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Impact of Compliance with Food Safety Measures in Fish Processing Units

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Abstract

Increasing consumer demand for greater food safety, particularly in developed countries has triggered the need for an integrated approach for ensuring food safety in the entire food production chain *viz.,* from farm to fork. This study estimates the cost of compliance with food safety measures in fish processing plants. The study is based on primary data collected from 14 fish processors cum exporters in West Bengal in the year 2011. West Bengal is one of the largest seafood exporters and contributes about 9% to the total seafood export from India. The study shows that status of compliance with food safety measures in Indian fish processing plants is satisfactory. Though the cost of compliance with food safety is high, it is beneficial to processor/ exporter in better price realization and acceptance of the products in international markets. The compliance with food safety measures can be further enhanced by easy and cheap availability of credit to processors and capacity building of all stakeholders in fish supply chain for their better adoption at lower level of supply chain to ensure safe raw material for the processing industries.

Keywords: Impact, compliance, food safety, fish and fish products, adoption

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Introduction

Consumers' greatest concern in modern times is the quality and safety of food they eat. To ensure the quality and safety of fish and fish products, it is important to adopt good hygienic practices in farming, harvesting and post-harvest handling of fish. Post-harvest handling of catch is the most important step in the production of high quality finished products (Devadasan, 2004). Food safety has also become one of the major concerns in international trade. Past studies have revealed that progressively stricter food safety requirements in major industrialized countries is one of the major challenges faced by exporters of fish and fish products in developing countries (Rahman, 2001; Musonda & Mbowe, 2001; Henson & Mitullah, 2004). Henson et al. (2005) reported that it is difficult to comply with food safety standards prescribed by developed countries as they are subject to change over time in response to emerging problems, advances in scientific knowledge, consumer concerns, political pressure etc. The cost of compliance with these food safety requirements can be high (Cato, 1998; Cato & Santos, 1998) and in some cases, prohibitive too. The resultant impact on the structure and size of fish processing industries may have significant economic and social consequences for developing countries like India. Exporters have faced numerous challenges in meeting these evolving food safety requirements in developed countries.

All these developments are expected to affect the fishery trade and well being of all the stakeholders involved in the supply chain of fish export. Therefore, there is a need to thoroughly investigate the impact of food safety measures on cost of compliance and profitability in export of fish and fish products. Knowledge about the level of adoption of food safety measures in fish processing industry will provide information regarding the status of food safety in domestic fish processing industry. Also, there is a need to identify the bottlenecks in adoption of food safety measures in fish processing so that corrective measures can be

taken to ensure food safety. With this background, the present study was attempted with the following specific objectives (a) to study the adoption of food safety measures by fish processing plants (b) to assess the impact of adoption of food safety measures on cost and profitability of fish processing plants and (c) to identify the constraints in adoption of food safety measures.

Materials and Methods

Primary data for the study was collected from processors using personal interview method with the help of pre-tested interview schedule specially designed for the study. Using stratified random sampling, a total of 14 fish processing plants (5 European Union (EU)-approved and 9 others) were selected randomly from a total of 42 processing/ exporting units (11 EU-approved and 31 other plants) available in West Bengal. Data was collected during November 2011 to February 2012.

Food safety adoption index was used to assess the adoption of food safety practices and food safety measures by identifying the recommended food safety practices and food safety measures through literature survey and consultation with subject experts. A total of 93 measures were identified as being practiced to ensure food safety of fish and fish products at fish processing plant level. These measures were related to the control of chemical and microbiological hazards. Food safety index for adoption of food safety practices was developed based on the weighted scores of different components of food safety measures. For the purpose of developing weighted scores, 93 practices being followed by fish processors were grouped under three categories *viz.,* receiving raw material (n=25), plant and personnel hygiene (n=37) and of water quality for washing and ice manufacturing (n=31). These three categories were assigned weights of 0.4, 0.25 and 0.35 respectively based on their relative importance in ensuring food safety in fish and fish products. These differential weights were arrived at in consultation with scientists working on these issues. The number of practices being followed in each category was multiplied by the respective weight and added up over all the categories to obtain a weighted score of adoption of food safety practices and food safety measures. For measuring food safety adoption index (I_j) of a processor, the index developed by Kumar et al. (2011) was modified and used as represented by following equation;

$$I_j = \Sigma\ w_j n_j$$

where,

w_j= Weight of the j^{th} hygienic category (j= 1 to 3) and

n_j= Number of practices related to the j^{th} hygienic category adopted by processor

After computing individual food safety scores, processors were divided into two groups, namely moderate adopters and high adopters based on their scores by taking 80 percentile scores as the cut off points. Thus, processors with a score below 80 percentile were classified as 'moderate adopter' and those scoring more than 80 were classified as 'high adopters'. The unit cost of compliance with food safety measures was estimated using partial budgeting technique, as per Shang (1990). The additional cost of compliance with food safety measures due to changes/supplementation in different measures was calculated based on data generated from the sample survey.

