broccoli (Figure

4). These findings contrast with those of Hoq et al. (2014), who reported that Bepari had the highest marketing costs, estimated at Tk. 212.74 per quintal for cabbage and Tk. 219.87 per quintal for cauliflower, surpassing other intermediaries. This variance can be attributed to factors like their extensive business volume and transportation expenditures. Understanding these variations in marketing costs sheds light on the unique dynamics of the broccoli distribution system within our studied area.

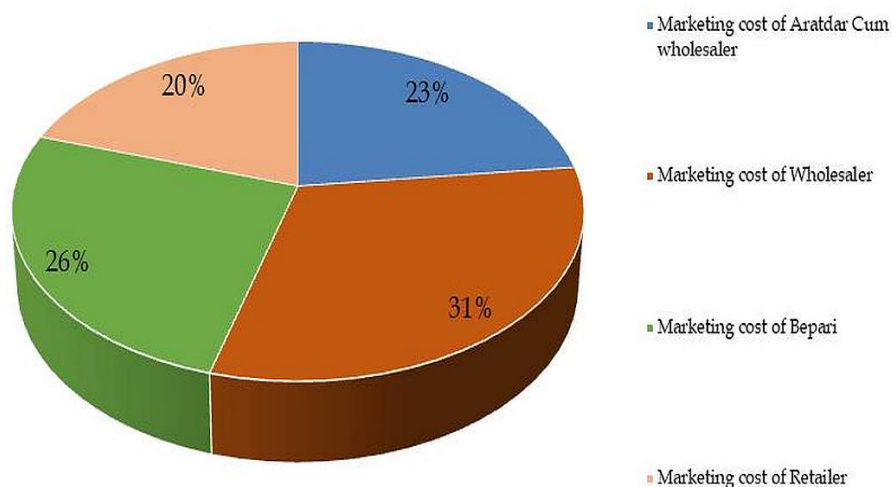


Figure 4. Total marketing cost of broccoli intermediaries (percentage)

Marketing Margin of Broccoli Intermediaries

Retailers emerged as the intermediaries with the highest gross and net marketing margins for broccoli, as depicted in Figure 5. These results align with the observations of Hoq et al. (2014) who noted that urban retailers earned the maximum marketing margin, estimated at Tk. 130.09 for cauliflower and Tk. 108.52 for cabbage. Interestingly, while Figure 5 illustrated a lower net marketing margin for wholesalers, this finding differs from Rahman and Neena (2018), whose research revealed that Aratdar had the minimum net marketing

margin for tomatoes, possibly due to their higher marketing costs. Consequently, their profits were the lowest among all intermediaries. In our context, wholesalers may have sold larger quantities of broccoli at lower prices, while retailers, dealing in smaller quantities at higher prices, managed to attain higher net marketing margins. These variations highlight the influence of pricing strategies and marketing costs on the profitability of intermediaries in the broccoli distribution chain within our study area.

