Nutrition value chain analysis: Place of Women Fish Processors

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Abstract

The fisheries value chain of Sri Lanka consists of stakeholders who participate in the coordinated production and value-adding activities which fulfilling the country's animal protein requirement by 60% (DOFA,2016). The study was taken up with the objectives of to assess the nutrition value: nutrient density, food safety, food quality, quantity, prices, profit/, market margin, to identify the points where safety, quantity, quality, prices, profit/market margin enhanced or diminished in the fishery value chain and to determine the time allocation of each value chain actors of both sexes for each activity. The methodology included four case studies and focus group discussions based on both dry fish and Maldives fish value chains in Southern coastal area. And its figure out that processing of dry fish and Maldives fish is done with more female participation while male are allocating more time as producer, collector, retailer/ wholesaler and exporter. The women processors were more economic concern and they are not paying much attention on quality raw materials, hygienic practices and this is same in collector, retailer/wholesaler level. But at the exporter level due to high legislations; more concerning on safe food production. Even fisheries sector supply country's protein demand by quantitatively; minimization of nutrition loss or sustaining the quality of final products throughout the value chain is not at optimum level while intermediaries earning high profit and consumers have to pay higher price for low safe products. Therefore, proper policy framework is essential to effectively link all stakeholders to promote safe fish nutrient value chain.

Introduction

Nutritious food, malnutrition, undernourishment, hidden hunger are globally trending hot topics and developing countries are the characterized regions who cannot afford healthy diet under low income settings. Agriculture sector can play a major role for address these issues and however, the new focus is to improve nutritional outcomes by considering on not only of the way food is produced, but also how it is processed, distributed, marketed and consumed, a process that is usually referred to as 'value chain' (FAO.,2014). This new focus will require the engagement of not only the agriculture sector, but also the other sectors involved, and approaches are needed to help overcome inter-sectoral barriers, which create disincentives to closer cooperation. The value chain is the core building block for food system. The nutrition value chain is consisting with the activities from food production, post-harvest through to consumers, which provide to identify entry points for policies and interventions to improve nutrition and its leverage opportunities to enhance supply and/or demand for nutritious food, as well as opportunities to add nutritional value (and/or minimize food and nutrient loss).

Fish is a highly nutritious food and an excellent source of proteins, vitamins, minerals and essential fatty acids. And More than 3.1 billion people depend on fish for at least 20% of their total animal protein intake (FAO,2015). Sri Lankan fisheries sector also the key source of providing animal protein in the diet and providing employment opportunities for more than 2.6 million coastal community. Generally, about 85% of the domestic production of marine fish is consumed in the fresh form and only about 10% is processed under poor hygienic conditions

(FAO,1984). These processed fishery sector mainly consists with dry fish and Maldives fish and its popular income generating source among coastal fish women. Drying in the sun and salt curing is the traditional and oldest methods which applied for fish preservation to reduce physical post-harvest losses and also add value to harvest in Sri Lanka. Even its fish or any target food type has to be safe at the point of delivery from the production step to reduce the loss of nutritional value as expected.

To address that issue; the primary focus could be on the nutritional impact of value chains and value chain-based interventions on women as they are playing major role in handling, processing, preparing and purchasing (Henson and Humphrey,2015). In fisheries sector, the governance of fish processing or value addition owned by women its important to investigate their role in nutritional value chain with the consideration of hygienical, safe and quality production.

Significance and Justification

The nutritional importance of fish was also recognized in 2013 by the COFI sub-committees on aquaculture and trade (FAO, 2014, 2015). Fish is more susceptible to spoilage than other animal protein foods and it's a perishable food type (Cutting, 1996). Therefore, to reduce the post-harvest loss and preserve the surplus of catch fish; most of Sri Lankan coastal communities adopted to process them as dry fish or Maldives fish.

Overall gender distribution in Sri Lanka is on par and it remains so in the fisheries s too. Depending on regions, different culture, values, attitudes, technological advancement and also access and control for resources, the extent of commercialization, and the product involved and comprehensive marketing network women and men are playing different kind of changing roles (De Silva, 2011). When considered the dry fish and Maldives fish processing sector; All most all processing activities are handled by women and fish production, marketing are handled by men. The key steps of dry fish and Maldives fish production are split or cut ventrally and the gut and skin are removed completely, then washed and add salt (200Kg of fish – 10 Kg of Salt), after that sun dried and kept until marketing. In Maldives fish processing after cut in to pieces, boiling and smoking are practicing before sun drying. These two steps are essential for hard and quality Maldives fish production.
The concept of a 'value chain' recognizes that the linkages between the many activities and actors involved in bringing a product or service from production through to consumption and this linkages value chain can easily use for bring nutritious final product to consumer. In fisheries sector many actors, intermediaries, supportive parties, policy makers are engaging to produce 456,990 Mt annually (DOFA,2016). And however, even its supply country's protein demand by quantitatively; minimization of nutrition loss or sustaining the quality of final products throughout the value chain is not at optimum level. As the women has dominant role here, the awareness on safe fish production, quality raw material usages, enhance the opportunities to ensure that food value chains contribute to improved food security and nutrition are critical to address. Therefore, with the intervention of nutrition value chain analysis approach; allow to identify roles and incentives of different actors along the chain and what policy and regulatory environment is conducive for value chain to contribute to nutrition.

