



Full Paper

Consumers' perception, buying behavior and income on consumption pattern of selected dried fish varieties in Sri Lanka

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Abstract

Dried fish consumption is ever becoming popularized locally and globally due to its micro-nutrient content, semi-perishability, and taste. The outcomes uncovered that physical quality attributes are the main choosing factors for dried fish. Perceptions and buying behavior of consumers are highly varied on dried fish varieties, purchasing level and quality attributes. Furthermore, studies on dried fish buying behavior, consumption patterns are lacking. Therefore, this study decided to identify the relationship between the level of dried fish consumption pattern over consumer's income and to analyze consumers' perception and buying behavior on selected dried fish varieties (sprats, skipjack tuna and smoothbelly sardinella) in Sri Lanka. Pre-tested structured questionnaire was distributed among 200 dried fish consumers by using Convenient and Snowball sampling in Kurunegala, Gampaha, Jaffna, Puttalam and Matara which represent the highest dried fish consumption and production districts in Sri Lanka. Secondary data was collected from the Department of Census and Statistics and Ministry of Fisheries and the Aquatic Resource Development on selected major animal protein sources during 2006-2019. Data were analyzed using descriptive and non-parametric statistics using Pearson correlation and Friedman test. The consumer preference is the highest for consumption of smoothbelly sardinella (Mean =2.95, p=0.00) than other two varieties. All perceived quality deterioration was observed along the supply chain. Consumers in Gampaha and Matara believe supermarkets (Mean> 3.13, p=0.00) while other all observed district believe producer level market (Mean >2.89) as the source for higher quality dried fish. Appearance (Mean> 3.79, p=0.00) is valued over texture, odor, breakage and shelf life while breakage (Mean< 2.82, p= 0.00) is indicated the least value by consumers in all five districts. Higher percentage share (36%<) of dried fish expenditure is captured by 1-4 income range of expenditure deciles that counts on 1-3 income range for consumption (43% <) of dried fish. Strong positive correlation between the percentage share of chicken consumption (0.777)/ expenditure (0.802) while negative correlation with the percentage share of dried sprats (-0.743)/ dried skipjack tuna (-0.798) consumption are observed against mean income in each expenditure deciles. In conclusion, the dried fish act as the main animal protein source for lower income households as giffen good. Appearance and texture are the main quality attributes perceived by consumer at buying. Consumers consider more on product and trader's level quality when buying dried fish. Effective value additions and standardized handling practices need to be introduced and practiced to enhance the physical quality of dried fish along the dried fish supply chains. Further, decisions and policies need to be addressed by identifying consumer preferences and buying behavior to establish the stable industry.

Keywords: buying behavior, consumer perception, consumption, dried fish, income

Introduction

Dried fish production in Sri Lanka has increased from 12,000 Mt in 1995 to 61, 250 Mt in 2018, accounting for 5.1 percent of total fish production in 1995 and 13.94 percent of total marine fish production in 2018 [6], [25]. The lowest national production was recorded in 2005 [25]. Local production satisfies only 65 percent of the local demand [13], [25] thus, dried fish varieties such as sprats, skipjack tuna, smoothbelly sardinella and shark are being imported, which accounts for about 35% of the local demand [31]. The major dried fish production districts are Trincomalee, Jaffna, Puttalama, Gampaha and Matara. Double-spotted queenfish (*Scomberoides lysan*), skipjack tuna (*Katsuwonus pelamis*), smooth-belly sardinella (*Amblygaster clupeioides*), seer fish (*Scomberomorus commersoni*), and giant catfish (*Arlus thalassinus*) are the main marine dried fish varieties produced in Sri Lanka [13], [25].

Trade is a core element of the dried fish industry, connecting producers/processors with consumers [12], [17]. Trade in dried fish occurs at the gathering, wholesale and retail levels [14]. The involvement of micro/retail dried fish traders at the local level is necessary to distribute products from producer to consumer [12], [21]. In addition, the trading segment of dried fish is highly diversified and buyers have more opportunities to buy different types of dried fish from different levels of the supply chain, as well as multiple markets including fairs, supermarkets, groceries and ordinary retail stores [02],[33].

The consumption of fish and dried fish has increased locally and globally in recent years due to the availability of micronutrients [30]; storage ability during COVID-19 pandemic season, taste, and ability to buy in smaller quantities [06]. Dried fish is a rich source of animal protein (<56.84%), minerals (<29.19%) and lipids (<18.45%), thus contributing to human food security [8], [26], [15]. The consumption pattern of several dried fish varieties differs depending on the type – small and large pelagic varieties [13]. Accordingly, skipjack tuna (113.15g/month), double-spotted queenfish (74.82g/month) and shark (84.19g/month) are the highest household consuming large pelagic species, while sprat (487g/month), smooth-belly sardinella (76.41g/month), gold-striped sardinella (43.69g/month) and trenched sardinella (22.85g/month) are the highest household consumption small pelagic varieties [13], [32]. Despite the lower production, Sri Lankan sprat is heavily consumed; hence the local demand is met by the imported sprat accounting for 72.2%; about 23,232 Mt in 2006-2018 [25].