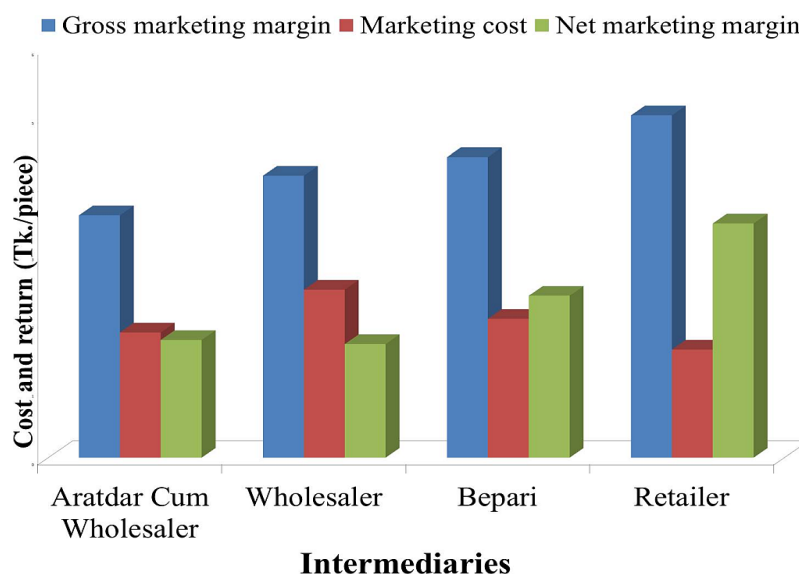


Figure 5. Gross marketing margin, marketing cost and net marketing margin of broccoli intermediaries

Conclusion

Broccoli holds a crucial role as a nutritional powerhouse and a significant source of income for both growers and traders. Its consumption is on the rise, driven by its exceptional nutritional value, motivating farmers to

increase production and encouraging middlemen to engage in marketing. Retailers, in particular, have reaped impressive net margins, showcasing the financial potential for all broccoli intermediaries. Given the extensive involvement of various stakeholders in

broccoli production and marketing, the development of an efficient marketing system can bring financial benefits to all. Our study has unveiled opportunities for enhancing the broccoli marketing system. Collaborative sharing of information among market participants, rather than competition, can foster cooperation. Governments and Non-Governmental Organizations should facilitate training and education for market participants, while modernizing storage facilities and improving transportation systems are essential for enhancing broccoli's marketing efficiency. Regular access to market information for both farmers and intermediaries is crucial for an accurate understanding of the broccoli market dynamics.

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Competing interests

The authors have declared that no competing interests exist.

Author's Contribution

S.Y.: Design, formulation, supervision and monitoring of study, prepare final draft article and editing of the manuscript; **S.M.:** Collecting the primary data, analysis data, prepare tables, figures and preliminary draft article; and **M.M.:** Supervision of study and editing of the manuscript.