Objectives of the Study

The study lies on three main objectives. Such as; to assess the nutrition value: nutrient density, food safety, food quality, food quantity, food prices, Profit/ market margin, to Identify the points where safety, quantity, quality, prices, profit/market margin enhanced or diminished in the fishery value chain and to determine the time allocation of each value chain actors: production-men /women; processing-men/women; marketing men/women.

Conceptual Framework

The conceptual framework illustrated the nutrition value chains of Maldives fish and dry fish. Here the key actors of both value chains are fishermen, processors, collectors, traders and consumers. Trader represent by the wholesaler, retailer or exporter. Mainly based on each node of actors; quality and safe production, fish quantity and nutritious value changes in each level, price and profit margin changes at each level also considered. The gender involvement and their time allocation at each level for each activity also focused to address the objectives of the study.

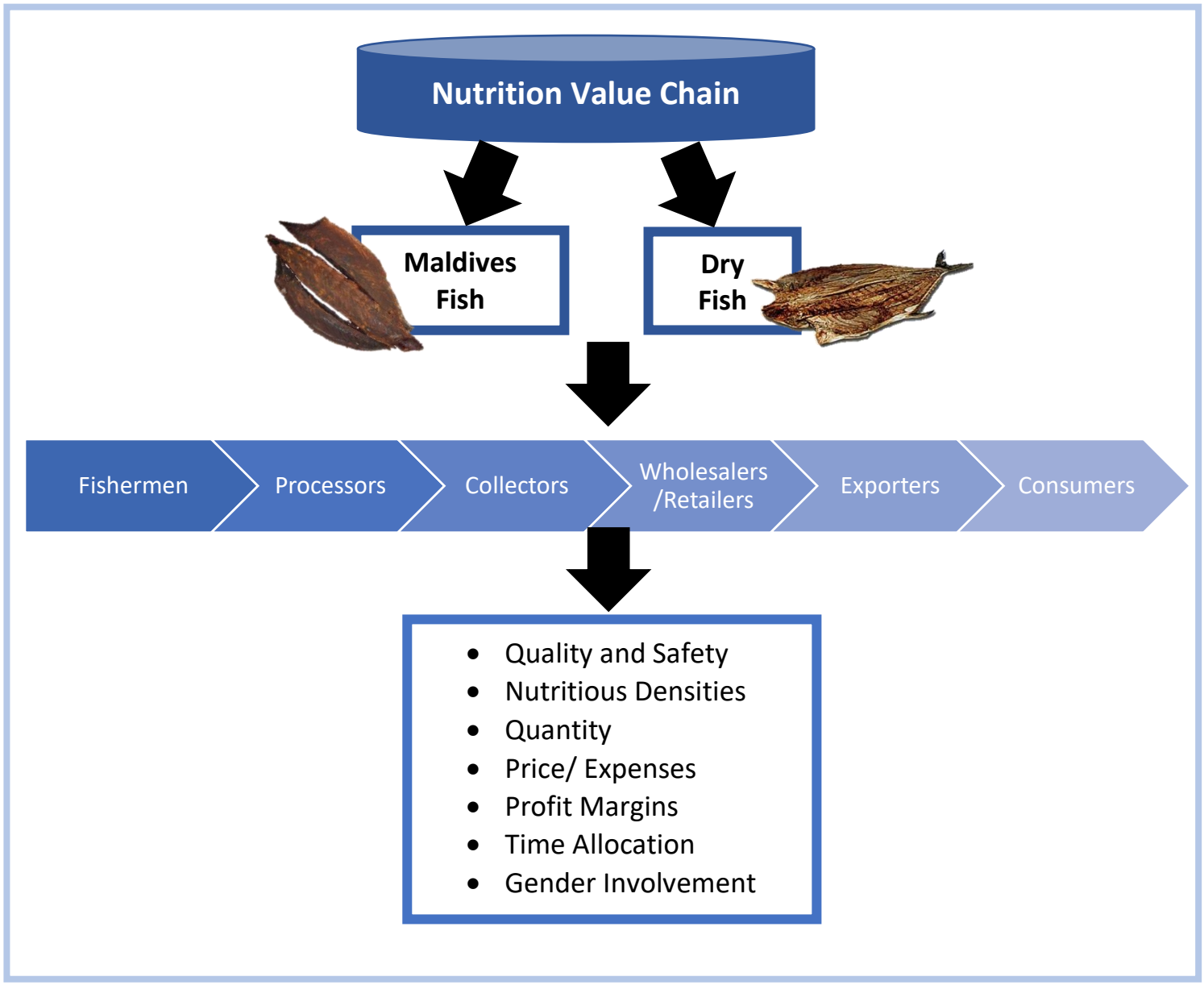


Figure 01: Conceptual Framework of the Study

Methodology

Beruwala, Balapitiya and Kudawella from southern coastal area were selected as research locations for this study by considering the specific research objectives as to explore the present situation.

According to the pilot study, women are playing major role in fish processing activities in this area when compared to other dominant fish processing areas in Sri Lanka. And based on the 2016 Industry capability report; there are totally 15 fisheries administrative districts and of them Tangalle and Galle districts were dominant and have contributed over 26% to the total marine fish production of the country.

