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# Redesign of work facilities at the tofu pressing station with a participatory ergonomic approach

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**Abstract:** Tahu Palda is a small and medium-sized micro business in the food industry that produces tofu. This factory has been producing tofu since 2005, located in North Aceh. The workers in this tofu usually five workers, with an average of 7 working hours per day. Based on the observations at several workstations, initial data indicate that the dominant work posture is standing, bending, and lifting heavy loads such as a 20 kg weight for pressing and lifting a mold holder with a 15 kg load. This is done continuously for 7 working hours each day. Based on the results of the distribution of the Cornell Musculoskeletal Discomfort Questionnaire (CMDQ), it was found that workers at the station experience complaints such as back pain, lower back pain, and upper arm pain due to the high frequency of lifting heavy loads. If this continues to be neglected, it can lead to work-related diseases such as musculoskeletal disorders. The assessment of workers' posture using the Rapid Entire Body Assessment (REBA) method shows that the score obtained for the job of pouring soybean paste is 7, which means a moderate risk, the job of lifting the press weight is 5, which means a moderate risk, and the job of flipping molds has a score of 10, which falls into the high-risk category and needs improvement. Improvements were made using a participatory ergonomics approach, resulting in the decision to redesign the tofu press tool to fit the workers' body anthropometry. The anthropometric calculations for the height range of the press support tool and cutting tool are 141.1 cm, the press support range is 68.78 cm, the width of the press tool is 49.4 cm, the height of the tray is 4.54 cm, and the height of the tray holder is 103.85 cm.

***Keywords:*** *Cornell musculoskeletal discomfort questionnaire, Participatory ergonomics, REBA, Work posture.*

## 1. Introduction

Industry is a type of economic activity that involves the processing of raw materials, semi-finished goods, or finished goods into high-quality products for their intended use. This process also includes design and industrial engineering activities. The food industry holds significant importance as it directly addresses the fundamental needs of society. The food industry encompasses a wide range of activities, including not only production but also processing and distribution. The food industry produces various processed food products in the form of both traditional and modern foods. Based on data obtained from the Central Statistics Agency of Lhokseumawe, there are 44 food industries in Aceh Province with a workforce of 7,897 people. The productivity of these companies serves as an important asset to advance the economy of Aceh Province. Generally, the food industry consists of small and medium enterprises, as well as micro, small, and medium enterprises. Tahu Palda is one of the micros, small, and medium enterprises engaged in the food industry, specifically tofu. This business has been producing tofu since 2005, located in Dewantara District, North Aceh. The workers at this tofu factory number 5 people, with an average working hours per day of 7 hours. The markets in Aceh Utara district receive the tofu for distribution. This business continues to conduct its production process using traditional methods and simple technology. The machines and equipment used to produce tofu include a soybean grinder, such as boiling stoves, tofu strainers, and tofu molds. The materials used are soybeans, water, and


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vinegar. This tofu business comprises six workstations, which include soaking, grinding, boiling, filtering, molding, and packaging. Based on initial observations conducted at the six workstations, the molding station is the one where the majority of work involves standing, bending, and lifting heavy loads, such as 20 kg weights for pressing and 15 kg molds, continuously for one working day. The Cornell Musculoskeletal Discomfort Questionnaire (CMDQ) results revealed that lifting loads at a high repetition rate causes workers at that station to experience complaints such as back pain, lower back pain, and upper arm pain. The purpose of this research is to assess the workers' posture and propose a work facility design at the printing station based on a participatory ergonomics approach.

## 2. Literature Review

### *2.1. Ergonomic*

Ergonomics derives from Greek, where "Ergo" means work and "nomos" means laws or rules guiding job performance [1][2]. Ergonomics is a scientific discipline that employs data regarding human characteristics, capabilities, and constraints to design work systems that enable people to perform their jobs effectively, comfortably, healthily, and efficiently while achieving their goals. Ergonomics encompasses not only tools but also the analysis of interactions between humans and other components of the work system, including materials, the environment, procedures, and organization [3][4][5].

