An investigation on price elasticity of demand for protein consumption in Sylhet City, Bangladesh

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Abstract

The study was carried out to measure the price elasticity of protein consumption in Sylhet City, Bangladesh. The objective of this study is to find out how people's protein consumption response with price changes. From various sources of proteins, 4 items (beef, chicken, egg, and milk) were selected to measure the protein intake of households. Simple random sampling was used to select four wards and households in the study area. A total number of 67 households were used for conducting the survey. The study is analyzed using descriptive statistics. The elasticity equation is used to measure the responsiveness between protein consumption and price changes. The correlations between income, household size, and protein consumption are also demonstrated here. The article is also discussed about the substitute goods which are replaced by household in case of price change. From the study, it is found that total protein consumption is negatively related to price and positively correlated with income. Protein consumption also depends on the size of the household and both are positively correlated. Among four protein sources, beef and milk are highly price elastic than chicken and egg. The elasticity of beef, chicken, egg, and milk are -2.43, -1.78, -1.72 and -2.14 respectively. Around 53.7 percent of households substitute fish, pulse, vegetables or other goods with those goods when the price increased. Again it is also showed that protein consumption varied with income level changes. Moreover low-income household is more responsive with price changes than high-income household.

Keywords: *Household, protein, price elasticity, income, consumption*

Introduction:

Protein is one of the macronutrients which are vastly needed for the functioning of our body (Lonnie et al., 2018). There are many sources of protein such as eggs, almonds, peanuts, pulse, chicken and turkey breast, oats, cottage cheese, yogurt, milk, lean beef, tuna, lentils, pumpkin seeds, Ezekiel bread, fish, shrimp (Gunnars,2018). From various sources of

proteins, this article has considered four items (egg, chicken, beef, and milk) to conduct the analysis. Eggs are among the most nutritious foods on the planet containing 6 grams of protein per piece and one roasted chicken breast contains 53 grams protein, 85 grams of beef contains 22 grams of protein and 1 cup of whole milk contains 8 grams of protein (Gunnars). The necessary amount of protein needed for one person depends on his weight, goals, and lifestyle. According to the National Institute of Health (Gunners), 0.8 - 1 gram of protein is needed per 1 kg of body weight.

Some previous work has focused on identifying the optimal protein amount, protein consumption pattern in rural and urban areas, protein consumption through plant and animal sources (Lonnie et al.). But a very few studies were done over the protein consumption and price changes. Thus this article has focused on the household's response to protein consumption with the price changes. Protein consumption patterns of people are affected by rising income, changing price, urbanization, globalization, demographic shifts, improved transportation and changing people's tastes and preferences (Rampal, 2018). Food preference is sometimes affected by social and cultural norms as well as region. There are many external factors such as social class, family decisions and certain situational determinants that may influence the consumer's purchase decisions (Alimi, 2013). Consumption pattern of protein of vegetarian and non-vegetarian are different. It was highly faced in times of data collection. The data were collected from some randomly selected households to find their weekly consumption for these four food items considered a good source of protein. The response of consumption to price changes is different between different groups. It is shown from the findings that protein consumption is price elastic. Besides the low-income group, people are more responsive to price changes than higher income group people. The relation between protein consumption and income is positive. The article also considered food items which are substituted when price increases of meat, egg, and milk. Most of the households substitute pulse and vegetables when price increases in those goods.

The next sections include the following things, section 2: literature review, section 3: methodology, section 4: Findings and discussions, conclusion is added in section 5.

Literature Review:

Global demographic shifts and a world population projected to reach 9.7 billion by 2050 lead to increasing demand for high-quality nutritional products, especially for elderly people. Elderly people need to maintain their muscle mass, so their diet must contain enough highly digestible protein. Other consumers need foods that help control weight and reduce the risk of obesity. For them, too, high-protein products can play an important role because they create a relatively high sense of satiety (PND, n.d).
The National Academy of Medicine recommends that adults get a minimum of 0.8grams for every 20 pounds of body weight (NS, n.d).
- For a 140-pound person, that means about 50 grams of protein each day.
- For a 200-pound person, that means about 70 grams of protein each day.
Rampal (2018) discussed the trends in pulse and protein consumption over the years and focused on the substitutability and complementarity between various sources of proteins. And

the price and income effect on proteins of unrelated regression estimation framework is used to different sources-cereals and pulses, milk and milk products, animal sources such as eggs, fish, meat, and other sources of protein. The result is found that the expenditure on proteins is large. Higher disposable incomes have led to a higher demand for animal sources of proteins. As the price of pulses increases, the consumption of animal's sources of protein increases. In this analysis, the large number of data availability is needed and income elasticity, price elasticity, and correlation gap can be discovered.

Alimi (2013) considered meat is highly nutritious among animal's products and it has become an integral component of the human diet. This study examined the preference for a consumption pattern of protein types by individual households and mainly investigated the extent to which household income, household size, and other socio-economic factors predicted monthly expenditure on protein. This study was used in a cross-sectional design and households head were the participants. In these consumption patterns of people, the study area showed beef is the most preferred meat, comparatively with chicken and turkey. Meat is highly expended in the proportion of food expenditure for both low-income households and high-income households relative to middle-income households. This study is limited, in that it only analyzed the preference for and consumption pattern of meat types.

Bett et al. (2012) estimated the demand for indigenous chicken meat in Kenya, including other available meat products for comparison purposes. The consumption data used was collected from the cross-sectional survey. The result found an increase in income, meat allocation patterns would fundamentally change with consumers spending more on other meats, exotic chicken and goat meats away from the indigenous chicken meat including beef and mutton in which household income is likely to have higher impacts on meat than price. Indigenous chicken meat and beef were identified as substitutes while indigenous chicken, goat, and exotic chicken meats were complements. Therefore high expenditure elasticity, considering a policy option that would enhance consumer income is desirable since the result came high consumption thereby providing more incentives for the production of meat products.

At this study, it discussed the protein consumption of households that how people's protein consumption response with price changes. But those articles of Rampal (2018), Alimi (2013) and Bett et al. (2012) are mainly emphasized on income and price effect on protein, consumption pattern of preference, household size and other socioeconomic factors of different countries. And this study explained the relation between income, household size and protein consumption in Bangladesh. Like the other articles, this research used cross-sectional data but particularly used SPSS software for analysis. In this paper, the price elasticity is mainly examined that total protein consumption is negatively related to price. And protein consumption is positively correlated with income and household size. And substitution effect measures that around 44.7 percent of households substitute with other proteins like fish and pulse. Rampal emphasized food price effects in their analysis-negative for cereals and positive for eggs and the price of pulses increases, consumption of animal sources of protein increases. Alimi examined the proportion of household food expenditure that is expended on meat is high for both low-income households and high-income households relative to the middle-income household which is not co-operate within this article.

Methodology:

The research article is based on some specified terms. The study has analyzed the relation between household protein consumption and price changes. This study is exploratory research. It has followed the quantitative method as all data are primary numerical data. It can be also called a deductive approach. The data was cross-sectional as it was collected at a point of time from several households in May 2019. The study is conducted at a 90% confidence interval level. The data was collected by surveying from household to household and a relevant questionnaire was used. For collecting data 67 households were selected randomly. For this, the total area of Sylhet City was divided into 2 parts; north and south. Then ward no 1 and 7 from the north side and ward no 14 and 21 from south side were selected by using simple random sampling method. This article has analyzed substitutes using descriptive statistics. Moreover, the correlation between income, household size, and protein (beef, chicken, egg, and milk) consumption are tested using SPSS-23.

The questionnaire was based on these research questions:

Q1: Anthropometric information of respondents.

Q2: How much protein-foods a household consume at the current market price?

Q3: What it would be if beef and chicken price increased 10% and egg & milk price increased 20%?

Q4: What it would be if the price of these items decreased at the same rate?

Q5: Do they substitute any goods when the price increased?

Price elasticity is the measurement of responsiveness of quantity demanded with the price change. The price elasticity is defined as the percentage change in quantity divided by the percentage change in price of the product (Workman et al., 1972).