In addition, the consumption of fish products was dependent on the level of income and the region [1], [3]. The upper and middle classes consume high-value large pelagic species such as Spanish mackerel, yellowfin tuna, skipjack and shrimp, while the lower classes consume small, low-value species such as reef fish and shore seine [33]. Southern consumers' prefer large pelagic species (so-called "blood fish"), and northern and eastern consumers for reef fish and shore seine varieties [6]. Consumers in urban cities, such as Colombo, prefer white fish, such as Spanish mackerel and trevally. The outcomes uncovered that freshness; color, appearance, smell and size are the main choosing factors for dried fish [4], [33]. Purchasers concern more on freshness and different variables as variety, dryness, bone rate, moisture percentage and presence of fungus to choose dried fish for utilization [3], [8]. Prices and consumer preferences differ for

different types of dried fish. Strongly fluctuating prices (77%), lack of availability (22%) and poor quality (10%) are mentioned as obstacles by the consumers [33].

Despite a considerable amount of research has conducted to analyses the nutritional values of dried fish [9], [6], [19] less attention has been paid on dried fish consumption determinants in Sri Lanka. Yet, research on demand for dried fish by species or product category is fairly new in developing countries [6]. The expenditure and consumption analysis over different income level for major animal protein sources including dried fish in developed countries are not applicable in developing countries due to lack of data [19], [33] but crucial in policy formulation as it contributes to safeguard both consumers and producers while attaining the food security in the country [1], [18]. Furthermore, demand for healthy food, convenience, versatility, cheapness, quality and quantity are perceived by different people in different ways [30], [34]. Besides, some consumers consider food safety [33] thus, traditional and preserve foods play a decisive role [8] together with quality parameters [7]. Dried fish is such a product with higher concerns on the quality and consumer perception on its buying behavior. Consumers' choice of dried fish is identified as more complex, dynamic and diversified [7], [20].

Information on current dried fish consumption patterns and how they are likely to change as incomes change is required to assess the nutritional intake pattern, welfare and distributional impacts of technological change, infrastructure development and economic policies [23], [33]. Therefore, this study decided to identify the relationship between the level of dried fish consumption and expenditure over mean income of each expenditure deciles and to analyze consumers' perception and buying behavior toward selected dried fish in Sri Lanka.

Material and Methods

Five major districts in Sri Lanka were selected to conduct the research representing the highest consumption district as Kurunagala and Gampaha while three major production districts as Jaffna, Puttalam and Matara [11], [25], [31]. Further data was mainly collected representing the highest consumption 03 dried fish varieties in Sri Lanka as small pelagic sprats and smoothbely sardinella and large pelagic skipjack tuna. Pre-tested structured questionnaire was distributed among selected consumers in each district to collect primary data. Forty respondents from each district were selected employing Snowball and convenient sampling techniques. Questionnaire was based upon the socio-demographic aspects, pattern of dried fish consumption, expenditure, factors consumer preference, buying behavior and quality determination factors of selected major three dried fish varieties. Each factor was mainly selected by using past published research materials [3], [23] and [33]. Secondary data was collected on dried skipjack tuna (*Katsuwonus pelamis*), dried sprats (*Stolephorus sp.*), chicken, skipjack tuna and yellow fin tuna (*Thunnus albacares*) fresh fish since these are the highly consuming animal protein sources which secondary data available in Sri Lanka. Average monthly household expenditure (Rs.) and consumption (g) data over mean income in each expenditure decile available at Household Income and Expenditure Survey reports from the Department of Census and Statistics were used as the main data source. Thus, Household Income and Expenditure Survey data for the year 2005, 2009/10, 2012/13, 2016 and 2019 were gathered to the analysis. The Ministry of Fisheries and Aquatic Resource Development and Hector Kobbekaduwa Agrarian Research and Training Institute were the other main secondary data sources. Data were analyzed using

both descriptive and inferential statistical methods. Percentage household consumption and expenditure of dried fish, chicken and fresh fish out of total average household consumption and expenditure were calculated for the generalized and to extract the clear variation. After that, all percentage value of observed protein sources in each year were converted to grand average percentage and shown in the bar chart. Further, inferential data analysis methods were applied as Pearson correlation coefficient analysis and Friedman test using SPSS 21 version. Data has been presented qualitatively for better understanding.

