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Adoption of Good Manufacturing Practices of Small and Medium Smoked Fish Enterprise (SMSFE) in Bicol Region, Philippines

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Abstract: **Adoption of Good Manufacturing Practices in of Small and Medium Smoked Fish Enterprise (SMSFE) is the key in producing safety food and quality product. Smoked fish is the most common cured fish sold in the market in Bicol. This study determines the extent of adoption of the good manufacturing practices of smoked fish operators. The study was conducted in twenty five (25) smoked fish operators in Bicol Region. Data were collected using structure interview schedules and observation methods on the general profile of SMSFE, availability of facilities, good manufacturing practices, good hygienic practices and problems encountered. The results revealed that majority of the smoked processors rated their facilities as "Partially adequate" meaning their equipment use still traditional. Most of the respondent had assessed their overall performance in manufacturing practices as "average or fair" hence the performance index is quite low. The general constraints experienced by the smoked processors are lack of capital, no available cold storage in the area, lack of proper training for workers, work load and time constraint. To ensure the safety of the consumers, it is important for the SMSFE to take corrective action to improve its GMP application status.**

Keyword: **Good Manufacturing, Hygienic Practices, Smoked Fish Bicol Region.**

I. INTRODUCTION

Good Manufacturing Practices is a guideline for food production that aims to make food producers meet the requirements that have been determined to produce quality food products and safely consumed according to the demands of consumers. Good Manufacturing Practices must be applied by the industry that produces food products as a preventive effort so that the food that is ready to consume is safe, decent, and quality y(Anggraini T. and Yudhastuti R., 2014) [1].

The existence of Micro, Small and Medium Enterprises (MSME) has a positive impact on the society's economy because MSMEs can grow and develop everywhere, from cities to villages. The increase of MSME can directly absorb labor so as to reducing unemployment rate; as the result, it will increase the economy of society. However, there is the fundamental problem often faced by MSME, such as there is limited capital support, have no skilled labor and have low standardized product (Latif,R., etal., 2017) [2]. In the Philippines, the problem face by Small and Medium Smoked Fish Enterprise (SMSFE) lack of information background on the international Code of Practice for fish and other fishery products, the science and technology of processing smoked fish and the production cost which in turn their finish were not qualified for export because the product is not suited to the required quality standard of FDA.

Smoked Fish Processing is one of the major economic activities in Bicol Region, Philippines. Smoked fish is one of the oldest of all processed fish products, continues to increase in popularity. Traditional smoked fish in Bicol includes milkfish, mackerel, round scad, anchovies and sardines fishes. Smoking method mostly imparts a desirable flavour and inhibit the growth of microbe (Swastawatia F., etal.,)[3]. The fish smoking process in Bicol Region, Philippines the fish

were soaked in saturated brine solution and precooked before smoking, other processors yellow food color is applied in the finish smoked products to enhance the color of the smoked. Conventional smoking is generally-hot-smoking which cooks and in part dries the fish and in addition conferring a smoky flavour. The open nature of numerous conventional fire pits implies that smoke densities and temperatures are roughly controlled by managing the fire itself, and the process requires a high level of supervision by an experienced administrator (FAO, 1990[4]. Fish smoking in Bicol is processed using conventional techniques, so processed products are moderately few with a shorter shelf-life and just marketed locally. Therefore it is of prime significance to encourage upgrading the SMSFE and to expand the interest in this sector, and to make utilization of stored fish monetarily through technique of preservation and processing and handling of fish (Sulieman A.E. and Mustafa W A., 2012) [5]. Therefore, it important for SMSFE to implement GMP in producing smoked fish. As stern quality norms are being enforced by various agencies in seafood trade, the adoption of good manufacturing practices has to be monitored and the innovation- diffusion efforts have to be strengthened to improve the extent of adoption. Further, identification of problem areas and suitable interventions are essential to motivate the people involved. This would improve the quality and thereby ensure better prices for their commodity, which will also ensure safety of fish consumers and job employment in Bicol. Hence, the present study was conducted provide information regarding the profile and the extent of adoption of SMSFE in Bicol Region

II. METHODOLOGY

The study was conducted among the SMSFE in Bicol Region from the list of 28 registered smoked fish processors. Only 25 operators involve in this study. These SMSFE were interviewed and surveyed on their Good Manufacturing Practices followed in the fish processing plants. Adequacy index for the availability of infrastructural facilities was calculated on a 5 likert-point rating scale viz., very adequate, adequate, partially adequate, not adequate and absent with the scoring pattern of 5,4,3,2 and 1 respectively.