Results and Discussion

Out of the 14 surveyed plants, six were high adopters (Composite adoption index > 80%) while the remaining eight were moderate adopters of the food safety measures. The extent of adoption of hygienic/ food safety practices by sample fish processors was estimated and presented in Table 1. Perusal of the table revealed that the adoption of food safety measures was moderate to high at the processing plants as indicated by the overall food safety index of 74. Out of the total plants, only 43% were high adopters while 57% were moderate adopters. The composite food safety adoption index for food safety measures was high (93%) for high adopters and 60% for moderate adopters. The high adopters were mostly EU approved plants and others were in moderate adopter category. It is also vivid that adoption of all groups of food safety measures were very high (more than 92%) on high adopters while that in moderate adopter plants, was as low as 54% in case of receiving raw materials. The lower adoption index (AI) of food safety measures during receiving of raw material indicates poor inspection of raw material quality by sensory, microbial or chemical evaluation. The main problem faced by processors in adoption of food safety

measure at this level was poor quality of the raw material which might be mainly due to low level of awareness about food safety measures at the lower levels of supply chain (fishers/farmers/wholesale level). Mohan et al. (2003) also found gaps in the adoption of improved fish processing practices in Kerala which varied from 67.5% in the use of deodorants to 5.0% in use of glazing (before/after freezing the material) and use of quality assurance systems. However, Balasubramaniam et al. (2012) reported very high adoption indices for good hygienic practices (99.51%), good manufacturing practices (97.65%), standard sanitation operation procedures (99.08%) and good laboratory practices (96.33%) for fish processing plants in Cochin region, Kerala. Improvements in adoption might be due to organizing refresher training courses among processing workers and other awareness programmes (Balasubramaniam & Krishna, 2003).

Component-wise cost of adoption of food safety measures in processing plants of both high and moderate adopters were estimated and are presented in Table 2. It is evident from the table that total cost of adopting food safety measures in high adopter plants was higher (Rs. 4.09 kg^{-1}) than the moderate adopters plants (Rs. 2.82 kg^{-1}). This indicates that adoption of food safety measures is a costly affair. Similar finding was reported by Kumar et al. (2011) for dairy sector where compliance with food safety measures for ensuring quality and safe milk required additional expenditure.

High adopter plants were conducting various chemical tests for identification of algal toxins, heavy

Table 1. Food safety indices of food safety practices and measures

Adopter category	Processing plant (%)	AI* of food safety measures for receiving raw material (%)	AI of plant sanitation and personnel hygiene (%)	AI of water quality (%)	Composite AI (%)
Moderate adopter	57	54	63	64	60
High adopter	43	92	95	92	93
Overall	100	70	77	76	74

* AI -Adoption Index

Table 2. Costs of adoption of food safety practices and measures at processing plant

Cost category	Cost (Rs kg^{-1})	
	High Adopter	Moderate Adopter
Personnel hygiene	0.90	0.60
Different chemical tests outside the plant (water quality, heavy metals, histamine etc.)	0.62	0.37
Use of chemicals inside the plant	0.59	0.45
Laboratory maintenance (test of raw material, water etc. during different stages of processing)	0.32	0.19
Miscellaneous (up-gradation of old or establishment of new infrastructural facilities as per HACCP norms to make the plants compliant to food safety norms)	1.10	0.87
Personnel training	0.06	0.02
Expenditure on quality control personnel	0.50	0.32
Total cost	4.09	2.82