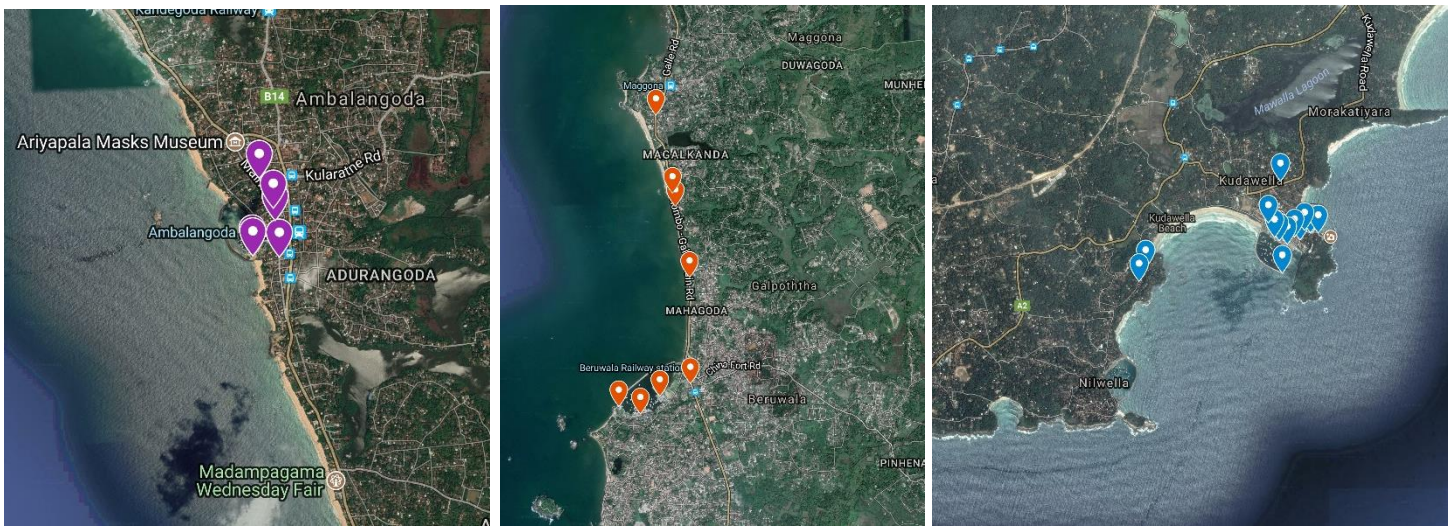
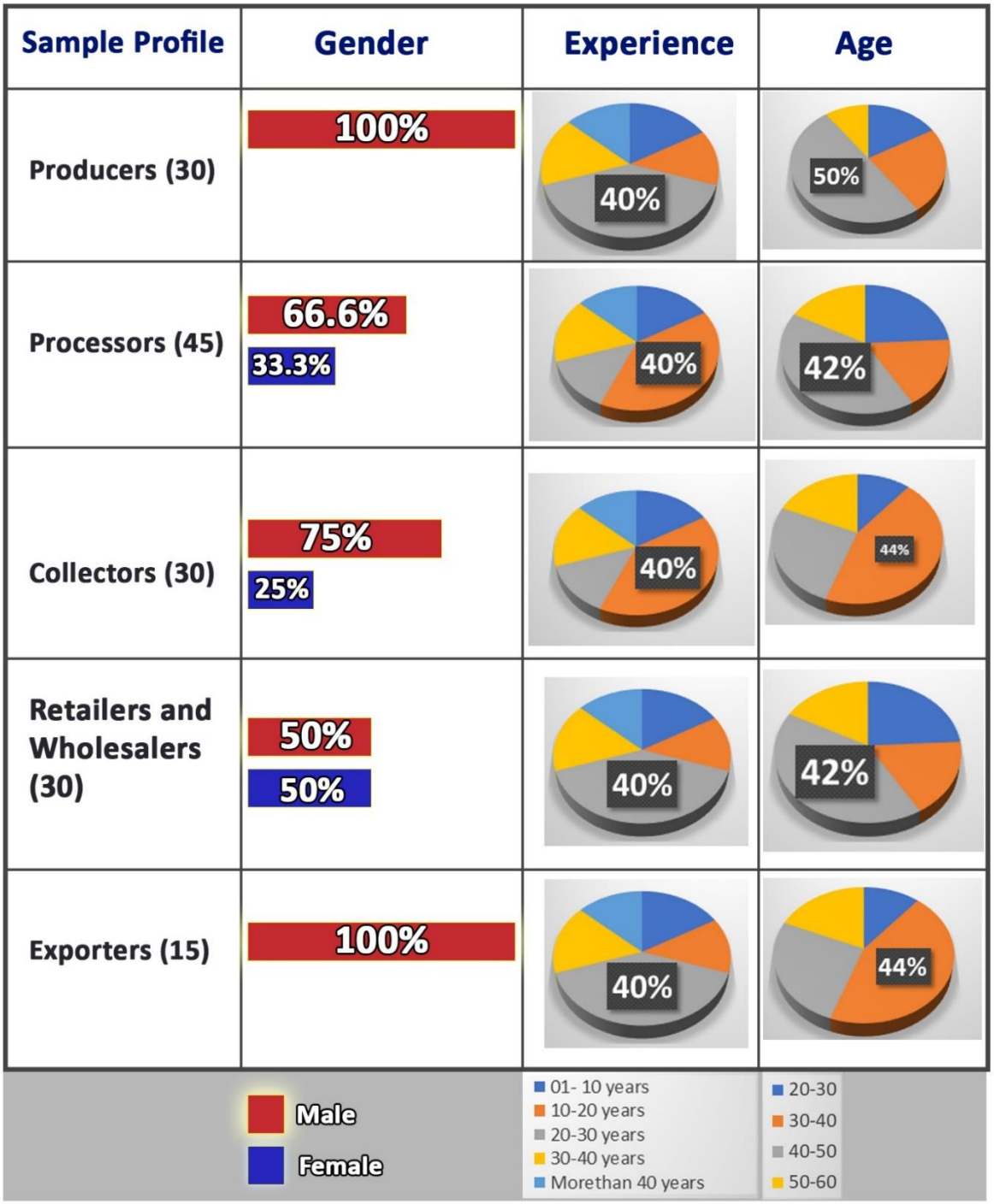


Figure 02: Research Locations of the study

The research approach was deductive and the study was based on both primary data and secondary data. The sample consists of all the value chain members including fishermen, fish processors, collectors, wholesalers, retailers and exporters of both Maldives fish value chain and dry fish value chain to achieve the objectives specifically. The sample size was 50 value chain members from each area and totally 150 respondents were interviewed. Their sample profile is illustrated by the following table (Table 01). And secondary data collected for assess the nutrition value and densities of each processed fish types.

Table 01: Sample profile of the study



The data collecting tools were four focus group discussions, four case studies and on site observations. Mainly qualitative data were collected. Focus group discussions were conducted in each district by participating from all value chain members except exporters. We had invited to 8-10 mixed group which consisted producers, processors, collectors wholesalers and retailers (both men and women). In Galle district, there were two focus group discussions were conducted and other discussion were conducted in Beruwala and Kudawella areas. Here mainly gender involvement, price and daily expenses, quantity handled by each actors data were collected. Case studies were also conducted with exporters and women processors to discuss about the quality and standards, mal practices during processing in deeply.

Data analysis mainly done for calculating the profit/market margins in each node. And Profit and market margin analysis was used to determine the profitability of dry fish and Maldives fishery sector in southern coastal area.