The questionnaire was prepared based from the Philippine National Standard (PNS/FDA:2010) adoption index was calculated for each variable such as Good Manufacturing Practices (GMP), Good Hygienic Practices (GHP)and Standard Sanitation Operation Procedures (SSOP) by likert-point using a 5 scale such as; always adopted (excellent), often adopted(very good), sometimes adopted (good), rarely adopted (fair) and never adopted (poor), with the scoring pattern of 5,4,3,2 and1 respectively[6]. For measuring the adoption of selected practices listed in the schedule. Each index was calculated as the ratio of actual score obtained to the maximum score possible and expressed in percentage and weighted mean for each respondent (Balasubramaniam & Perumal, 1990; Balasubramaniam et al., 1998; 2000) [7,8]. The problems encountered was calculated using 5 likert-point scale such as: serious problem, major problem, neutral, minor problem and not a problem with scoring pattern of 5,4,3,2, and 1 respectively. The questionnaires were dry run to fish drying operators in the locality to validate the questionnaire and was revised.

The data collected from the respondent using structured interview and observation methods. The data was analysed using various statistical tools such as: percentage and weighted mean. The software used for the analysis was Statistical Package for Social Sciences (SPSS version 21).

III. RESULTS AND FINDINGS

General Profile of Small and Medium Smoked Fish Enterprise (SMSFE)

Many SMSFE in Bicol Region, Philippines find difficulty to implement quality assurance systems due to economic and technical constraints. SMFE Supply the whole region the smoked fish product. However, it was observed that the storage life of their products is less than a week. Smoked fish products represent a significantly large part of total fish utilization and are a major source of animal protein. Hence, smoked fish products are important to food security, especially considering that the Bicolanos population consume most of these products. In view of the importance of these products Partido State University tried to find the enterprise profile and the extent of adoption standard Good manufacturing practices to assure quality and safety of these products. Therefore, to help the SMSFE in Bicol Region, Philippines meet food safety and quality assurance requirement, first it is necessary to assess the enterprise whether they are adopting the recommended standard of GMP set by Philippine National Standard (PNS/FDA:2010). The General profile of SMSFE shown in Figure 1, 2,3 and 4.

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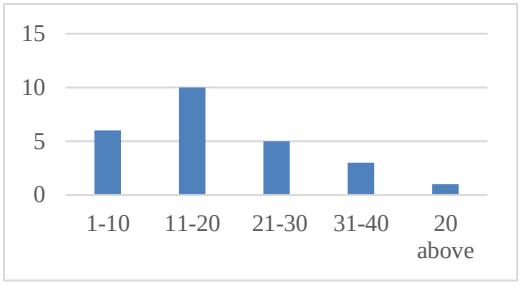

