Efforts to Control Work Environment Hazards Based on 5S Principles for Smoked Fish Workers

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Abstract. Workstation design can be a potential hazard for workers. A workstation that is arranged following the 5S principles will prevent the exposure of potential work environment hazards such as improper work position that can affect the health of the workers. This research aimed to describe the condition of work station and create a new design a workstation according to 5S principles. This research was quantitative research with cross sectional approach. Samples were taken purposively from 141 smoked fish workers The data on the respondents' characteristics and potential hazards were analyzed using descriptive analysis. The data were collected using a checklist and a questionnaire**.** Only several parts of the 5S principles had been applied in the smoked fish workstation. The workstation at the smoked fish production site was not in accordance with 5S principles. The work station has poor hygiene and sanitation condition. New design workstations based on 5S principles with low-cost intervention are proposed to increase the health condition of the workers.

1 Background

The growing economy in developing countries cannot be separated from the major role of informal sectors. However, it seems contradictive with the work condition of the informal sector such as the substandard working condition that brings health issues to the workers [1, 2]. Indigenous ingredients, traditional processes, and unavailable organizational structures in enterprises make smoked fish production part of the informal sector. The smoked fish workers are the informal sector workers who have a high risk at the workplace such as hand and finger injury from sharp cutting tools, fire incidents from fish smoking processing, and musculoskeletal disorder as a result of improper manual handling and poor workstation layout. Moreover, people who involve in the informal sector lack hygiene sanitation awareness and unergonomic work tools [3, 4]. Activities in the smoked fish industry are routine and repetitive activities. In addition, workstation design can be a potential hazard for workers. Some workers complained of musculoskeletal pain symptoms at work. Work tools and working positions that are not ergonomic tend to make an awkward work posture and are not suitable for the principles of health and safety at work [1]. Workstations that are arranged in accordance with the Sorting, Setting in Order, Shine, Standardizing, and Sustaining (5S) principles can be a solution to prevent the exposure of potential work environment hazards to workers. 5S principles is from Japanese Work Principles widely used in industries, even

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for small and medium enterprises [4]. 5S principles are originally from Japanese Work Culture which stands for *Seiri, Seiton, Seiso, Seikatsu,* and *Shitsuke*. In English, they can be translated into Sorting, Setting in Order, Shine, Standardizing, and Sustaining [5]. These principles are already well known to boost the efficiency and productivity of workers in many areas [6]. Sorting can be described as activities of classifying and separating items that are needed and removing items that are not necessary for the workstation. After sorting, setting in order can include labeling items, placing similar tools together, and using the rack for tools in the workstation. Shine means daily cleaning of the workstation which creates a neat and pleasant ambiance in the workstation. Moreover, those first three principles are beneficial as prevention from incidents that can happen to the workers. The fourth principle is standardizing that can be done by making sure that each worker knows their job description and responsibilities to keep workstation clean and tidy. Therefore, eventually those principles build standard of the way the work should be done. Last but not least is Sustaining which can be a harder challenge since all the members of enterprises need to make sure that principles of Sorting, Setting in Order, Shine, and Standardizing are conducted continually and become a habit for all who involves in the workplace [6]. This research aimed to describe efforts to control work environment hazards and provide an alternative to reduce potential health hazards of smoked fish workers by designing a workstation according to the 5S principles.

2 Methods

This research was quantitative research with cross sectional approach. Samples were taken purposively from 141 smoked fish workers The variables were respondent characteristics, 5S and workstation arrangement. The data about the implementation of 5S was asked using interviews guidelines for an in-depth interview and checklists, while respondents characteristics were collected using a questionnaire. The Health Research Ethics Committee, Public Health Faculty, Diponegoro University, conducted and approved the ethical clearance of this research with registration number 200/EA/KEPK-FKM/2020.

3 Results and Discussions

Table 1. Respondents' Characteristics of Smoked Fish Workers

No	Variable	Frequency	%
1	Age		
	a. < 30 years	25	17.7
	b. ≥ 30 years	116	82.3
2.	Length of work		
	a. < 3 years	48	34
	b. ≥ 3 years	93	66
3.	Gender		
	a. Male	84	59.6
	b. Female	57	40.4

The study found that the workplace was very muddy and lack of hygiene and sanitation. Although there have been ventilations, there is still a lot of smoke at the workstation. The use of stools tends to be an awkward work posture for workers even though the workers spend

most of their time sitting while doing their job. The characteristic of respondents can be seen in the table 1.

It can be seen from table 1 that most workers are older or equal to 30 years old (82.3%). The majority of them have already worked in the smoked fish informal sector for more than or equal to 3 years (66%), and most of them are men (59.6%).