References

- Akter, A., Hoque, F., Mukul, A.Z.A., Kamal, M.R. and Rasha, R.K. (2016). Financial Analysis of Winter Vegetables Production in a Selected Area of Brahmanbaria District in Bangladesh. *International Research Journal of Agricultural and Food Sciences*, Vol. 1 Issue 6, pp. 120-127.
- Appleton, K.M., Dinnella, C., Spinelli, S., Morizet, D., Saulais, L., Hemingway, A., Moteleone, E., Depezay, L., Perez-Cueto, F.J.A. and Hartwell, H. (2019). Liking and Consumption of Vegetables with More Appealing and Less Appealing Sensory Properties: Associations with Attitudes. Food Neophobia and Food Choice Motivations in European Adolescents. *Food Quality and Preference*, vol.75, pp. 179- 186. <https://doi.org/10.1016/j.foodqual.2019.02.007>
- Aune, D., Giovannucci, E., Boffetta, P., Fadnes, L.T., Keum, N., Norat, T., Greenwood, D.C., Riboli, E., Vatten, L.J. and Tonstad, S. (2017). Fruit and Vegetable Intake and the Risk of Cardiovascular Disease, Total Cancer and All-Cause Mortality-A Systematic Review and Dose-Response Meta-Analysis of Prospective Studies, *International Journal of Epidemiology*, vol.46, pp.1029-1056. <https://doi.org/10.1093/ije/dyw319>
- Becker, T. M. and Juvik, J. A. (2016). The Role of Glucosinolate Hydrolysis Products from Brassica Vegetable Consumption in Inducing Antioxidant Activity and Reducing Cancer Incidence. *Diseases*, vol.4, no.2, pp. 22. <https://doi.org/10.3390/diseases4020022>
- Chaudhary, K. R. (2010). Analysis of Tomato Marketing System in Lalitpur District, Nepal. Unpublished Master in Management of Development Specialization International Agriculture. Thesis submitted to Van Hall Larenstein University of Applied Sciences. <https://doi.org/10.1016/j.jafr.2020.100051>
- FAOSTAT (2019). Broccoli (and Cauliflower) Production. UN Food and Agriculture Organization, Corporate Statistical Database, Retrieved 10 February 2021,
- Hasan, M.R., Haque, S., Islam, M.A. and Hoque, M.N. (2007). Marketing System of Some Selected Vegetables in Bangladesh. *International Journal of Bio Research*, vol.3, no.4, pp. 46-51.
- Hajong, P., Rahman, M.H. and Kobir, M.S. (2022). Marketing System of Summer Tomato in Jashore District of Bangladesh. *International Journal of Agricultural Research, Innovation and Technology*, vol. 12, no. 1, pp.12-17. <https://doi.org/10.3329/ijarit.v12i1.61025>
- Hoq, M.S., Matin, M.A., Hossain, T.M. and Hossain, S. (2014). Cabbage (Brassica Oleracea) and Cauliflower (Brassica Oleracea) Marketing in Selected Areas of Bangladesh. *Bangladesh Journal of Agricultural Research*, vol. 39,no.1, pp.127-141.
- Islam, M.M. (2020). An Inquiry of the Nature and Causes of Price Variation in Vegetable Marketing System of Bangladesh. *Research in Business and Social Science*, vol.9, no.6, pp. 224-229. <https://doi.org/10.20525/ijrbs.v9i6.882>
- Jahan, I.A., Mostafa, M., Nimmi, I., Hossain, M.H., Ahsan, M. and Chowdhury, J.U. (2010). Chemical and Antioxidant Properties of Broccoli Growing in Bangladesh. Dhaka University. *Journal of Pharmaceutical Sciences*, vol.9, no.1, pp.31-37.
- Li, Z., Mei, Y., Liu, Y., Fang, Z., Yang, L., Zhuang, M., Zhang, Y. and Lv, H. (2019). The Evolution of Genetic Diversity of Broccoli Cultivars in China since 1980. *Scientia Horticulturae*, vol.250,no.10, pp.69-80. <https://doi.org/10.1016/j.scientia.2019.02.034>
- Li, H., Xia, Y., Liu, H., Guo, H., He, X., Liu, Y., Wu, D., Mai, Y., Li, H., Zou, L. and Gan, R. (2022). Nutritional Values, Beneficial Effects, and Food Applications of Broccoli (Brassica oleracea var. italica Plenck). *Trends in Food Science and Technology*, pp.119, pp.288-308. <https://doi.org/10.1016/j.tifs.2021.12.015>.
- Lutfia, A., Happy, F. A., Yasmin, F. and Hera, H.H. (2019). Production Marketing of Cucumber in Some Selected Areas of Mymensingh District. *Agricultural Research and Technology: Open Access Journal*, vol. 15, no. 5, pp. 555969. <https://doi.org/10.19080/ARTOAJ.2018.15.555969>.
- Moore, L. V. and Thompson, F. E. (2015). Adults Meeting Fruit and Vegetable Intake Recommendations- United States, 2013. *Morbidity and Mortality Weekly Report*, vol. 64, no. 26, pp. 709-713. <https://doi.org/mm6426a3>.
- Mukaila, R., Obetta, A.E., Awoyelu, F.E.D., Chiemela, C.J. and Ugwu, A.O. (2021). Marketing Analysis of Vegetables: the Case of Carrot and Cucumber. *Turkish Journal of Agriculture – Food Science and Technology*, vol.9, no.2, pp. 346-351. <https://doi.org/10.24925/turjaf.v9i2.346-351.4000>
- Mustafiz, S., Nakayasu, A. and Itabashi, M. (2021). Marketing of Vegetable Seeds: Practice and Behavioral Inclinations of Vegetable Seed Sellers and Farmers in Selected Areas of Bangladesh. *Agriculture*, vol.11, no. 4, pp. 1-16. <https://doi.org/10.3390/agriculture11040364>
- Nugrahdadi, P.Y., Verkerk, R., Widianarko, B. and Dekker, M. A. (2015). Mechanistic Perspective on Process-Induced Changes in Glucosinolate Content in Brassica Vegetables: A Review. *Critical Reviews in Food Science and Nutrition*, vol.55, no.6, pp. 823-838. <https://doi.org/10.1080/10408398.2012.688076>