FIGURE 1. Number of Worker

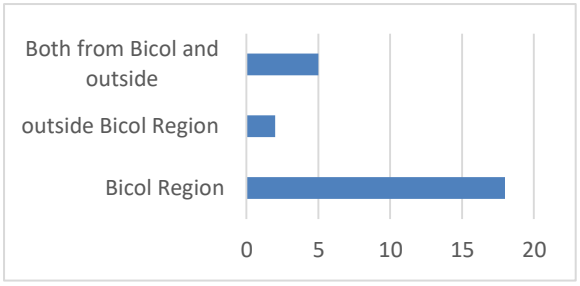

FIGURE 2. Sources of Raw

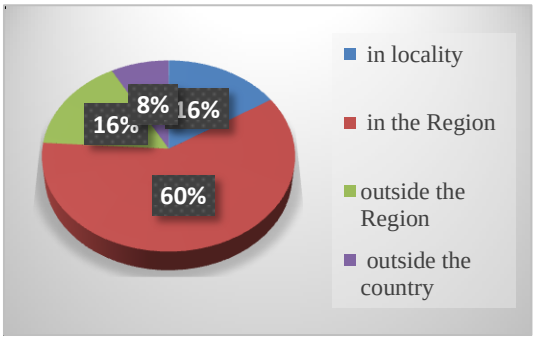

Figure 3. Market Outlet of the Product

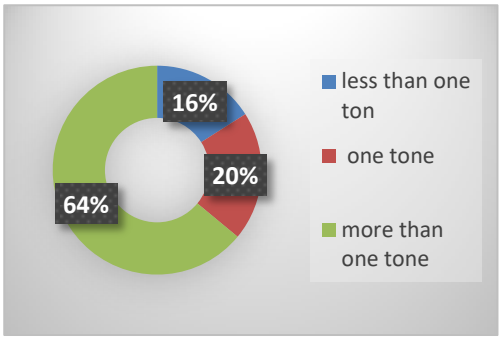

Figure 4. Estimated Annual Production

The smoked production operates in two shifts per day with the range of 11-20 (40%) workers. The working days of operation are based from the availability of raw material materials. In order to have continues supply of raw material majority of smoked processors source out raw materials not only in Bicol region but also outside the region (Figure 1 & 2). Similarly, Struan Noble, Marta Moran Quintana and Hazel Curtis (2016) [9] reported that 5% of total industry employment was part-time and 5% were seasonal positions and average seasonal staff employment was 14 people which accounted for 28% of the total average number of employees for an average duration of 17 weeks. This study and previous studies implied that employment of a certain enterprise is dependent on the seasonality of the raw material. On the other hand, 18 or 72% of SMSFE sold their product within the region, only two or (8%) exported their product. It was also observed that 100% of the operators were engaged in processing only 'marine raw materials' such as, round scad, mackerel, sardines fish and anchovies. Majority (64%) of the processors estimated the annual production to more than one ton. (Figure 3, & 4).

Adequacy of Infrastructural Facilities

The high perishability of fish demands that it is handled properly immediately after catching and until it is preserved for human consumption. The traditional technologies available for fish processing contribute to the reduction of postharvest losses (S. Sefa-Dedeh, 2003) [10]. Accordingly, optimal combinations of both hygienic handling practices and refrigeration are key parameters to be considered with a view to guaranteeing seafood safety and wholesomeness. In this sense, in order to preserve the greatest proportion of a fish catch in an acceptable manner several on-board handling systems, such as storage in conventional ice, flake-ice, slurry ice, "slush" ice, chilled sea water (CSW), refrigerated seawater (RSW), in combination with the addition of chemicals, have been proposed. Such chilling methods have traditionally made it possible to slow down both microbial degradation mechanisms and the autolytic breakdown pathways in aquatic food products (Ranken, M.D.; Kill, R.C.; Baker, C., 1997; Piñeiroa, C.; Barros-Velázquez, B.; Aubourg, S.P. ,2004)[11,12]. Maintaining the freshness is very difficult without storage facilities and available technologies. Smoking is an important operation used to give the combined effects of preservation, drying, and cooking to fish. Different smoking ovens are used. Hence, there is a need fish smoking industry to use hygienic design of fish processing equipment. Table 1 showed adequacy of infrastructural facilities in the smoked processing area of SMSFE.

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TABLE 1. Adequacy of Infrastructural Facilities in the Smoked Processing Area

Infrastructural Facilities	Adequacy index (WM)	Descriptive Analysis
Availability of Potable Water	2.7	Partially adequate
Water Treatment Facilities	1.2	Absent
Effluent Treatment Facilities	2.0	Not Adequate
Drainage Facilities	1.9	Not Adequate
Toilet Facilities	2.4	Partially adequate
Waste Disposal Facilities	2.2	Partially adequate
Equipment and Machineries	1.5	Not Adequate
Laboratory Equipment Facilities	0.7	Absent
Rest/ Dining Room for the Workers	2.0	Not Adequate
Fly Proof Netting	1.0	Absent
Cold Storage Facilities	0.7	Absent
Receiving and Processing Area	2.2	Not Adequate
Storage Facilities	1.7	Partially adequate
Overall Adequacy of Facilities	1.7	Partially adequate