Profit (Rs./kg) = Total revenue (TR) – Total variable cost (TVC)

Where, TR = p×y where, p = price per kg of dry fish (Rs); y = output (kg)

TVC = Total variable costs (Rs), which include cost of fish, transport cost, processing cost, labor cost, packaging cost etc. (Lliyasu et al., 2011).

Market Margin (MM) = (Retail price – Farm gate price)

Results and Discussion

Nutrient density or nutrient value can define as the foods that supply relatively more nutrients than calories (Fulgoni and Adam,2014). Generally, Nutrient density can calculate by the content of key nutrients per 100 g, 100 kcal, or per serving size of food. In this study we used nutrients per 100g in processed forms of tuna fish. There was no higher significant difference among fresh form of fish and processed fish forms (Dry fish and Maldives fish) based on key nutrient factors such as protein content, saturated fat, vitamins, minerals etc.as shown in the following table 02. Which means processed types is a good solution for reduce the post-harvest deterioration and to preserve surplus of fish harvest as microbiological stable product by securing expected nutrition amounts and no any harmful damage for nutrient value.

Table 02: Nutrient densities of fresh, dry and Maldives fish types of Tuna (100g)

Fresh Form		**Dry Fish**		**Maldives Fish**	
Calories	184kcal	Calories	144kcal	Calories	162kcal
Total Fat	6.3g	Total Fat	4.9g	Total Fat	2g
Saturated Fat	1.6g	Saturated Fat	1.3g	Saturated Fat	0g
Cholesterol	49mg	Cholesterol	38mg	Cholesterol	0mg
Sodium	50mg	Sodium	39mg	Sodium	540mg
Protein	30g	Protein	23g	Protein	28g

Source: https://www.nutritionvalue.org

According to the requirements stipulated in SLS 643: 1984 or SLS 811: 1988, Sri Lanka Standard Specifications for Dried Fish and Maldives Fish respectively there should be at least following steps have to follow for ensure the quality and safe final product and rarely observed in southern costal processing centers.

- Fish should be sorted out according to the size and their species
- Have to wash thoroughly by using potable water to remove all contaminants
- After removing unnecessary parts such as gut, gills, head should immerse in salt water for few hours depending on different size and that salt water should be prepared with potable water
- Salted fish spread on the racks or shelves and should dried for 3-4 days before marketing

Quality losses can be occurred very rapidly after catching. During our study; majority of processors not much concern on above factors. They usually use spoilt fish and low-grade raw materials, not using quality salt and adding petrol, formalin, pesticides, ash like human toxic ingredients to avoid fungal growth specially during Maldives fish processing. And their processing centers were not well prepared or hygienical ones. We found that majority of them

not using potable water source (most of them use harbor water to wash fish) and not available racks or shelves for drying they were just sun drying by laying on the ground which can easily contaminated. Not any person founded who use safety gears such as gloves, mask, separate cloths etc. during processing practices. Table 03 shown the comparison of current practices and required standard of fish processing at the processor level.

Table 03: Comparison between current practices and SLS specifications in fish processing

Activity	Current Practices	Standards
Fish Handling and Grading	Sort out based on size of fish	Should sort out according to size and species
Cleaning	Harbor water	Clean potable water source
Drying	On the floor/ outside of houses	Racks or shelves
Adulteration	Low quality salt, petrol, formalin, pesticides	Only high-quality salt

Collectors, retailers and wholesalers also not much paying the attention on hygienically produced or high-quality products. With that even sun drying is cheaper significant loss can be occurred due to contamination by dust, fungal growth, and insect infestation.

However, in the exporter level, they were using higher hygienic processing factories, US Food and Drug Administration quality audit checking, traceable products and having HACCP :2005, ISO22000:2014, GMP, SSOP, BRC like standards and certifications even processor did not hear about those quality requirements or regulations.

Figure 05: Processing practices of dry fish and Maldives fish production

Fish quantity, price and market margins were differ depending on fish availability, season, climate change, fish type, market demand etc. and mainly price is fluctuated with the imported dry fish Maldives fish prices. The quantity of fishermen handling is 10,000-20,000Kg and one processor normally buying 3000-6000Kg for dry fish and 3000-4000Kg for Maldives fish production. A collector handling 500-2000Kg of dry fish and 500-1000Kg at once and retailer or wholesalers are handling 500Kg – 1000Kg of dry fish and 300-500Kg of Maldives fish. In customer level normally, they are purchasing 250g -2Kg of dry fish depending on the need and income levels and 100g-500g of Maldives fish at once. The price was also highly differed along the value chains which resulting higher profit margin to intermediaries and retailer/wholesalers while producers have to bear huge cost and profit margins were fluctuated as Rs.200-300/=. The main expenses that they have to bear were labor cost Rs.2000/= per day, wood-Rs.10,000/= per load, Salt- 1000/= at once and transport cost 200/= at once. The quality issues also affected for this price fluctuation and low level of profit margins. As illustrated in the below Figure 06 and 07 each product has different price range, profit margins from upstream to downstream of

the both value chains and also its clearly showed the gender involvement and quantity of fish handling in each node as well.

