

Design of workstation in the home industry of Amplang crackers production

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Abstract. Amplang crackers production in home industry activities carried out with a variety of different body positions while working. From the results of previous studies it was found that the ergonomic position in producing Amplang crackers is the position of standing workers. The problem faced in this research is how to design an ergonomic workers workstation for the standing worker's position. The results of this study are the design of workstations in the form of tables, chairs and stoves. The table design results in this research have two functions for the work of making the dough and the process of twisting and cutting Amplang. The length of the table is 1000 mm and the height is 1000 mm. The table is 600 mm wide and has a footrest slope of 20 degree. The seat size has a height of 700 mm and the seat width is 400 mm. For the design of the stove has a height of 800 mm and a width of 500 mm, for footrest with a length of 300 mm with a slope of 20 degree. The anthropometry used is Asian women 50 percentile and 95 percentile.

1. Introduction

Amplang crackers are typical foods of the East Kalimantan, especially the city of Samarinda in the form of general round shape with a certain size made from fish from the Mahakam river. The process of making Amplang crackers has been done for a long time for generations. In the production of Amplang crackers, there are three main production processes carried out. The process of producing Amplang crackers in general is to make the dough which is a process of mixing and stirring the dough of the Amplang, the next process of the finished dough is continued into the process of twisting the Amplang to the size of an adult human finger and cutting it into sizes 2-3 cm or according to production requirements, the last step is the process of frying the dough Amplang cracker which after being cooled is ready to be packaged [1]. Amplang crackers production activities carried out with a variety of different body positions while working. From the results of previous studies it was found that the ergonomic work position in producing Amplang is the position of standing workers. This position is stated to minimize fatigue that is too fast and to reduce injuries that may occur due to work



position that is not ergonomic. The problem in this research is how to design an ergonomic Amplang crackers workers' workstation for the standing worker's position. The aim of this research is to design an ergonomic workstation that is suitable for the type of standing position in the home industry of the production of Amplang crackers. Contribution to the development of science is to provide an important role in the need for workstations that are ergonomic and in accordance with the anthropometry of workers who are very influential in improving the effectiveness and efficiency of work and can help reduce the fatigue that occurs when working in the production of Amplang crackers.

2. Literature Review

2.1. *Amplang crackers production*

Amplang crackers is typical foods of the city of Samarinda. Amplang crackers processed with the main ingredients are fish belida [2]. In Figure 1 that show the process of producing Amplang crackers in general is to make the dough which is a process of mixing and stirring the dough of the Amplang, twisting and cutting the dough of Amplang, and frying the dough Amplang cracker which after being cooled is ready to be packaged.

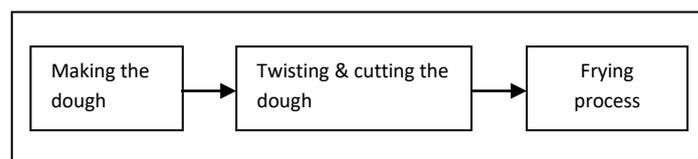


Figure 1. Amplang crackers production process.

Rapid Upper Limb Assessment (RULA) is methods in ergonomic evaluation of posture positions by the worker's body [3, 4]. Nordic body map atau NBM is a questionnaire that assesses the pain experienced by workers [5].

2.2. *Ergonomic and workstation*

Ergonomics is the study of systems, where people, work facilities and the environment interact with one another to improve effectiveness and efficiency. Ergonomics will focus on the abilities and limitations possessed by humans in interacting with the surrounding environment [6]. Other studies state the principle of ergonomics in the design of tasks can improve the results of employee performance [7]. One way to reduce non-ergonomic work positions is to manage room layout and ergonomic motion studies to reduce non-productive time [8]. The need for the availability of desks and workstation arrangements from spatial layout and range of distance for workers is very influential on the safety of workers. To overcome the problem of fatigue or injury at work, it is also necessary to design about using equipment and working methods that are correct and ergonomic [9-11]. The initial stage of handling this problem can begin at the school or basic education stage by introducing good ergonomic posture training [12]. The importance of ergonomic posture in working to reduce discomfort that occurs in workers due to incorrect posture at work and the position of equipment that is not in accordance with the standards of the human body as its users [13, 14]. Improper lifting movements can also cause pain in the neck, back, shoulders and wrists. Appropriate tools and rest periods need to be considered in every human activity at work [15]. To increase worker comfort, the addition of work facilities such as chairs is considered to be very helpful for workers, because when sitting workers' weight is concentrated in the knees, thighs and lower back will be supported by the seat holder. In addition, in working, it is necessary to have sufficient rest before continuing to work again. During activities in a sitting position it is necessary to have a cycle for resting time to reduce fatigue in the body [16, 17]. The application of ergonomics to the work system has been proven to be able to increase productivity, health, safety and comfort of work by making the design of equipment

(tables and chairs) as workstations that use anthropometric data as a standard measurement of table and chair design. Anthropometric is a study related to the measurement of human body dimensions that can be used as a standard in designing equipment and work space [18]. One of the software that can help in designing work retirement is Mannaquin Pro software [19].