WM Weighted Mean

The data on adequacy of infrastructural facilities available in smoked processing are given in Table 2. From the table, it could be inferred that water treatment, laboratory equipment, fly roof netting and cold storage facilities are absent in smoked fish processing plant. On the other hand, the respondent rated the partially adequate the toilet, waste disposal, storage facilities with of 2.4, 2.2 and 1.7 respectively. Furthermore, the effluent treatments, drainage, rest/dining room for workers, receiving and processing facilities are available but not adequate. These results indicate that there is the need to support the SMSFE in the improvement of the facilities for the assurance that the smoked product is safe to consume. S. Vidaček, E. Bugge, (2016) [13] recommends that Fish processing equipment has been much improved since 2000 in terms of the hygienic design. As the hygienic challenges in fish processing are complex, it is important to have a good collaboration and a clear agreement between the supplier (equipment manufacturer) and the purchaser (fish industry). This should include not only the purchase-agreement, but adequate follow-up and commissioning after installation. A multidisciplinary team in the fish industry should be set up early in the procurement process to specify the equipment. It is important to consider and specify all the aspects that affect hygienic design and how easy the equipment is to clean and sanitize. Hygienic design principles must be used as a basis during evaluation of the equipment with regard to hygiene and cleaning. The specification of the equipment (by drawings and diagrams) should include installation procedures and include a review of all the possible cross-contamination routes. Dismantling and sampling should be carried out a few months after commissioning to check that there are no hygiene traps in the equipment. This should be done in collaboration with the equipment supplier.

Adoption of Good Manufacturing Practices (GMP)

GMP can cover every aspect of food production, employee/personnel hygiene and training, plant and equipment/utensils design and specifications, cleaning and sanitation, and even warehousing and distribution of the finished products. [14]. Mendis, E. and Rajapakse, N. (2009) [15] stated that Pathogenic microorganisms are a major safety concern for the food industry. The vast majority of outbreaks of food-related illness are due to pathogenic microorganisms, rather than to chemical or physical contaminants. As they are generally undetectable by the unaided human senses and they are capable of rapid growth under favourable storage conditions, much time and effort are spent in controlling and/or eliminating them. Food spoilage microorganisms are microorganisms upon growth in a food, produce undesirable flavour, odor, texture and appearance, and make food unsuitable for human consumption. Table 2 presented the extent of the adoption GMP of SMSFE in Bicol Region Philippines.

TABLE 2. Extent Adoption of Good Manufacturing Practices

Manufacturing Practices	Adequacy index (WM)	Descriptive Analysis
The raw material (fish) used are freshly caught , chilled and frozen	4.2	Often adopted/good
Iodized salt is used	1.1	Never Adopted/ Poor
Potable water is used in entire smoked processing	4.1	Often Adopted/ Very Good

Suitable smoking material is used	3.4	Sometimes adopted/good
Fresh fish are thoroughly washed , eviscerated and gutted immediately after catching	2.7	Sometimes adopted/good
Right amount are determined using salinometer	1.5	Rarely Adopted/fair
The brine are reused only in one day operation	1.0	Never Adopted/ Poor
The fish are rinse after brining	4.2	Often adopted/good
The fish are cooked in right amount of brine	2.0	Rarely Adopted/fair
Cooking brine are re-used only for one day operation	1.3	Never Adopted/ Poor
Cooked fish are rinse with potable water	2.4	Rarely Adopted/fair
Cooked fish are surface dried under the heat the of the sun and free from contamination flies and rodent	1.4	Never Adopted/ Poor
Cooked fish are surface dried using suitable mechanical drying	1.0	Never Adopted/ Poor
Fish are smoked in a suitable mechanical smoked house	4.2	Often adopted/good
Smoking time and temperature are controlled both for cold smoked and hot smoked using thermometer	1.0	Never Adopted/ Poor
Smoked fish are thoroughly cooled before packing	3.1	Sometimes adopted/good
Appropriate packaging material is used (Polyethylene plastic)	1.0	Never Adopted/ Poor
Smoked fish are vacuum packed	1.0	Never Adopted/ Poor
Package are properly labelled with complete information	1.0	Never Adopted/ Poor
Overall Adoption Index	2.2	Rarely Adopted/fair