In algebraic terms:
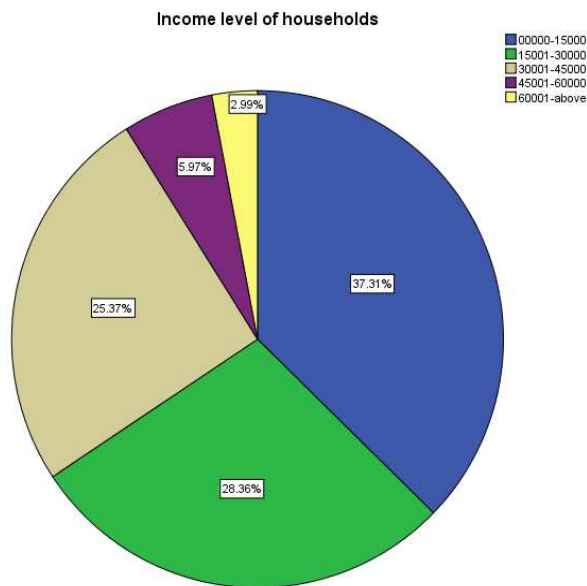
$$E = \frac{\Delta Q}{Q} \div \frac{\Delta P}{P}$$

where Δ denotes "change in", Q is the total quantity consumed and P is the price of the product. If the absolute value of E is greater than 1 then price elasticity is said to be relatively elastic and when E is less than 1 then price elasticity is said to be relatively inelastic. Microsoft Office Excel 2010 is used to find out the price elasticity of demand.

Elasticity equation is used in this study to measure the impact of the price change on quantity demanded. Because the quantity demanded was taken from the respondent if 20% price increases for meat and 10% price increases for milk and egg. Similarly, the quantity demanded was taken for price decreases at the same percentage.

Findings and discussions:

The income-wise distribution of households is presented by pie chart using descriptive statistics analysis from the collected data. In Figure-1, around 37.3 percent of households are in the income level of 0-15000 and 28.4 percent of households are in the income level of 15001-30000 who are lower middle class. The other 25.4 percent are middle class and their income level is 30001-45000. That means the largest number of households in Sylhet City are poor. Only 9 percent households' income is above 45000.

Figure-1: Frequency distribution of income

Income level of households

- 00000-15000
- 15001-30000
- 30001-45000
- 45001-60000
- 60001-above

2.99%
5.97%
25.37%
37.31%
28.36%

There is a significant correlation between household income and protein consumption. In Table-1, the correlation of beef consumption is insignificant and the correlation is 0.191. That indicates the change in income is parallel with the change in beef consumption. The other items (chicken, egg, milk) are also correlated with income at a 0.01 significant level. A positive increase in income would positively affect the consumption of chicken, egg & milk. Here chicken consumption is significantly correlated with beef and egg. That means a positive change in chicken consumption would affect the consumption of beef and egg positively.

Table-1: Correlation between income and beef, chicken, egg, and milk

		Level of income	Quantity of Beef	Quantity of Chicken	Quantity of Egg	Quantity of Milk
Level of income	Pearson Correlation	1	.191	.404**	.454**	.487**
	Sig. (2-tailed)		.123	.001	.000	.000
	N	67	67	67	67	67
Quantity Beef	Pearson Correlation	.191	1	.249*	.079	.155
	Sig. (2-tailed)	.123		.042	.525	.210
	N	67	67	67	67	67
Quantity of Chicken	Pearson Correlation	.404**	.249*	1	.510**	.081
	Sig. (2-tailed)	.001	.042		.000	.517
	N	67	67	67	67	67
Quantity of Egg	Pearson Correlation	.454**	.079	.510**	1	.190
	Sig. (2-tailed)	.000	.525	.000		.123
	N	67	67	67	67	67
Quantity of Milk	Pearson Correlation	.487**	.155	.081	.190	1
	Sig. (2-tailed)	.000	.210	.517	.123	
	N	67	67	67	67	67

**. Correlation is significant at the 0.01 level (2-tailed).

After income, protein consumption is significantly affected by the number of household members. Among the randomly selected households, there is 1.5 percent of households having 12 members, 31.3 percent of households having 5 members, 19.4 percent of households having 4 members and 7.5 percent households having 2 members. 12 is the highest and 2 is the lowest number of a family member. All of them are represented in Figure-2.