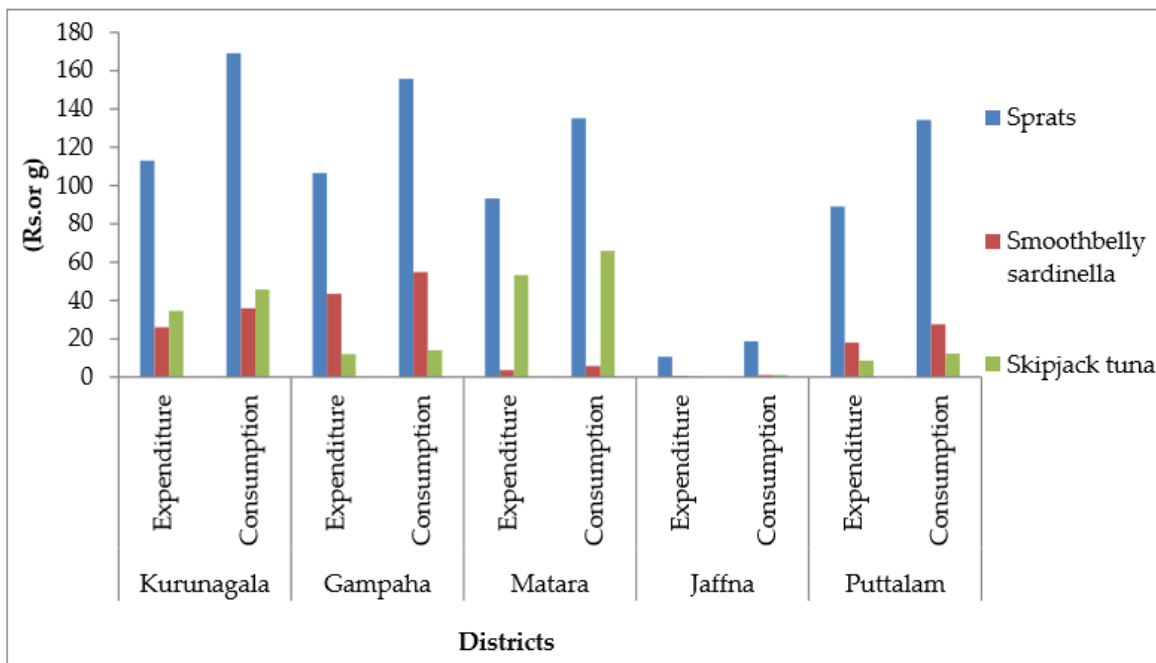
Results and discussion

This section elaborates on the consumption pattern, expenditure, consumer preference for each dried fish variety, buying behavior influencing attributes, quality determination factors and relationship between income and consumption of selected major three dried fish varieties and animal protein sources.

Household consumption and expenditure of dried fish

Figure 01 indicates the average monthly percapita consumption and expenditure for sprats, smoothbelly sardinella and skipjacktuna dried fish in Colombo, Gampaha, Matara, Jaffna and Puttalam districts.

Figure 01. Monthly per capita consumption and expenditure of dried fish varieties (Source: DCS, 2019)



The highest sprats consumption and expenditure is identified in Kurunagala district while the lowest consumption and expenditure in Jaffna district. The highest smoothbelly sardinella consumption and expenditure is identified Gampaha district as well as lowest consumption and expenditure in Jaffna district. Furthermore, the highest skipjack tuna consumption and expenditure is identified in Matara district while the lowest in Jaffna district out of the observed district. Furthermore, the highest consumption and expenditure is identified in Kurunagala and Gampaha district while the lowest dries fish consumption and expenditure in Jaffna district.

Consumer preferences

Table 01 indicates the consumer preferences toward consuming dried fish varieties. Smoothbelly sardinella is identified as the most preferred dried fish variety while skipjack tuna is identified as the lowest preferred dried fish variety from observed three varieties. Friedman test indicate that, there is a significant relationship between consumer preferences and selection of each dried fish varieties.

Table 01. Consumer preferences toward each dried fish variety

Dried fish variety	Mean	P value
Skipjack tuna dried fish	1.55	0.00
Sprats	1.68	0.00
Smoothbelly sardinella	2.95	0.00

(Likert scale 3- the most preferred, 1- least preferred) (Significant at the 0.05 level)

Sprats are identified as the highest consume dried fish varieties in Sri Lanka based on the DCS report [13]. Also, sprats is identified as the most expensive while skipjack tuna as the least expensive dried fish variety [25]. There are considerable imports for sprats and skipjack tuna nationally [25]. Accordingly, findings for consumer preference in this study contradicted with the results of Household Income and Expenditure survey of the Department of Census and Statistics. This may be happened due to the different reasons. There is not considerable production of smoothbelly sardinella to fullfill local demand as well as smoothbelly sardinella is not imports from other countries to fill the surplus of demand. Therefore, actual preference of consumers at national level may shift with the actual preference [6], [25], [31]. Further, the study of [6], [7], [24] and [31] denotes the differences of consumer preference toward dried fish varieties. Accordingly, different consumers perceived several dried fish varieties differently on their preferences. Some of consumers highly consume small pelagic varieties as well as some are large pelagic varieties. Gender, age, family size and occupation affect to change their preferences when selecting dried fish varieties [33].