3. Methodology

In this workstation design research, the first step is to divide the type of work process of the production of Amplang crackers into three main things, namely the process of making dough, twisting and cutting of dough and frying. In these processes after preliminary observations a workatation in the form of tables and chairs is needed in accordance with the type of standing position work. To design appropriate tables and chairs, anthropometric data types from the dimensions of the human body size of asian peoples are needed. In helping to design workstations, ergonomics software Mannaquin Pro is needed as software that contains anthropometric data that is useful in designing workstations.

4. Results and discussion

Based on the results of previous studies stated that the data processing method RULA and NBM questionnaires in the production process of envelopes produce recommendations for standing position jobs. The work position recommendations are as shown below in Figure 2. The next step is to design a work station that is more ergonomic. In this case work facilities will be designed such as design of tables and chairs and an ergonomic stove. In the workstation design process, this was assisted with Mannaquin Pro software as shown in Figure 2.

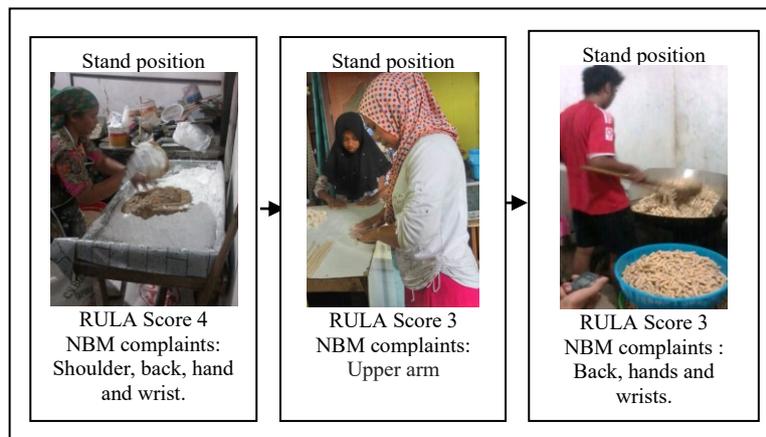


Figure 2. Recommended standing postures in production of Amplang crackers.

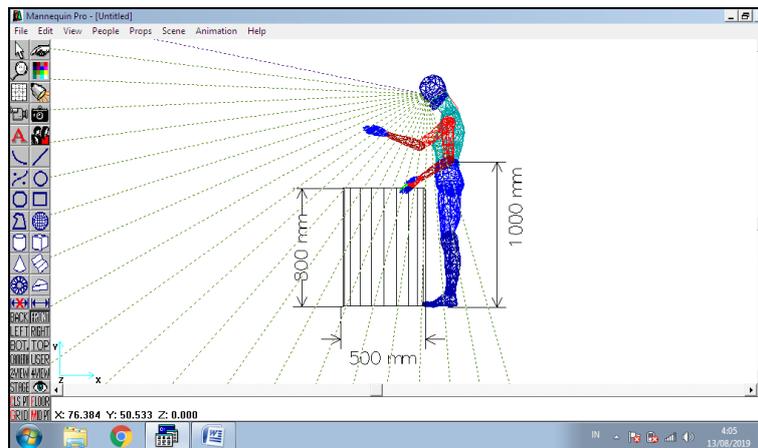


Figure 3. Design workstation using Mannequin Pro.

The Figure 3 is just one example of the use of Mannequin Pro software to measure and design an ergonomic stove height to facilitate the process of frying the Amplang. The fig 4 is the result of a workstation analysis in the form of placing chairs, tables and stoves for workers in the home industry of Amplang crackers. Laying tables, chairs and stoves that have been designed according to the anthropometry of workers and optimal space will increase the work to be more ergonomic.

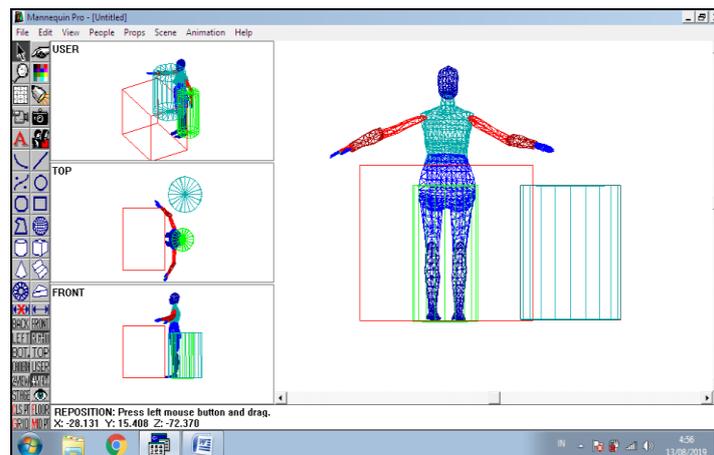


Figure 4. Workstation consisting of chairs, tables and stoves in an ergonomic position.