In Table-2, a significant correlation is found between household size and consumption of chicken and egg. This indicates that the change in both chicken and egg consumption in parallel with the change in household size. That means the household having a large number of members consumes much more protein than the household having a small number of members.

Figure-2: Frequency of household size
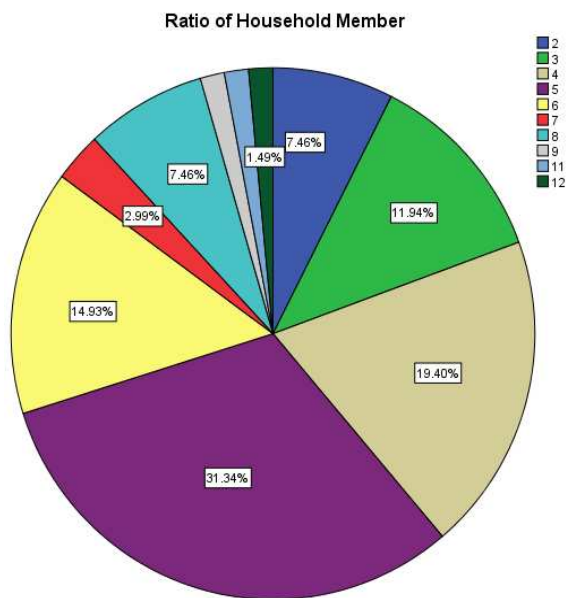
The larger number of household members with a low level of income is not able to buy the essential protein-containing food compared with the less number of household members with a low level of income. This is also true for middle-class households. But the higher class households are different.

Table-2: Correlation between household size and beef, chicken, egg, and milk

		HH Size	Quantity of Beef	Quantity of Chicken	Quantity of Egg	Quantity of Milk
HH Size	Pearson Correlation	1	.132	.393**	.522**	.080
	Sig. (2-tailed)		.285	.001	.000	.519
	N	67	67	67	67	67
Quantity of Beef	Pearson Correlation	.132	1	.249*	.079	.155
	Sig. (2-tailed)	.285		.042	.525	.210
	N	67	67	67	67	67

Quantity of Chicken	Pearson Correlation	.393[**]	.249[*]	1	.510[**]	.081
	Sig. (2-tailed)	.001	.042		.000	.517
	N	67	67	67	67	67
Quantity of Egg	Pearson Correlation	.522[**]	.079	.510[**]	1	.190
	Sig. (2-tailed)	.000	.525	.000		.123
	N	67	67	67	67	67
Quantity of Milk	Pearson Correlation	.080	.155	.081	.190	1
	Sig. (2-tailed)	.519	.210	.517	.123	
	N	67	67	67	67	67

[**]. Correlation is significant at the 0.01 level (2-tailed).
[*]. Correlation is significant at the 0.05 level (2-tailed).

Price elasticity of demand measure the responsiveness of quantity demanded with a change in price and are specific to the product, market condition and time period over which the analysis is done (Anwarul Huq and Arshad, 2010). There is a problem of finding elasticity from cross-sectional data. But the research question of this article is, 'how households consumption changes when beef & chickens price increased by 10 percent and egg & milks price increased by 20 percent.' So, the price of elasticity can be easily computed.

Table-3: Price elasticity of beef, chicken, egg, and milk

Price Elasticity of demand			
Beef	Chicken	Egg	Milk
৳ -2.43	৳ -1.78	৳ -1.72	৳ -2.14

The result of price elasticity for beef consumption is -2.43 in Table-3. That means beef consumption is highly elastic. It demonstrates that the quantity of beef consumption decreases by 2.43 percent as a result of a one percent increase in price. The inverse of the price elasticity (also called price coefficient) shows the 0.41 percent decrease in price would cause a one percent increase in quantity (Workman et al.).

$$\frac{1}{-2.43} = -0.41$$

The result of the price coefficient for the chicken, egg, and milk is -1.78, -1.72, and -2.14 respectively. That means all of these goods are elastic but beef and milk are highly elastic. When the price of these foods increases, households simply reduce their consumption.