In Bangladesh, preferences are largely a function of local cultural preferences and geographical locations [33]. Consumption of dried fish is highest in Chittagong and Sylhet divisions, moderate in Dhaka division, low in Barisal and Rashjahi divisions, and almost non-existent in Khulna division [33]. There are also differences within and between regions when it comes to the consumption of dried fish [16], [28].

Consumer perception on product quality

Table 02 indicates the consumer perception toward quality of dried fish at producer, wholesaler, retailer and supermarket levels. The results denote that producer level product quality is the highest quality while retailer level product quality is the lowest quality in Puttalama, Kurunagala and Jaffna district. There is the highest product quality in supermarket level while the lowest in retailer levels in Gampaha and Matara

district. Significant relationship between consumer preferences and product quality at producer, wholesaler, retailer and supermarket level is identified on Friedman test.

Table 02. Consumer perception toward quality of dried fish at each value chain level

Criteria	Puttalama	Jaffna	Gampaha	Matara	Kurunagala
	Mean	Mean	Mean	Mean	Mean
Producer level quality	3.12	3.14	2.79	2.89	3.04
Wholesaler level quality	2.25	2.35	2.10	2.20	2.15
Normal retailer level quality	1.95	1.95	1.90	1.80	1.85
Supermarket	2.98	2.85	3.13	3.10	2.96
	P= 0.00>		Chi Sq= 25.48<		

(Likert scale 4- the most preferred, 1- least preferred) (Significant at the 0.05 level)

Gampaha and Matara districts are identified as the urbanization districts than other observed districts. There are many urban families and supermarkets in Matara and Gampaha than other districts [13]. These two districts are identified as major dried fish production district [31]. Consumers in Matara and Puttalam have well experience with all four trading places than other districts [6]. Therefore, consumers in these two districts may experience, supermarket quality is higher than other quality level. Puttalama and Jaffna districts are identified as the major small pelagic dried fish production district, specially sprats and smoothbelly sardinella [31]. Consumer in these two districts frequently deal with producers to fulfill their dried fish requirements. Available number of supermarkets, normal wholesalers and retailers are less in Puttalam and Jaffna than other districts [13]. Further, kurunagala and Gampaha districts are identified as the highest dried fish consumption district in Sri Lanka [11], [13]. Kurunagala consumers frequently deal with wholesalers and retailers. Therefore, consumers in these three districts may think producer quality is higher than wholesaler, retailer and supermarket.

The study results of [8], [9], [10] and [33] indicates, consumers are aware of the quality of dried fish and there are often complaints about the quality of the dried fish available in the different dried fish markets. There are diversified quality characteristics of dried fish which collected from market and drying centre at Kuakata in Patuakhali [21].

Attributes influencing buying behavior

Table 03 indicates the different attributes which influence buying behavior of dried fish consumers in Puttalama, Jaffna, Gampaha, Kurunagala and Matara districts. Appearance of dried fish varieties are the most important characteristics considered by dried fish consumers when buying products in all observed

districts while breakages are the least important characteristics which consumers consider when buying dried fish. Furthermore, Friedman test indicate the significant relationship between each dried fish attribute and buying behavior of consumers.

Table 03. Attributes which influence buying behavior of dried fish consumers

Attributes	Puttalama	Jaffna	Gampaha	Matara	Kurunagala
	Mean	Mean	Mean	Mean	
Appearance	3.95	4.12	3.79	3.89	4.02
Texture	3.85	3.17	3.57	3.67	3.97
Odor	3.70	3.82	3.45	3.55	3.72
Breakage	1.85	2.07	2.72	2.82	1.97
Shelf life	3.18	3.38	3.38	3.48	3.28
	P= 0.00>		Chi sq= 28.45<		

(Likert scale 5- the most preferred, 1- least preferred) (Significant at the 0.05 level)

The study by [3], [33] shows the consumer preference for dried fish in the city of Dhaka and Sri Lanka. For dried fish, freshness, size and color are the main factors influencing consumption. In addition, variety, dryness, color, bone content, moisture content and fungal growth are the main factors influencing dried fish purchasing decisions.

Income and dried fish consumptions comparatively main animal protein sources

The expenditure deciles are categorization of socioeconomic status by dividing the population into 10 income groups from lowest income (1) to the highest income group (10) based on the expenditure pattern. Mean household income of each expenditure deciles is identified as (Quintile 01-20,734>/ 02- 31,961> 03- 39,628/ 04- 48,632/ 05- 54,416/ 06-63,020/ 07- 70,013/ 08- 88,199>/ 09- 112,376> and 10- 112,376<) during 2005-2019.