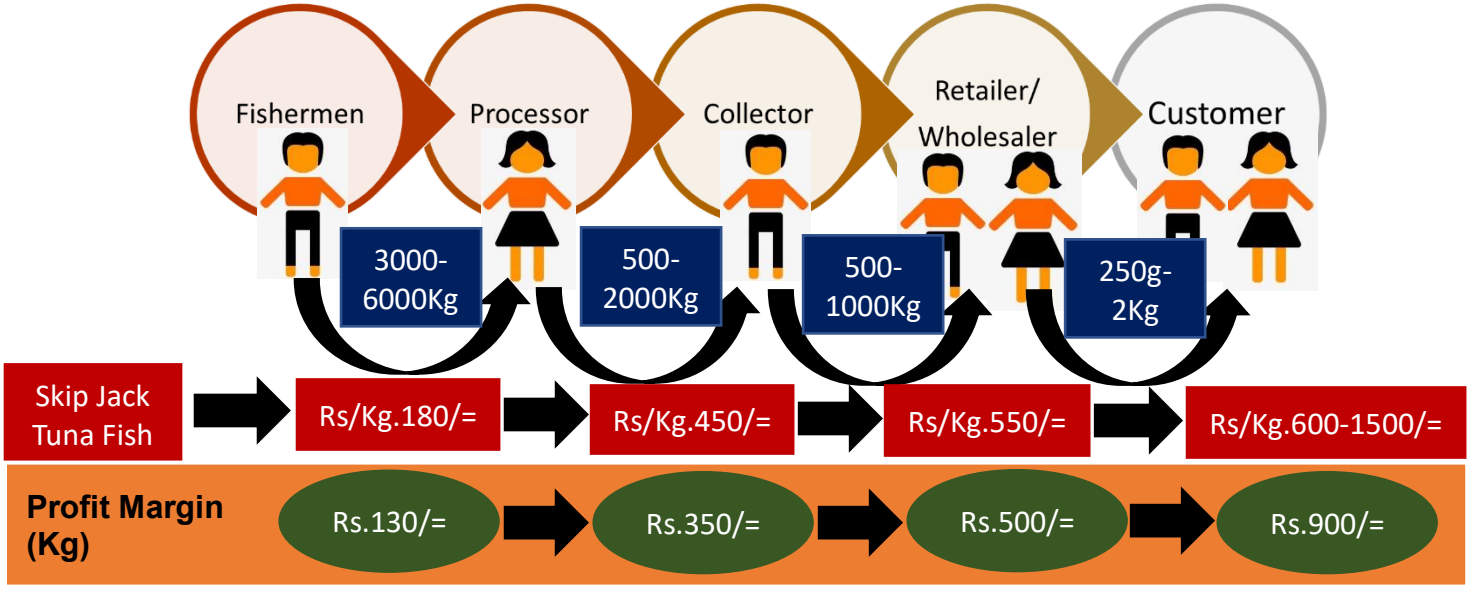


Figure06: Fish quantity, price and profit margin changes along the Dry Fish Value Chain