The results shows that the Adoption index was very good for potable water used in the entire smoked processing and extremely good for all the five practices such as the raw material (fish) used are freshly caught, chilled and frozen (4.2); the fish are rinse after brining (4.2); suitable smoking material is used (3.4); Fresh fish are thoroughly washed, eviscerated and gutted immediately after catching (2.7), Fish are smoked in a suitable mechanical smoked house (4.2); and Smoked fish are thoroughly cooled before packing (3.1). On the other hand, iodized is not used for processing, brined used for soaking and cooking are used not only once day but several days, cooked fish were not dried using mechanical drier and those that were dried under the heat sun were not free from contamination of pest and rodent and smoked product were not hygienically packed. Generally, the overall adoption index of Good Manufacturing Practices (GMP) for smoked fish was fairly adopted with the rating of 2.2 or rarely adopted. These findings indicate that the shelf life of the product is very short. Based from the interview that the product just good to consume for 3 to 7 seven days. This study has shown that the implementation of GMP in processing smoked fish is very important in order to produce good quality of smoked fish products, guaranteed safety and fulfilled consumer expectations. Thus, in the future, the stages of the corrective actions of existing deviations are the most important action in the processing activity (Costa Dias M A , etal., 2012; Abou-El-Enein M, etal., 2013; Godinho Filho M , etal. 2017) [16,17,18]. The results of this study provide some managerial implications that is improvements toward critical deviations (Badan Pengawasan, Obat dan Makanan, 2012) [19]. Moreover, is very important that food sold in the market are safe, wholesome and properly labelled. FDA requires that food labelling is required for most prepared foods, such as breads, cereals, canned and frozen foods, snacks, desserts, drinks, etc. [20].

Adoption of Good Hygienic Practices

TABLE 3. Extent of Adoption of Good Hygienic Practices

Hygienic Practices	Adequacy index (WM)	Descriptive Analysis
Use of uniform, apron, cap and shoes by workers	2.2	Rarely adopted/fair
Cleaning of hands and feet	3.7	Often adopted/very good
Use of soap/ germicide for cleaning hands and feet while entering in processing area	1.9	Rarely adopted/fair
Periodical medical check-ups for the workers	1.4	Never Adopted/Poor
Periodical training of technologists/ workers on quality control and food safety aspects	1.8	Rarely adopted/fair
Suitable and clean place for processing	2.3	Rarely adopted/fair
Use of stainless steel tables for processing	1.3	Never Adopted/ Poor
Use of adequate potable water for washing	4.5	Always Adopted/very good
Use of adequate quantity of soaps and detergents	2.5	Sometimes Adopted/good

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Use of chlorinated water for washing	1.3	Never Adopted/Poor
Use of recommended cleaning schedule	1.2	Never Adopted/Poor
Maintaining a high degree of personal cleanliness	2.0	Rarely adopted/fair
Handling of ice hygienically to avoid bacterial contamination	2.5	Sometimes Adopted/good
Use of adequate rodent control measures	2.0	Rarely adopted/fair
Overall Adoption	2.2	Rarely adopted/fair

The extent of adoption of good hygienic practices indicated that the overall 'Adoption Index' was fair with weighted mean of 2.2 (Table 4). As shown in the Table above the extent of adoption for the use of adequate potable water for washing and cleaning and feet is often adopted or very good. The results also shows that the smoked processing plant the workers has no periodic medical check-ups, the tables use is not stainless for the workers. Furthermore, the five hygienic practices was rated poor or never adopted such as: periodical medical check-ups for the workers (1.4); the use of stainless steel tables for processing (1.3); the use of chlorinated water for washing (1.3) and the use of recommended cleaning schedule(1.2). Handling of ice hygienically to avoid bacterial contamination and the use of adequate quantity of soaps and detergents was sometime adopted. Mostly, the smoked fish processor/worker was fairly or rarely adopted the Good Hygienic Practices (GHP). This finding specified that both employer and employees needs to undergo training on (GHP). This result is in contrast with the finding Balasubramaniam, Jeev a and Ashaletha, (2012) [21] in their research study on the Adoption of Quality Management Practices in Seafood Processing Sector, they reported that the scores on the extent of adoption of good hygienic practices indicated that the overall 'Adoption Index' was 99.51. Hence, refresher training program for the smoked fish processing worker is recommended.

Adoption of Standard Sanitation Operation Procedures

Table 4. Adoption of Standard Sanitation Operation Procedures by Women Smoked Fish Processors

Standard Sanitation Operation Procedures	Adequacy index (WM)	Descriptive Analysis
Safety of water that used in smoked processing and cleaning processing plant	4.2	Often adopted/very good
Condition and cleanliness fish contact surfaces, including utensils, gloves and outer garments	2.1	Rarely Adopted/Fair
Prevention of cross contamination	1.6	Rarely Adopted/Fair
Maintenance of hand washing, sanitizing and toilet facilities	2.3	Rarely Adopted/Fair
Proper labelling, storage and use of toxic compounds	1.4	Never Adopted
Control of employee health conditions that could result in the microbiological contamination	2.4	Rarely Adopted/Fair
Exclusion of pests from the food plant	2.4	Rarely Adopted/Fair
Overall Adoption Index	2.3	Rarely Adopted/Fair