Figure 02 illustrates the percentage of expenditure for fish, dried fish and chicken out of total expenditure (Rs.) of observed animal protein source within each income level in expenditure deciles.

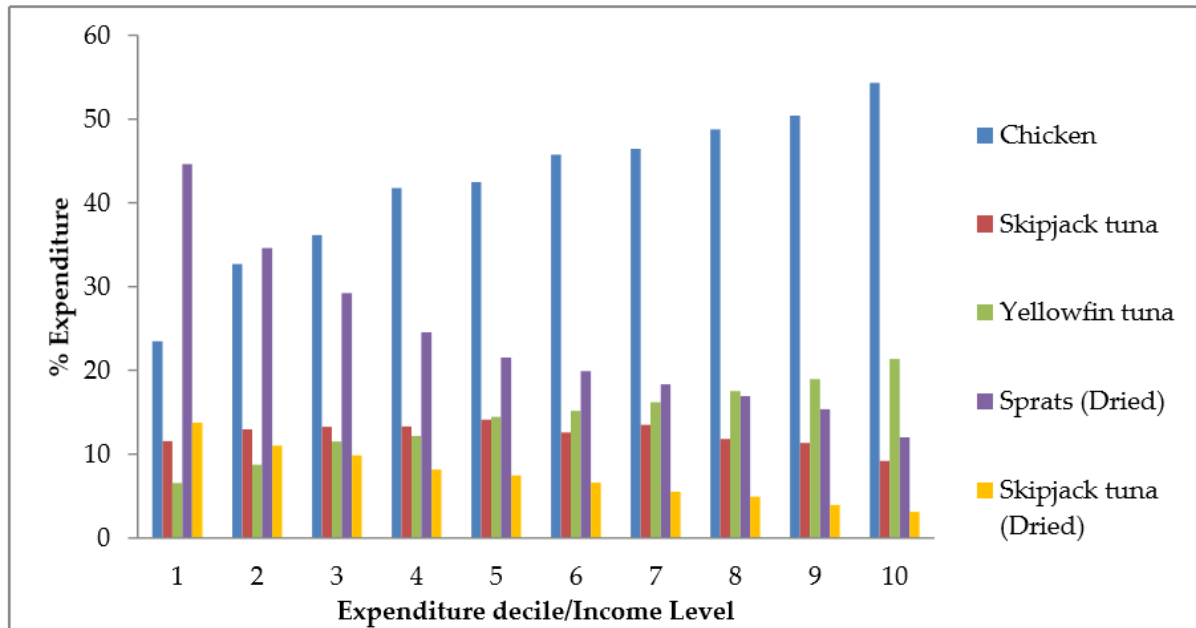


Figure 02. Percentage expenditure of different animal protein sources

Percentage monthly household expenditure of chicken, dried sprats and dried skipjack tuna is shown explicit variations within each income levels of expenditure deciles. Dried sprat is the highest expenditure verity within the income level 1 and 2 out of observed animal protein sources. It became second-highest expenditure animal protein source in income levels 3-7 and third highest animal protein source after income level 06. Furthermore, dried fish (total of all varieties) is the highest expenditure animal protein sources within the income level 1-4. The chicken is the highest expenditure animal protein source within the income level 5-10. Furthermore, chicken is the second-highest expenditure animal protein source within income level 1-4.

Figure 03 illustrates the percentage of consumption of fish, dried fish and chicken out of total consumption (g) of observed animal protein source within each income level in expenditure deciles.