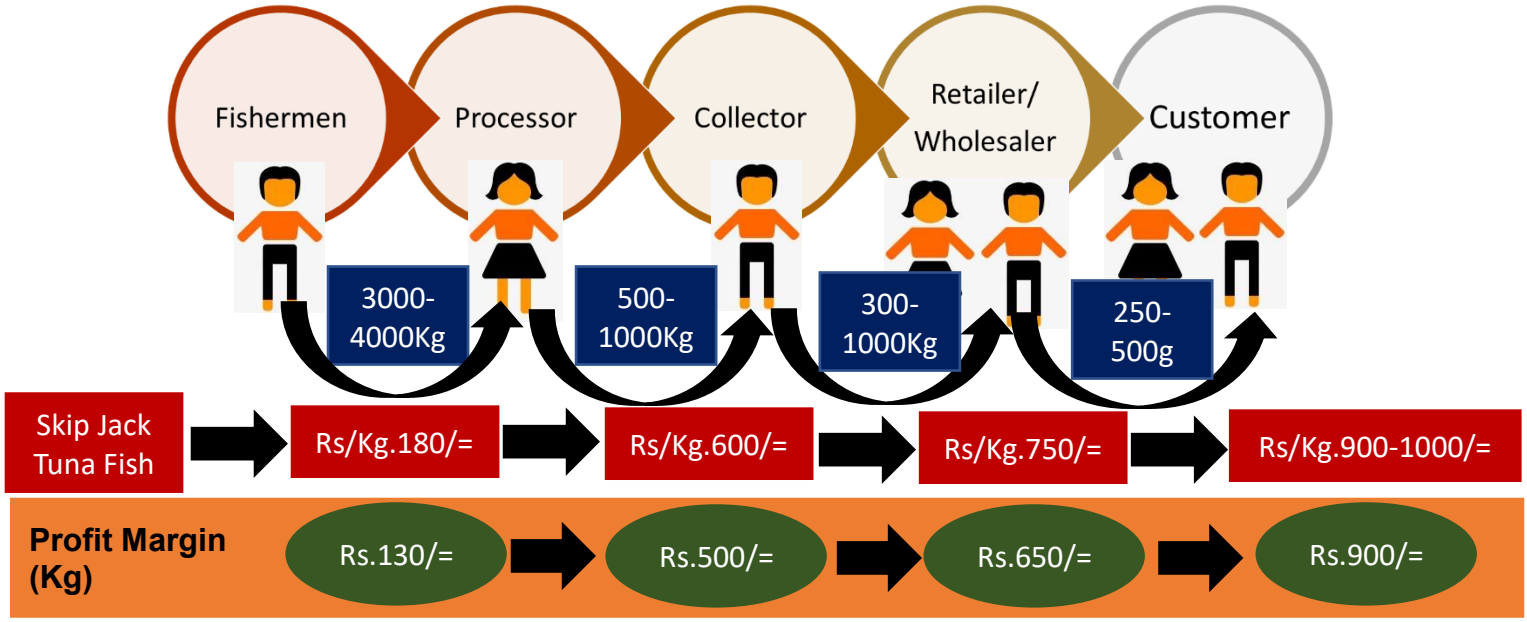


Figure07: Fish quantity, price and profit margin changes along the Maldives Fish Value Chain

The quantity and quality mainly diminished at fishermen and processor levels. This was mainly due to not having clean water source, ice boxes for proper storage, racks or shelves for drying. And also, unhygienic working environment and adulteration of toxic substances like mal practices also act as causes for reducing the safe and quality of products. Harbor water was the common water source for washing fish and this water highly contaminated with hazards, toxic compounds and which not suitable for consumption. Non-availability of racks for drying could

diminish the efficiency of drying and retention of higher moisture content ultimately reduce the quality of the product, its marketability and shelf life.

In collector and trader levels also can reduce the quantity and quality due to poor storage facilities, contaminated with unhygienic and hazards stuff and not following quality standards requirements. The higher profit margins and price levels also obtaining by them while producer and processor getting lower income. And improper marketing channels leads to unstable prices.

The time allocation of each value chains; need to spend nearly 2weeks to produce dry fish or Maldives fish (Figure 8). The time allocation for each processing step mainly depends on the adverse weather condition South- West Monsoon rainy period is very harder time for small scale processors for drying and keeping processed fish without any fungal growth. Therefore, above time allocation can be highly varied based on daily weather conditions the processing practices mainly govern by women while men playing their role in transporting, collecting and trading. Most of these women unaware about required quality standards and less consideration on safe produce.