metals, histamine and antibiotics etc. of the raw material as per HACCP (Hazard Analysis at Critical Control Point) requirements during the entry of raw material and also during the various stages of production to ensure the quality of finished products. To monitor the quality, more numbers of employees were recruited by the plants. The average number of employee per ton capacity of the plant and quality control personnel was 7.5 and 2.66 respectively in high adopter plants and 6.25 and 1.67 in moderate adopter plants. High adopter plants were also emphasizing more on personnel hygiene by providing medical check-up at regular intervals and clean dress, gloves, gum boots etc. at work place. Sanitation and cleanliness is maintained inside and also the surroundings of the plants. Component wise analysis of cost of compliance at high adopter plants revealed that the cost of personnel hygiene was highest (Rs. 0.9 kg^{-1}) followed by different chemical tests done outside the plant (Rs. 0.62 kg^{-1}), use of chemical to maintain plant sanitation (Rs. 0.59 kg^{-1}) and expenditure on quality control personnel (Rs. 0.5 kg^{-1}). In case of moderate adopter plants, the cost of personnel hygiene was the highest (Rs. 0.6 kg^{-1}) followed by cost of chemical used inside the plant (Rs. 0.45 kg^{-1}) and cost of different chemical tests (Rs. 0.37 kg^{-1}). Miscellaneous cost is the major portion of cost of compliance in both the high and moderate adopter categories which consisted of upgradation of old infrastructural facilities or establishment of new ones as per HACCP norms to make the processing plants compliant to food safety norms. Henson et al. (2005), Bojan & Patrick (1998) and Hassan et al. (2012) also found that increased level of hygiene and sanitation in processing plants enhanced the cost of production considerably but it benefitted them to get more access to markets in developed countries and helped them in fetching better prices when compared to other moderate adopter plants as they do not have access to those markets.

The processors were hesitant to share information regarding species-wise and market-wise price and volume of products traded. However, they shared their perception about the benefit and losses due to adoption of food safety measures. The perception of processors regarding overall benefits of adoption of food safety measures have been compiled and presented in Fig. 1. Majority (93%) of the processors expressed that the adoption of food safety measures has helped them in producing safe products and also providing hygiene environment in production unit, as reported by 86% of the respondents. About 50% opined that the adoption of food safety measures had reduced product loss. Bai et al. (2007) observed that adoption of HACCP in food industry provided more access to new market and improved quality. Iyer (2003) reported that HACCP enhanced degrees of control at the level of food industry and promoted international trade by increasing buyer's confidence.

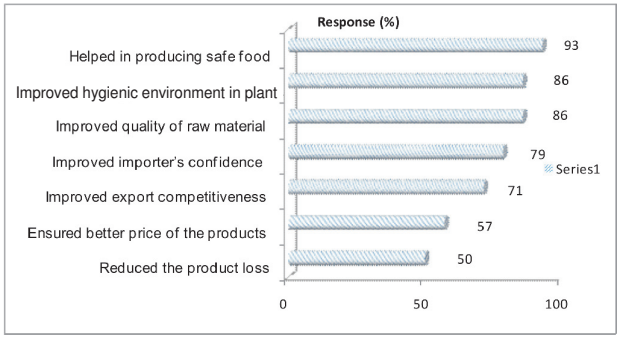

Fig. 1. Advantages of adoption of food safety measures

In addition to the advantages of adoption of food safety measures, there were some disadvantages too as reported by the processors. Seventy three per cent of processsor were of the view that non-qualified personnel cannot apply the food safety measures properly and hence required training/skill upgradation that added additional cost to the plants as reported by 65% of respondents (Fig. 2).

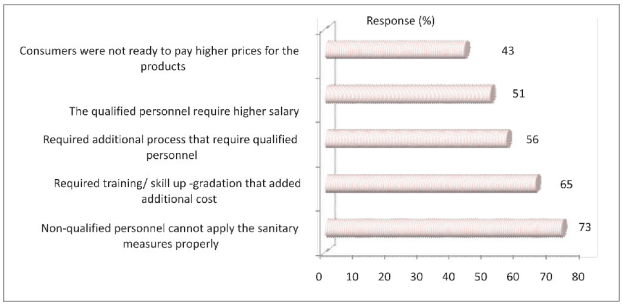

Fig. 2. Disadvantages of adoption of food safety measures

The most important constraint faced by the processors was the lack of good quality raw material as reported by 90% of the processors. This might be mainly due to lack of awareness about food safety measures at the lower level of supply chain. The second important problem was the ever increasing level of stringency of food safety measures in

international market, reported by 86% of processors. Other constraints in adopting food safety measures like lack of proper technical knowledge was reported by 80% of processors followed by high cost of compliances (77%), lack of adequate capital (75%) and lack of skilled labour (71%). Noor (1998) reported that lack of technical expertise; information and finance were the major constraints in implementing the food safety and sanitary and phytosanitary (SPS) measures while Jirathana (1998) and Mutlu et al. (2003) identified lack of training as the major constraint in applying HACCP in the processing firms.

The cost of compliances can be overcome by facilitating easy and subsidized credit. It is also necessary to make the processor aware about the fact that, cost involved in food safety measures is not an expense but an investment for their business and these expenses will pay off in the long run. Results of the study indicates that this is a method to produce safe and quality products which enhances competitiveness and demand of products in the global market.

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