### *2.2. Rapid Entire Body Assessment (REBA)*

REBA is an analytical tool designed for the rapid and straightforward assessment of work position. Furthermore, REBA serves as an assessment tool for both static and dynamic activities, offering a risk action level for musculoskeletal disorders [6][7][8]. The calculation of the REBA score is presented in the following figure and table

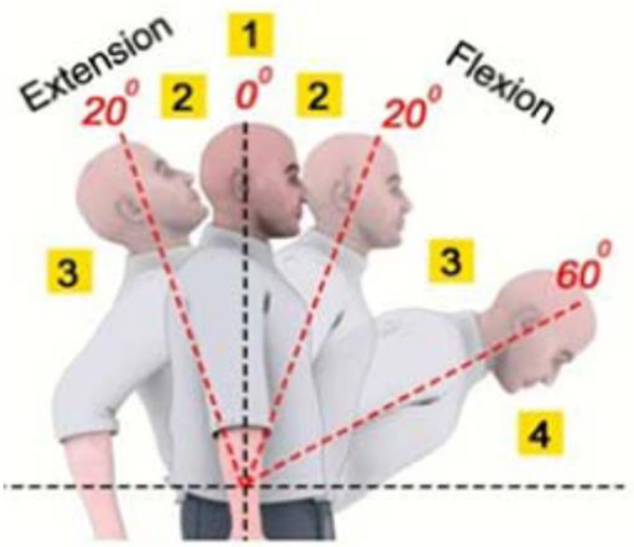


**Figure 1.**
Back movement score.

**Table 1.**
Back movement score.

| Movement upright | Score | Score change |
|---|---|---|
| 0° -20° *flexion* | 1 | |
| 0° -20° *extension* | 2 | |

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Movements of more body parts, including the neck, back, arms, legs, and wrists, have been assigned reference angles and scores [9].

*2.3. Cornell Musculoskeletal Discomfort Questionnaire* (CMDQ)

CMDQ is a subjective questionnaire comprising questions regarding discomfort experienced during work, related to job productivity [10]. CMDQ is a combined questionnaire from NBM that includes additional questions regarding the severity level and its effect on workers' work performance [11][12][13].

*2.4. Participatory Ergonomics*

Participatory ergonomics is a methodology that prioritizes worker participation in the design and evaluation of ergonomic systems [14][15]. Participatory ergonomics involves the participation of workers in the planning and management of work activities, possessing adequate knowledge and power to influence both the process and outcomes to achieve the desired goals. This strategy allows workers to participate in planning, supervision, and decision-making in work activities, thereby enhancing self-confidence and job motivation [16][17].

*2.5. Anthropometry*

The term Anthropometry comes from the words "anthropos" meaning human and "metron" meaning size. Thus Anthropometry has the meaning of studying the size of the human body and seeking evaluation to carry out its activities with ease and simple movements. Anthropometry is very important to note especially in designing the workplace. This is due to the size of the body and the shape of humans that have many variables. In addition, gender, race or ethnicity and type of work also influence design. The application of anthropometric data will be able to be done if there is an average value (mean) and standard deviation from a normal distribution. The normal distribution is characterized by the existence of average values (mean) and Standard Deviation (SD). A percentile is a value that states a certain percentage of a group of people whose dimensions are equal to or lower than that value. For example, 95% of the population is equal to or lower than 95 percentiles, and 5% of the population is equal to or lower than 5 percentiles [18].

*2.6. Data Uniformity Test*

The calculation steps of the data uniformity test :

1. The first step in the data uniformity test is to calculate the average magnitude of each observation, with the following equation:

$$\bar{X} = \frac{\sum Xi}{n}$$

2. The second step is to calculate the standard deviation with the following equation:

$$\sigma = \sqrt{\frac{\sum (X - \bar{X})^2}{n - 1}}$$

σ = standard deviation
Xi = data value
X = average price
N = number of observations

3. The third step is to determine the Upper Control Limit (UCL) and the Lower Control Limit (LCL) which are used as barriers for the disposal of extreme data using equations as follows:

UCL $= \bar{X} + 2\sigma$
Center Line $= \bar{X}$
LCL $= \bar{X} - 2\sigma$
X= Average of observation data

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σ= Standard deviation of the population

K = Coefesien confidence level index, namely:
Confidence level 0% - 68% , k = 1
Confidence level 69% - 95%, k = 2
Confidence level 96% - 100%, k = 3

## 3. Method

*3.1. Place of Research*

The research was conducted at Tahu Palda. This home industry is engaged in the food industry located in Dewantara – Aceh

*3.2. Operational Variables*

This research variable consists of two parts, such as:

*3.2.1. Independent variables.*

This research-free variable is a measurement of the risks of working posture of workers who in their activities carry out home industry production process activities Tahu Palda, it can be seen as follows:

- The work element, is the part of the work time that is carried out sequentially in one work cycle.
- Actual work posture, is the attitude of work while doing work.
- Actual work facilities, are supporting means in the activities of physical form companies.

*3.2.2. Dependent Variables*

Dependent variables, as a result of being affected. Variables that are affected or that are the result of free variables, while the bound variables in this study are complaints of musculoskeletal disorder muscles.