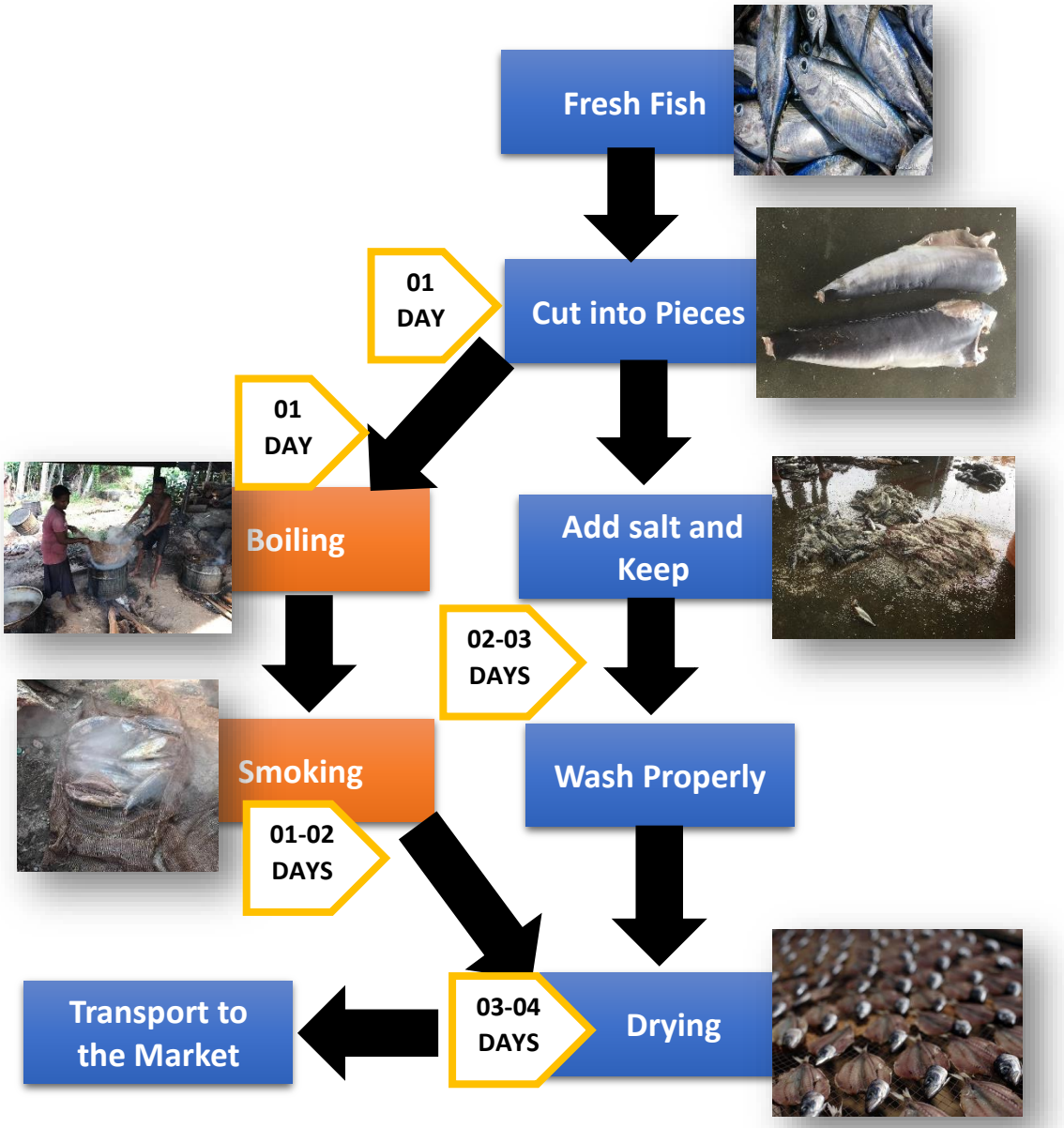


Figure 08: Time allocation of dry fish and Maldives fish processing

Conclusions

The study figured out that processing of dry fish and Maldives fish not affected to reduce the nutrition value of it but with the low-grade raw materials, contamination by, hazards, dust, and insect infestation and mal practices could be causes to reduce the nutrition value and food safety. With the uncertainty of the market and unstable price; product prices, profit/market margins were differed and intermediaries enjoying higher profit margins.

When gone through the both value chains from upstream to downstream; the quantity of fish handling, quality of final products, nutrition densities were diminished while profit/market margins and price levels were enhanced. Which resulting consumers have to pay higher price for unsafe products.

The processing practices were mainly done with more female participation while male is allocating more time as producer, collector, retailer/ wholesaler and exporter. The women processors are more economic concern and they are not paying much attention on quality raw materials, hygienic practices and this is same in collector, retailer/wholesaler level. However, at the exporter level due to high legislations; more concerning on safe food production and they are richer with HACCP, ISO, BRC like certifications.

Unavailability of proper/ hygienic environment, low level of awareness on quality standards and certifications, unhygienic processing practices were the key barriers in Sri Lankan dried and Maldives fish industry to reach its excellency and Therefore, finally can conclude that even fisheries sector supply country's protein demand by quantitatively; minimization of nutrition loss or sustaining the quality of final products throughout the value chain is not at optimum level.

Following key recommendations could be made to uplift the industry.

- Proper awareness program on safe and quality processing practice
- Provide adequate infrastructure facilities to enhance the efficiency and quality
- Introduce new technologies such as Artificial drying by modified solar dehydrators, oven drying to achieve a better-quality product
- Establish a proper policy frame work to effectively link all stakeholders to promote safe fish nutrient value chain
- Empower women for produce value added products (Bottled or packed products)
- Implementation of alternative market channels

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