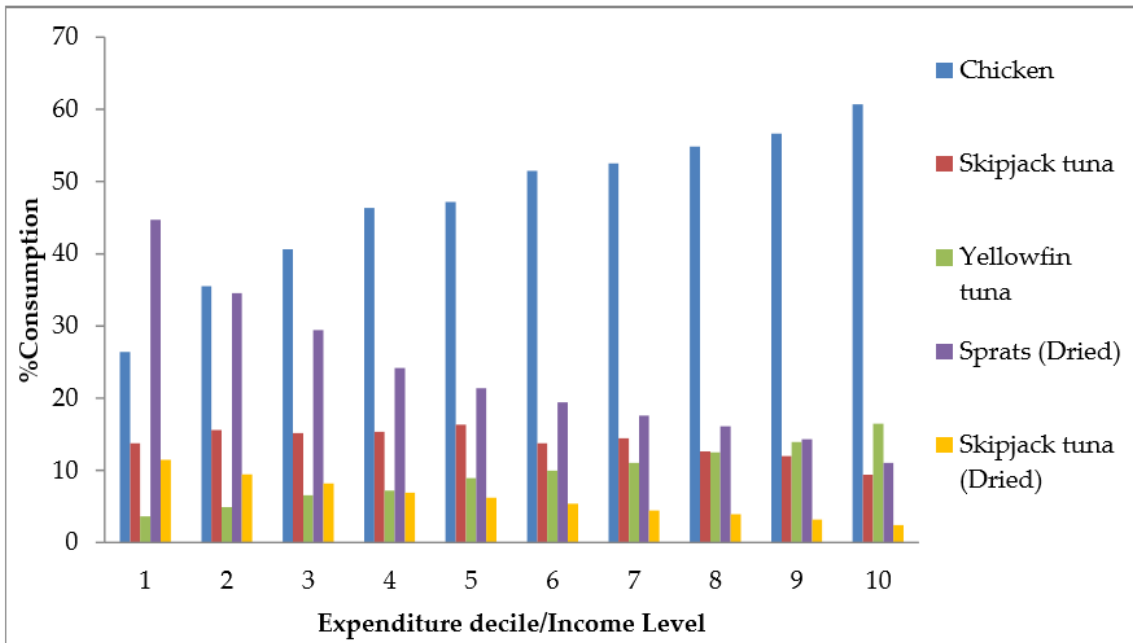


Figure 03. Percentage consumption of different animal protein sources

Figure 03 illustrates the dried sprats are the highest percentage consumption protein source out of the observed sources within the income level 1. It is becoming the second-highest protein sources after income quintiles 2 and this situation is continued up to income level 9. Furthermore, dried sprat is the third-highest consumption varieties in the income level 10 out of observed protein source. However total dried fish is attained the highest consumption level within the income level 1-3 and it became second largest consumption sources within the 4-10 income levels. The chicken is the highest consumption protein sources within the 4-10 income level. There can be identified chicken as the second highest consumption protein source within the income level 1-3. Total fish consumption is identified as the second-largest protein source out of observed sources within all the expenditure deciles/ income level.

Per-capita consumption of chicken is highest in the urban sector than the rural sector in Turkey. Also, the chicken consumption quantity is raised in the rural sector than the urban sector with income increment [1]. Furthermore, findings of [11], [6] and [27] indicate the diversification of dried fish consumption on different income levels. Lowest income people have poor access while high income people have the greatest access for different animal protein sources [1]. Therefore, most of the consumers fulfill their nutritional requirement on low price protein sources as dried fish [5], [22], [11].

The analyzed results of the Pearson correlation coefficient of percentage household expenditure against mean income of each expenditure deciles are shown in table 04. Strong positive co-relation (0.802) between percentage expenditure of chicken and each income quintiles are observed. Further, it is revealed the strong negative correlation between the percentage expenditure of each dried fish varieties [Sprats (-0.718) and

skipjack tuna (-0.778)] and income. It revealed that, percentage expenditure for chicken consumption is increased with increasing household income and percentage expenditure for dried fish consumption is decreased with increasing household income.

Table 04. Pearson correlation of percentage HH expenditure of animal protein sources against mean income

	Income	Chicken	Skipjack tuna	Yellowfin tuna	Sprats (Dried)	Skipjack tuna (Dried)
Income	1	.777**	-0.573	.892**	-.743*	-.798**
Chicken		1	-0.177	.958**	-.993**	-.996**
Skipjack tuna			1	-0.4	0.071	0.253
Yellowfin tuna				1	-.936**	-.972**
Sprats (Dried)					1	.979**
Skipjack tuna (Dried)						1

** Correlation is significant at the 0.05 level

Correlation coefficient analysis of percentage household consumption of each protein sources against mean income of each income quintiles (Table 05) revealed that strong positive correlation between chicken (0.777) consumption against income while strong negative correlation between dried fish (sprats -0.743 and skipjack tuna -0.798) consumption and income. It means percentage dried fish consumption is decreased with increasing income and percentage chicken consumption is increased with increasing income.

Table 05. Pearson correlation of percentage HH consumption of animal protein sources against mean income

	Income	Chicken	Skipjack tuna	Yellowfin tuna	Sprats (Dried)	Skipjack tuna (Dried)
Income	1	.802**	-0.379	.734**	-.718**	-.778**
Chicken		1	0.128	.992**	-.986**	-.995**
Skipjack tuna			1	0.253	-0.287	-0.131
Yellowfin tuna				1	-.999**	-.988**
Sprats (Dried)					1	.980**
Skipjack tuna (Dried)						1

** Correlation is significant at the 0.05 level

The household income and expenditure survey of Bangladesh indicates the relationship between income and different animal protein sources consumption of the consumers [18]. Accordingly, the consumption of chicken, fish and dried fish among different persons which come from different income categories are

highly diversified. Furthermore, results of [29] provide that, fish products consumption is diversified with income and amount of food supply. Low income person has poor access for the consumption of high price animal protein sources while high income people have the highest access [11]. Therefore, dried fish consumption is decreased with the increasing income [11].