The Table 4 shows the adoption index of Standard Sanitation Operation Procedures (SSOP). The results shows that SSOP was fairly adopted or rarely adopted by the smoked fish processors/workers for 5 indicators like: Condition and cleanliness fish contact surfaces, including utensils, gloves and outer garments (1.6); maintenance of hand washing, sanitizing and toilet facilities (2.3) on and cleanliness fish contact surfaces, including utensils, gloves and outer garments (2.1); control of employee health conditions that could result in the microbiological contamination (2.4) and exclusion of pests from the food plant (2.4). However, during processing and cleaning safe water or potable was used. Generally, the adoption index on SSOP was fairly adopted. These results indicate that proper orientation and training for smoked fish processor is necessary. Correspondingly, Joy L. Frestedt, (2017) cited that FDA issued a warning letter to US fish processing plant for a serious violations of seafood HACCP (21CFR123) and cGMP regulations (21CFR110)., one of FDA finding was the company failed to document sanitation control activities (monitoring and corrections) related to water safety for contact with food and/or food contacting surfaces, including water used in ice production and cleaning activities per 21CFR123.11 (b) and (c). Cross-contamination from insanitary items, hand washing, and sanitizing and cleanliness of toilet facilities were not monitored [22]. In relation to requirement of production employees according to Latif,R., etal., (2017) [2] that they should wear work clothes, gloves, masks, and work shoes. Employees should also wash their hands with hand soap after work and in particular after going to the toilet. Employee habits such as eating and drinking at work, smoking, spitting, sneezing in front of the food and using jewellery must be prohibited since these habits may contaminate the processed food products. According to Pupitas and Monika (2016) [23] employees should wear standard clothing for a food industry, namely head, mouth and nose, and gloves covers.

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Problems Encountered

TABLE 5. Problems Encountered by SMSFE

Problem Encountered of women Smoked Fish Processors	Problem Index (WM)	Descriptive Analysis
Lack Equipment and Machineries	4.2	Major Problem
Lack of Support from the Government	2.6	Neutral
Lack of Capital	4.5	Serious Problem
Lack of Training, workload and time	3.9	Major Problem
Lack of Training for Bookkeeping	4.4	Major Problem
Lack of Laborers	1.7	Minor Problem
Lack of Market	2.3	Minor Problem
Lack of Raw Materials	4.3	Major Problem
Lack of cold storage in area	4.6	Serious problem
Work load and time	4.5	Serious problem

The general constraints encounters by smoked fish processors in Bicol region was lack of capital, lack of cold storage in the area and work load and time. Lack of training for bookkeeping (4.4); lack of raw materials (4.3 lack equipment and machineries (4.2); lack of training workload and time (3.9) were rated major problem. On the other hand laborer and market of the product is not a problem. To achieve the availability of safe smoked fish products and to ensure the safety of the consumers, it is of utmost importance to adopt good manufacturing practices in smoking fish. Similarly, based on the Bureau of Fisheries and Aquatic Resources (BFAR) Fisheries Profile 2007, smoked fish has a very low Free on Board (FOB) value compared to other fishery exports. This could be attributed to the fact that many small and medium-size fish smoking plants in the Philippines find it difficult to implement GMP due to their economic and technical constraints [14].

IV. CONCLUSIONS AND RECOMMENDATION

The Good Manufacturing Practices (GMP), Good Hygienic Practices (GHP) and Standard Sanitation Operation Procedures (SSOP) were fairly or rarely adopted by the smoked fish operators in smoking the fish. This may be due to the fact that smoked fish processors are lack of capital, equipment, machineries, lack of trainings for GMP and bookkeeping and work load and time. Furthermore, the results of the study revealed the general profile of SMSFE and the extent of adoption of various quality manufacturing practices. The findings of the present study would also be helpful in planning and implementing suitable extension programs to promote the quality control variables in the manufacturing the smoked fish[21]. Production of smoked fish products demands smoked products that are clean, wholesome and fit for human consumption. No amount of cooking or processing that can restore the wholesomeness of fish products. Likewise potential foodborne pathogens may be present in the environment that can cause food hazards. So, therefore, it is the operator's obligation to take all precautionary measures. The SMSFE should ensures that only wholesome fish products that are not decomposed be used in smoked processing, good hygienic practices good hygienic practices should be adopted.

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