4.1. Designing table and chair

The design of this Amplang cracker production table is designed with an ergonomic table for the process of kneading the dough and for the process of twisting and cutting the Amplang as shown in Figure 5. This table is designed for 50 percentile Asian women's body dimensions or anthropometry and is divided into two different sides, for the left side is a table for processing Amplang dough that is shaped like a container with a height of 700 mm, while the right side for twisting and cutting activities with a height of 1000 mm. The height of the table is designed by taking the minimum dimensions from the height of the elbow when standing with a size adapted to the type of work standing posture. For the width of the table is 600 mm using minimal data from anthropometry of 50 percentile Asian women's body dimensions from the distance of the hands reaching forward. For the length of the table designed for the two processes, this activity is taken from the minimum dimensions of women's shoulder width of 50 percentile, size $50 \text{ mm} \times 2 = 1000 \text{ mm}$. On this table also made footrest /

backrest with an angle of 20° . The function of the footrest is to give workers a footrest when working in a standing position to avoid fatigue in the legs when working.

To help the work of making the dough, twisting and cutting dough of Amplang carried out with standing posture also designed chairs for this work activity. This is done to minimize the static position when standing which can cause fatigue in the worker's body. With this ergonomic chair, it is expected that workers can lean on the chair for some time to reduce fatigue in the calf muscles and thighs. Chair height is taken from anthropometric data of 50 percentile of asian women's from the addition of elbow height in sitting position - elbow height in standing position = $930 - 230 \text{ mm} = 700 \text{ mm}$. The seat width for the seat is taken from the anthropometric data of 95 percentile butt width of asian women's with an adjusted value of 400 mm as shown in Figure 6.



Figure 5. Amplang crackers workstation table.

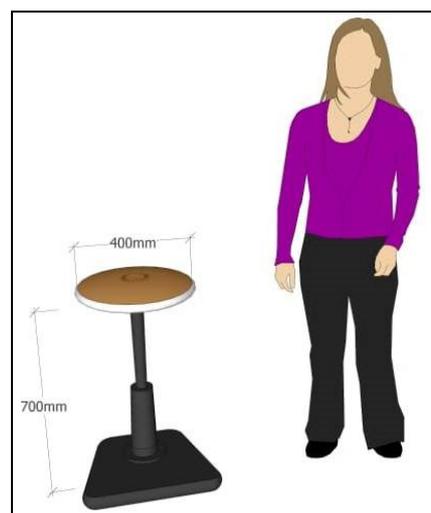


Figure 6. Amplang crackers workstation chair.

4.2. The design of a stove for the process of Amplang crackers frying work

For the process of frying the Amplang cracker in standing posture, it is necessary to measure the height of the stove's ergonomics so as to prevent the formation of large angles in the hands, shoulders

and arms that can cause fatigue faster when working like seen in Figure 7. The height of the stove is obtained from anthropometric data of elbow height when standing women 5% percentile asian women. The value taken for the height of the stove is 800 mm. at the foot of the stove is given a foothold for workers to avoid static muscles in the feet. The slope angle of this step is 20°.

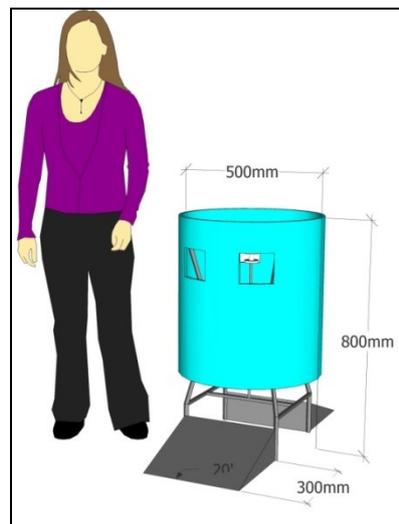


Figure 7. Amplang crackers workstation stove.

5. Conclusions

Ergonomic design of workstations in Amplang production using anthropometric data of asian people will greatly assist in reducing worker fatigue and avoiding work injuries due to repetitive types of work with non-ergonomic work positions that cause static muscle loads. The design of workstations in the form of tables, chairs and stoves on the type of work in the production of Amplang crackers will provide a sense of comfort and health in work which will ultimately increase the productivity of Amplang crackers workers. The table design results in this research have two functions for the work of making the dough and the process of twisting and cutting Amplang. The length of the table is 1000 mm. The height 1000 mm for twisting and cutting work, and 700 mm for table height made in the form of hollows. The table is 600 mm wide and has a footrest slope of 20°. The seat size has a height of 700 mm and the seat width is 400 mm. For the design of the stove has a height of 800 mm and a width of 500 mm, for footrest with a length of 300 mm with a slope of 20°. Anthropometry used is Asian women 50 percentile and 95 percentile. Further research can be done by designing workstation chairs, tables and stoves that have been designed in this study to make it more aesthetic by using product design development methods.

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