Conclusion

This study mainly decided to identify the relationship between the level of dried fish consumption and expenditure over mean income of each expenditure deciles and to analyses consumers' perception and buying behavior toward selected dried fish in Sri Lanka. In contrast, multiple modes are used to purchase dried fish by consumers including producer, wholesaler, retailers as normal retailers and supermarkets. The customers perceive a quality deterioration along the supply chain thus value additions and standardized handling practices need to be introduced and practiced to ensure the quality of dried fish. Buying process is mainly determined by the appearance hence quality packing, free from molds and precautions for discoloration would be advantageous for the sellers. Percentage of household expenditure and consumption for dried fish shows a decreasing pattern with increasing income. Furthermore, the dried fish act as the main animal protein source for lower income households. It serves as a giffen good. Besides, the marketers need to be vigilant about the quality of the product because majority of buyers look for appearance, texture, odor and keeping quality. Consumers consider more on product and trader's level quality when buying dried fish. This calls for careful attention on hygienic practices and quality consciousness in observed dried fish processing and handling along the supply chain to expand quality production on consumer perception. Further, decisions and policies need to be addressed by identifying consumer preferences and buying behavior to establish stable industry.

Conflict of interest

The authors declare no conflict of interest

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References

- [1] M. Blades, I. Yildirim, M. Ceylan, Urban and rural households' fresh chicken meat consumption behaviors in Turkey, *Nutrition & Food Science*. 2008, 6(1), 420-428.
- [2] M.M. Dey, Analysis of demand for fish in Bangladesh. *Aquaculture Economics & Management*, 2000, 4(1), 63-81.
- [3] N.Y. Hirimuthugoda, N.A. Pethiyagoda, S.T. Madusanka, Factors affecting the consumer preference and consumer buying behavior of dried fish: A case of Southern province in Sri Lanka. *International Symposium on Agriculture and Environment*, University of Ruhuna, Sri Lanka, 2014, 419-421.
- [4] A. Jónsson, G.A. Finnbogadóttir, G. Porkelsson, H. Magnússon, O. Reykdal, S. Arason, Dried fish as health food. *Published by SkyrslaMatis*, 2007, 10 (1), 32-07.

- [5] K. Kandeepan, S. Balakumar, V. Arasaratnam, Nutritional status and food insecurity among the children in Northern Sri Lanka. *Procedia food science*, **2016**, 6(1), 220-224.
- [6] D.N. Koralagama, S.L. Wickrama, A. Adikary, A Preliminary Analysis of the Social Economy of Dried Fish in Sri Lanka. *Dried Fish Matters data base*, 09, July, **2021**. <https://api.zotero.org/users/4955564/items/GEP3CAJD/file/view>
- [7] F. Conte, A. Passantino, S. Longo, E. Voslářová, Farmed fish welfare: consumer perception and choice, *Animal protection and welfare*. **2013**, 2013(1), 30-31.
- [8] H.M.T.N.B. Herath, K. Radampola, Consumption behavior and pattern of fish consumption among university students: A case study from university of Ruhuna, Sri Lanka, *International Journal of Fisheries and Aquatic Studies*. **2016**, 20(21), 46-47.
- [9] N. Ullah, P. Hazarika, P.J. Handique, Biochemical Quality Assessment of Ten Selected Dried Fish Species of North East India. *International Advanced Research Journal in Science, Engineering and Technology*. **2016**, 3(1), 30-33.
- [10] F. Wang, J. Zhang, W. Mun, Z. Fun, X. Zhang, Consumers' perception toward quality and safety of fishery products, Beijing, China, *Food control*. **2009**, 20(10), 918-922.
- [11] P.S.S.L. Wickrama, D.N. Koralagama, P.V.S. Harshana, The impact of household income on dried fish consumption in Sri Lanka, *International Syoposium of Agriculture and Environment*, University of Ruhuna, Sri Lanka, 07 May **2021**
- [12] T. Calzolari, A. Genovese, A. Brint, Circular Economy indicators for supply chains: A systematic literature review, *Environmental and Sustainability Indicators*. **2022**, 13 (1), 100-160.
- [13] Department of Census and Statistics, Household Income and Expenditure Survey, Ministry of National Policies and Economic Affairs. Colombo 01, Sri Lanka. **2019**.
- [14] H. De Steur, J. Wesana, M.K. Dora, D. Pearce, X. Gellynck, Applying Value Stream Mapping to reduce food losses and wastes in supply chains: A systematic review, *Waste management*. **2016**, 58, 359-368.
- [15] T. Trondsen, T. Braaten, E. Lund and A.E. Eggen, Consumption of seafood—the influence of overweight and health beliefs, *Food Qual. Prefer.* **2004**, 15(1), 361-374.
- [16] Food and Agriculture Organisation, The consumption of fish and fish products in the Asia-Pacific region based on household surveys, United Nations, **2020**.
- [17] H.A. Grema, J.K.P. Kwaga, M. Bello, O.H. Umaru, Understanding fish production and marketing systems in North-western Nigeria and identification of potential food safety risks using value chain framework, *Preventive Veterinary Medicine*. **2020**, 181, 105-380.
- [18] Bangladesh Bureau of Statistics (BBS), Household income and expenditure survey, Ministry of Planning, Government of the People's Republic of Bangladesh, **2017**.
- [19] A. Henriques, J.A. Vázquez, J. Valcarcel, R. Mendes, N.M. Bandarra, C. Pires, Characterization of Protein Hydrolysates from Fish Discards and By-Products from the North-West Spain Fishing Fleet as Potential Sources of Bioactive Peptides, *Marine Drugs*. **2021**, 19(6), 338.
- [20] R. Hilborn, C. Costello, The potential for blue growth in marine fish yield, profit and abundance of fish in the ocean, *Marine Policy*, **2018**, 87, 350-355.