Beef is highly elastic because of the limited production of the livestock sector in Bangladesh. According to Parvez (2017), beef is 32 percent costlier in Bangladesh than the global average, largely due to inadequate domestic production, drop in the flow of cattle smuggle in from India and extortion from traders. It implies that beef is already at a higher price. So, a further increase in beef prices will directly affect consumer's income. Thus they reduce the consumption of beef at a high rate as a small increase in price. Most of the respondents said

that they consume beef only a single time in a month or not. Some of them avoid it for allergic disease, cardiovascular disease, and many more reasons.

Figure-3: Frequency of substitution
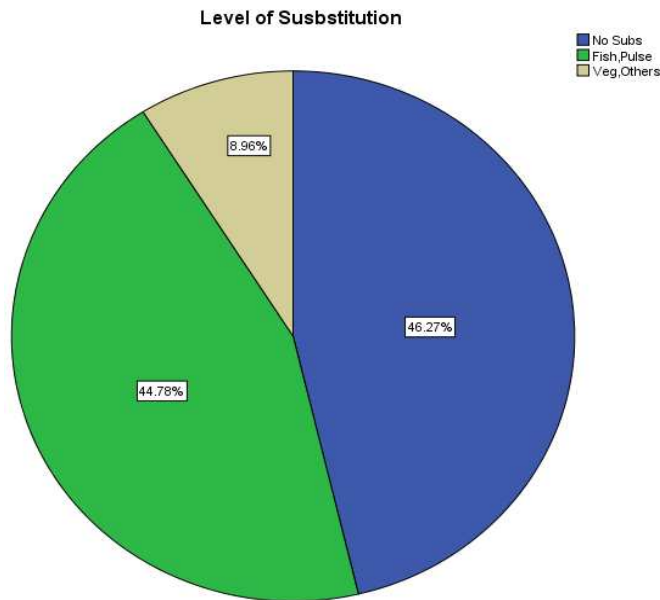
On the other hand, milk is highly elastic because the supply of milk is limited. Nowadays it may appear alien to many that traditional milk collectors and sellers, known as 'Goalas', used to visit households with their milk containers every morning to sell fresh milk and households used to buy from them (Parvez, 2018). Most of the household depends on processed or powdered milk. Adulterate milk is everywhere in the market. Some of the households don't want to buy milk for these reasons. But the price of fresh milk is relatively high for its unavailability so its demand is very high. Households having children are spending their large proportion of income on protein consumption especially milk.

Egg and chicken are less elastic relatively to the beef and milk. Households mostly recruit their protein gap by consuming egg and chicken when the price of beef and milk is increasing. Also, they try to substitute other products when the price of beef, chicken, egg, and milk is increased. From Figure-3, total 53.7 percent household substitutes with other products like fish, pulse, vegetables, etc. Around 44.7 percent of total households substitute with other protein-containing goods like fish and pulse. The other 9 percent of households substitute with non-protein foods. And a high proportion of households do not substitute any good with this which is 46.3 percent.

Conclusion:

The study concluded that in the case of protein consumption, price change and income are most influential. By surveying quantitatively, the impact of the price change on quantity demanded is calculated. As income increases, consumption of protein increases for the urban area, especially in middle and lower-class people. Higher disposable income leads to higher demand for animal sources of protein such as beef, chicken. The consumption of protein from

different sources is positively correlated to the income and negatively related to price changes. The egg and chicken are the most important source of protein when price increases of other sources of protein (beef, milk) as eggs and chicken are less price elastic than beef and milk. The most important factor considered by households while purchasing chicken depends on tastes and habits. Mostly fish and pulses are substituted with beef, chicken, egg, and milk. The study is limited because it has only analyzed the elasticity for and consumption of protein like beef, chicken, egg, and milk but the other easy source of protein's like fish and pulses were ignored. Future studies will analyze the reasons for the high price of protein.

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