- Patel, P. and Pundir, R.S. A. (2016). Study on Marketing of Cauliflower in Middle Gujarat, India. *International Journal of Forestry and Crop Improvement*, vol.7, no.1, pp. 72-78. <https://doi.org/10.15740/HAS/IJFCI/7.1/72-78>
- Paudel, A., Paudel, A. and Kattel, R.R. (2021). An Economic Analysis of Production and Marketing of Major Vegetables in Parsa District, Nepal. *Food and Agri Economics Review (FAER)*, vol.1, no.2, pp. 107-120. <https://doi.org/10.26480/faer.02.2021.107.120>
- Pavithra, S. and SP Singh. (2020). Economics of Production and Marketing of Cauliflower in Indore District of Madhya Pradesh. *The Pharma Innovation Journal*, vol. 9, no. 11, pp. 80-83.
- Pokharkar, S.V., Perake, D.S. and Pokharkar,V.G. (2020). Economic Analysis of Beet Root Marketing in Pune District. *Journal of Pharmacognosy and Phytochemistry*, vol.9, no. 2, pp. 819-822.
- Rahman, M.M. and Neena, S.B. (2018). The Marketing System of Agricultural Products in Bangladesh: A Case Study from Sylhet District. *Bangladesh Journal of Public Administration*, vol.26, no. 2, pp. 61-78. <https://doi.org/10.36609/bjpa.v26i2.21>
- Rai, M. K., Nepal, P., Rai, D.B. and Paudel, B. (2019). Commercial Vegetable Farming: Constraints and Opportunities of Farmers in Kirtipur, Nepal. *The Geographical Journal of Nepal*, vol.12, pp. 101-118. <http://dx.doi.org/10.3126/gjn.v12i1.23418>
- Schreinemachers, P., Simmons, E.B. and Wopereis, M.C.S. (2018). Tapping the Economic and Nutritional Power of Vegetables. *Global Food Security*, vol. 16, pp. 36-45. <https://doi.org/10.1016/j.gfs.2017.09.005>
- Stables, G.J., Subar, A.F., Patterson, B.H., Dodd, K., Heimendinger, J., Duyn, M.A.S.V. and Nebeling, L. (2002). Changes in Vegetable and Fruit Consumption and Awareness among US adults: Results of the 1991 and 1997 5 A Day for Better Health Program surveys, *Journal of the American Dietetic Association*, vol. 102, no.6, pp. 809-817. [https://doi.org/10.1016/s0002-8223\(02\)90181-1](https://doi.org/10.1016/s0002-8223(02)90181-1)
- Susaad, S.A., M.M.A., M.M and Uddin, G.T. (2022). An Economic Assessment of Production and Marketing of Winter Vegetables in Selected Char Areas of Mymensingh District. *Asian Research Journal of Agriculture*, <https://doi.org/10.9734/arja/2022/v15i330159>
- Tanha, S. (2018). A Study on Profitability and Marketing of Cauliflower Cultivation in Narsingdi District of Bangladesh. A Thesis Submitted to the Faculty of Agribusiness Management Sher-e-Bangla Agricultural University, Dhaka-1207 in partial fulfillment of the requirements for the degree of Master of Science in Agricultural Economics. <http://archive.saulibrary.edu.bd:8080/xmlui/handle/123456789/3427>
- Weinberger, K. and Genova II, C.A. (2005). Vegetable Production in Bangladesh: Commercialization and Rural Livelihoods, Technical Bulletin No. 33. VRDC publication number 05621. Shanhua, Taiwan: AVRDC–The World Vegetable Center, pp. 1- 51.