- [21] M.N. Jaman, M.S. Hoque, F. Yeasmin, M.M. Hasan , M.A.S. Ripon, A. Akter, M.A. Jhumur, Comparative assessment of dried fish quality collected from market and drying centre at Kuakata in Patuakhali, Bangladesh, *Bangladesh Journal of Fisheries*. **2021**, 33(1), 137-146.
- [22] S.B. Jeffer, Analysis of the postharvest food safety management systems in the meat supply chain: a case of Uganda, Ph.D thesis, American University of Beirut, Uganda, **2021**.
- [23] A. Kumar, G. Kushwaha, Value stream mapping: a tool for Indian agri-food supply chain, *International Journal of Multidisciplinary Research in Social and Management Sciences*. **2015**, 3(1), 45-54.
- [24] M.A. Mansur, S. Rahman, M.N.A. Khan, M.S. Reza, S. Uga, Study on the quality and safety aspect of three sun-dried fish, *African Journal of Agricultural Research*, **2013**, 8(41), 5149-5155.
- [25] Ministry of Fisheries and Aquatic Resource Development, Fisheries statistics. Colombo 10, Sri Lanka, **2021**.
- [26] J. Pal, B.N. Shukla, A.K. Maurya, H.O. Verma, G. Pandey, A. Amitha, A review on role of fish in human nutrition with special emphasis to essential fatty acid, *International Journal of Fisheries and Aquatic Studies*. **2018**, 6(2), 427-430.
- [27] N. Roberts, From catch to consumption: food security dynamics in an Indonesian fishing community: A dissertation submitted in partial fulfillment of the requirements for the degree of master of science in biological and environmental sciences, M.Sc. Thesis, University of Rhode Island, **2021**.
- [28] R.M.N.S. Sugathapala, T.V. Suntharabarathy, U. Edirisinghe, Salt based dry fish processing and marketing by fishers of minneriya reservoir in Sri Lanka. *Tropical Agricultural Research*. **2012**, 23(4), 357 -362.
- [29] A.G. Tacon, M. Metian, Food matters: fish, income, and food supply—a comparative analysis. *Reviews in Fisheries Science & Aquaculture*, **2018**, 26(1), 15-28.
- [30] J. Wesana, X. Gellynck, M.K. Dora, D. Pearce, H. De Steur H, Measuring food and nutritional losses through value stream mapping along the dairy value chain in Uganda. *Resources, Conservation and Recycling*, **2019**, 150, 104-416.
- [31] P.S.S.L. Wickrama, D.N. Koralagama, A.L. Sandika, Assesing seasonal price behavior of selected dried fish varieties in Sri Lanka, *Tropical Agricultural Research & Extension*, **2021**, 24 (1), 21-34.
- [32] T.P. Neranjala, W.G. Eranga, D.C. Dissanayake, Dried fish production and trade in Negombo, Sri Lanka, *Sri Lanka Journal of Aquatic Sciences*, **2022**, 27(1), 31-43.
- [33] M.D. Islam, P. Chowdury, S.N. Jahan, F.A. Fawzia Adib, "Consumers' preference for dried fish with emphasis on packaging in Dhaka city, *Fisheries Technology*, **2020**, 57, 291-296.
- [34] M.M. Hossain, M.D. Hossain, M.A. Noor, A.S.M.T. Haque, M.A. Kabir, Quality aspects of some dried fish products collected from different super shops of Dhaka city in Bangladesh, *Journal of the Sylhet Agricultural University*. **2013**, 2(2), 283-287.