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*3.3. Research Method*

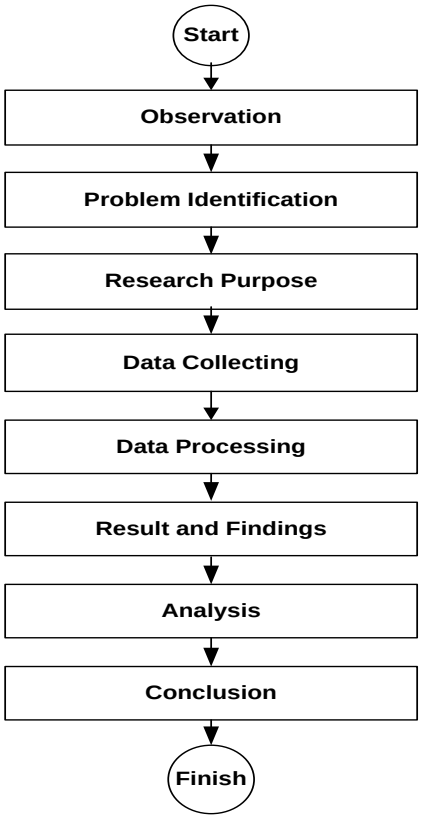


**Figure 2.**
Research flow diagram.

*3.4. Research Instrument*

The research instruments used in this research are as follows:

1. Questionnaires, used to obtain individual characteristic data from an overview of factors related to MSDs complaints in workers using the Cornell Musculoskeletal Discomfort Questionnaire (CMDQ).
2. Camera, used for documentation of workers posture.
3. Rapid Entire Body Assessment (REBA) Assessment Form.
4. Arc degrees, to measure the angle of the worker working posture
5. Autocad, used to draw proposed designs based on anthropometric data and the application of participatory ergonomics.

## 4. Result and Discussion

*4.1. CMDQ Result*

Based on the results of CMDQ, the part of the limb that experienced the most complaints by multiplyi ng the frequency score by the comfort score and interference score such as Table 2 as follows:

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**Table 2.**
Calculation of complaint score based on CMDQ results.

| Limbs | Frequency | Comfort | Interference | Total | % |
|---|---|---|---|---|---|
| Neck | 10.5 | 6 | 8 | 504 | 6.3 |
| Shoulder (Right) | 3 | 17 | 8 | 408 | 5.1 |
| Shoulder (Left) | 3 | 6 | 6 | 108 | 1.4 |
| Upper back | 8.5 | 6 | 6 | 306 | 3.9 |
| Upper arm (Right) | 1.5 | 1 | 1 | 1.5 | 0.0 |
| Upper arm (Left) | 1.5 | 2 | 1 | 3 | 0.0 |
| Lower back | 15.5 | 4 | 10 | 620 | 7.8 |
| Forearm (Right) | 8 | 4 | 8 | 256 | 3.2 |
| Forearm (Left) | 8 | 4 | 8 | 256 | 3.2 |
| Wrist (Right) | 10 | 2 | 2 | 40 | 0.5 |
| Wrist (Left) | 10 | 2 | 2 | 40 | 0.5 |
| Hips/ Buttocks | 21.5 | 14 | 10 | 3010 | 37.9 |
| Thighs (Right) | 10 | 3 | 5 | 150 | 1.9 |
| Thigh (Left) | 10 | 3 | 3 | 90 | 1.1 |
| Knee (Right) | 10 | 4 | 6 | 240 | 3.0 |
| Knee (Left) | 10 | 4 | 6 | 240 | 3.0 |
| Feet (Right) | 9.5 | 8 | 11 | 836 | 10.5 |
| Foot (Left) | 9.5 | 8 | 11 | 836 | 10.5 |

*4.1. Discomfort Calculation for the Neck*

Neck

a. Frequency = (2)(5) + (1,5)(0) + (3,5)(3) + (5)(0) + (10)(0) = 10.5
b. Comfort = (1)(0) + (2)(3) + (3)(0) = 6
c. Interference = (1)(2) + (2)(4) + (3)(0) = 8
d. Total = (10.5)(6)(8) = 504
e. Percentage = (504/7944.5)(100%) = 6.3%

From the results of CMDQ data processing, we found the most complaints in workers are in parts of the body such as the lower back, hips/buttocks, and legs. This can happen because the worker's position when working irregularly such as work done by standing too long, the position of the body often bends and lifts heavy objects such as containers that have been filled with soybeans, ancak and lifting ballast weights for the compressing process. The spread of questionnaires on the Tahu Palda was done for 5 workers. The symptoms of pain are felt in general due to a lot of work done manually that is too draining for workers.