5S principles are originally from Japanese Work Culture which stands for Seiri, Seiton, Seiso, Seikatsu, and Shitsuke. In English, they can be translated into Sorting, Setting in Order, Shine, Standardizing, and Sustaining [5]. 5S Principles in the smoked fish workplace can be explained in Table 3:

Table 2. Sorting Principle in The Smoked Fish Workstation

No	Description	Frequency (%)	
		Yes	No
1	Separate fish washing place	99.3	0.7
2	Separate fish immersion area	99.3	0.7
3	Separate place for smoking the fish	100.0	-
4	Storage of smoked fish separately	89.4	10.6
5	Separate storage of raw materials	26.2	73.8
6	Separate tool storage	26.2	73.8
7	Separate smoked waste bin	63.1	36.9
8	The waste container is tightly closed	28.4	71.6

Table 2 shows that only separating places for smoking the fish activity conducted completely by the workers, and they dominantly have separated fish washing place and fish immersion area. As much as 73.8% of respondents do not have their storage for raw materials and fish-smoking equipment. However, more than half of the respondents showed that the waste container was not tightly closed (28.4%).

Table 3 shows that 91.5% of the respondents had a waterway, and 66.7% did not have a clean fish handling room.

Table 3. Setting in Order Principle in Smoked Fish Workstation

No	Description	Frequency (%)	
		Yes	No
1	Workstations are arranged sequentially	56.0	44.0
2	There is waterway	91.5	8.5
3	There is a clean fish handling room	33.3	66.7

Table 4. Shine Principle in Smoked Fish Workstation

No	Description	Frequency (%)	
		Yes	No
1	Work with apron	12.1	97.9
2	Work with a head covering	46.8	53.2
3	Work in gloves	14.2	85.8
4	Work using booth shoes	8.5	91.5
5	Work with jewelry	15.6	83.7
6	The dirty appliance separately	23.4	76.6
7	Workers wash hands before work	91.5	8.5
8	Workers wash hands after work	92.2	7.8
9	Workers wear special clothes	44.0	56.0
10	These special clothes are washed regularly	0.0	100.0

Table 4 shows that 97.9% of the respondents did not use an apron while working. As much as 91.5% did not use boots and 85.8% did not use gloves while working, and 76,6% of the dirty tools used were mixed with clean tools. Additionally, 44% of respondents wore special work clothes, but no one washed them regularly.

Table 5. Standardizing in Smoked Fish Workstation

No	Description	Frequency (%)	
		Yes	No
1	Raw material storage container in clean condition	56.1	43.9
2	Closed raw material storage containers	48.2	51.8
3	There is a waste bin in the fish smoking area	50.4	49.6
4	The tool is made of anti-rust material	74.1	25.9
5	Tools made of materials that absorb water	84.9	15.1
6	The tool is made of materials that are easy to clean	83.5	16.5
7	There is a storage area for PPE	7.9	92.1

Table 5 shows that 51.8% of the respondents had an open storage area for raw materials, and 50.4% of the area had waste bins. Then, 92.1% of the respondents had no storage for Personal Protective Equipment.

Table 6. Sustaining in Smoked Fish Workstation

No	Description	Frequency (%)	
		Yes	No
1	Workers always keep the workplace clean	65.5	34.5
2	Workers maintain a safe work environment	75.5	24.5
3	Comply with workplace regulations	56.2	33.8

Table 6 shows that 34.5% of the respondents rarely kept the work environment clean although most workers said that they maintained a safe work environment (75.5%). The workstation in the smoked fish center was not neat and clean based on 5S principles. Therefore, the workstation should be restructured according to 5S principles. Figure 1 shows a Flow Diagram of the Smoked Fish Processing

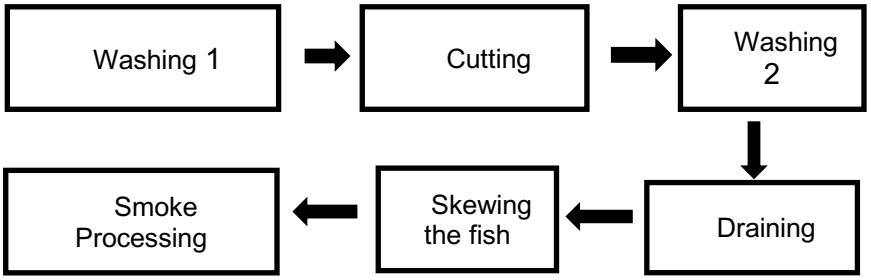

Figure 1. Flow Diagram of the Smoked Fish Processing

As can be seen from Figure 1, the flow diagram of the smoked fish processing started with washing the fish with clean water, cutting the fish into chunks, and then washing again before letting the fish drain. Next, the drained fish were skewed with a small coconut stick and transferred to a smoking place. However, Table 4 shows that only half of the respondents had workstations arranged sequentially, and only 33% had a clean fish handling room. Thus, a workstation reconstruction design was proposed as in Figure 2.

Figure 2a shows that Setting in Order and Shine principles were not implemented; which is why a new fish washing workstation design was proposed. Next, Figure 3 shows the Fish Cutting Workstation and a Proposal of New Fish Cutting Workstation Design.

a. Fish Washing Workstation **b. Proposal for New Fish Washing Workstation Design**

Figure 2: Fish Washing Workstation and Proposal for New Workstation Design

a. Fish Cutting Workstation **b. Proposal for New Fish Cutting Workstation Design**

Figure 3: Fish Cutting Workstation and Proposal for New Workstation Design

Figure 3a. shows that Fish Cutting Workstation seemed unorganized and had an improper work position. Thus, figure 3b shows the new design of the fish cutting workstation which is simple and at a low cost but still applies ergonomic principle [7].

4 Discussion

Related to the application of 5S in the smoked fish informal sector, only some of the principles are applied. Figure 2 and Figure 3 depict that the workstations need to be improved to be more organized and clean. Cleanliness in the workstation does not only affect the health of the worker but also the consumers who consume the smoked fish. There was even a correlation between poor hygiene smoked fish working environment and the number of germs contaminating the smoked fish [4] .

The application of food hygiene and sanitation needs to be done to maintain and improve health. Respondents who do not wash their hands when touching food will cause food contamination. If the hands of food handlers are dirty due to touching garbage, soil or animal waste, bacteria can stick to their hands if they do not wash their hands beforehand. This will cause contamination of the food. It is known that E. coli can grow in animal and human faeces. To maintain the quality of food so that it remains hygienic, you must wash your hands first, preferably with soap to effectively kill germs. Possible causes of unfavourable hygiene and sanitation practice included person-related factors and human resource management [8].

Hands or gloves of workers from the majority of companies were highly contaminated with Staphylococcus aureus at levels above the recommended limits. Large-sized companies performed better in Enterobacteriaceae, Escherichia coli, and S. aureus than medium- and small-sized ones in a majority of the CSLs, including receipt of raw fish material, heading and gutting, and the condition of the fish processing tables and facilities before cleaning and sanitation [9].

In addition, the use of adequate PPE during the cleaning and smoking process of fish will prevent contamination from bacteria and germs. Respondents' unfavourable practices such as not using aprons, head coverings when processing food and dirty clothes can cause food contamination. Respondents assumed that the use of attributes made them uncomfortable and hot when processing food, this is research which stated that respondents did not use clean and tidy work clothes. There are 23.4 % work with dirty appliance separately. Research by Johnson shown that the relationship between food hygiene knowledge and practice was statistically significant ($p=0.00$). There were also statistically significant associations between having good knowledge of food hygiene and use of apron, hair covering, observing good sanitary conditions, water supply, waste disposal and protection of food from flies ($p<0.05$) [10].

Respondents still use jewellery when processing food so that it can cause food contamination. In this study, 15.6 % respondents used jewellery when processing food. Rings can store dirt or food residue in between the ring and fingers, causing bacteria to easily breed on the skin so that it can contaminate food. Knowledge and attitude on hygiene and sanitation are generally good among food-handlers in the work place. Almost all of the food-handlers were aware of the critical role of general sanitary practices in the work place, such as hand washing (98.7% correct answers), using gloves (77.9%), proper cleaning of the instruments/utensils (86.4%) and detergent use (72.8%) [11].

Previous research shows that improvement of workstations could lessen health problems for the workers and enhance their productivity [1,8] Thus, proposing a reconstruction work design based on 5S principles with low-cost intervention [11]. The risk level of the context could be reduced through automation of production processes (such as filleting, packaging, and sanitation) to restrict people's interference, recruitment of permanent high-skilled technological staff, and setting requirements on product use (storage and distribution conditions) on customers. However, such intervention measures for improvement could be taken in phases, starting with less expensive ones (such as sanitation procedures) that can be implemented in the short term to more expensive interventions (setting up assurance activities) to be adopted in the long term [12].

Workstation design can be a potential hazard for workers. A workstation that is arranged following the 5S principles will prevent the exposure of potential work environment hazards such as improper work position and workstation that can affect the health of the workers. Figure 3 indicates improper sitting position when the stool and cutting board are too short without the worker changing position for working 8 hours a day, depending on how many fish to cut. Moreover, research by Sulistiyani shows that a sitting position can be used to predict low back pain in informal workers [13]. Furthermore, working activities of smoked fish workers, such as lifting, pulling, and pushing may contribute to low back pain [14]. A retrospective study shows that heavy lifting and prolonged sitting positions have the strongest correlation with low back pain for men [15]. In an article by Buchbinder, worker‘s pain should become the priority of public health departments, and it needs integration between public health departments, workplace, and the government. In a positive health approach in a workplace setting, work-related low back pain should not be an injury that needs medical treatment. Nevertheless, workstation design can be a preventive solution to reduce the worker’s pain [16].

The separation of the fish cutting and the fish washing area will make the work environment more spacious and clean. A clean and tidy workplace arranged according to the 5S principle will make workers more efficient at work. Simple structural and procedural changes by the company (and others like it in the industry) can decrease the risk for work-related injuries and improve the overall well-being of the workforce [17]. The research also gave modification of workstations as an intervention. Another research that implemented an ergonomic intervention that included workstation design succeeded to prevent pain in various informal sectors. By implementing 5S in the company, we can improve work as effectively as possible as well as employee [9]. A neat work station arrangement will not only make employees comfortable for working, avoid complaints of work-related pain also increase work productivity.

We would like to express our gratitude to all of the participants and data collectors for their dedication during data collection.

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