*4.2. REBA*

The work of the worker with the work element of pouring soybeans is part of the work in the process of printing tofu in Tahu palda. This work is the process of pouring soybean juice into the mold with the contents of soybean juice that is quite a lot, about more than 20 kg. This requires the worker pouring it by using a small container and doing continuous pouring with the position of the body, such as in Figure 3 as follows

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**Figure 3.**
Pouring soybeans.

The REBA method can obtain the work posture angle by observing the work posture during the pouring of soybean milk into the mold. The following table displays the calculation of Group A scores.

**Table 3.**
Scoring group C.

| Table C | Score A | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **0** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** |
| Score B | 1 | 1 | 1 | 2 | 3 | 4 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| | 2 | 1 | 2 | 3 | 4 | 4 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| | 3 | 1 | 2 | 3 | 4 | 4 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| | 4 | 2 | 3 | 3 | 4 | 5 | 7 | 8 | 9 | 10 | 11 | 11 | 12 |
| | 5 | 3 | 4 | 4 | 5 | 6 | 8 | 9 | 10 | 10 | 11 | 12 | 12 |
| | 6 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 10 | 11 | 12 | 12 |
| | 7 | 4 | 5 | 6 | 7 | 8 | 9 | 9 | 10 | 11 | 11 | 12 | 12 |
| | 8 | 5 | 6 | 7 | 8 | 8 | 9 | 10 | 10 | 11 | 12 | 12 | 12 |
| | 9 | 6 | 6 | 7 | 8 | 9 | 10 | 10 | 10 | 11 | 12 | 12 | 12 |
| | 10 | 7 | 7 | 8 | 9 | 9 | 10 | 11 | 11 | 12 | 12 | 12 | 12 |
| | 11 | 7 | 7 | 8 | 9 | 9 | 10 | 11 | 11 | 12 | 12 | 12 | 12 |
| | 12 | 7 | 8 | 8 | 9 | 9 | 10 | 11 | 11 | 12 | 12 | 12 | 12 |

The following are the results of the REBA score determination can be seen in Table 4 as follows:

**Table 4.**
REBA score work elements pouring soybeans.

| Score group c | Use group | Load/ Force | Coupling | Activity score | Information |
|---|---|---|---|---|---|
| Group A | 5 | 2 | | | Medium level of risk, further investigation, immediate changes |
| Group B | 5 | | 0 | 1 | |
| Group C | 6 | | | | |
| REBA score | 6 + 1 (Activity Score) = 7 | | | | |

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This work is one of the jobs that exist at the printing station tofu. This work requires human energy to lift the load of about 20 kg that is lifted to be done to suppress the tofu pulp.
The worker's working can be seen in Figure 4 as follows:


**Figure 4.**
Elements of compressing load lifting work.

The following table displays the calculation of Group A scores.

**Table 5.**
Scoring group C.

| Table C | Score A | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **0** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** |
| Score B | 1 | 1 | 1 | 2 | 3 | 4 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| | 2 | 1 | 2 | 3 | 4 | 4 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| | 3 | 1 | 2 | 3 | 4 | 4 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| | 4 | 2 | 3 | 3 | 4 | 5 | 7 | 8 | 9 | 10 | 11 | 11 | 12 |
| | 5 | 3 | 4 | 4 | 5 | 6 | 8 | 9 | 10 | 10 | 11 | 12 | 12 |
| | 6 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 10 | 11 | 12 | 12 |
| | 7 | 4 | 5 | 6 | 7 | 8 | 9 | 9 | 10 | 11 | 11 | 12 | 12 |
| | 8 | 5 | 6 | 7 | 8 | 8 | 9 | 10 | 10 | 11 | 12 | 12 | 12 |
| | 9 | 6 | 6 | 7 | 8 | 9 | 10 | 10 | 10 | 11 | 12 | 12 | 12 |
| | 10 | 7 | 7 | 8 | 9 | 9 | 10 | 11 | 11 | 12 | 12 | 12 | 12 |
| | 11 | 7 | 7 | 8 | 9 | 9 | 10 | 11 | 11 | 12 | 12 | 12 | 12 |
| | 12 | 7 | 8 | 8 | 9 | 9 | 10 | 11 | 11 | 12 | 12 | 12 | 12 |

The following are the results of the REBA score determination can be seen in Table 6 as follows:

**Table 6.**
REBA score work elements compressing load lifting.

| Score group C | Use group | Load/ Force | Coupling | Activity score | Information |
|---|---|---|---|---|---|
| Group A | 4 | 1 | | | Medium level of risk, further investigation, immediate changes |
| Group B | 3 | | 0 | 1 | |
| Group C | 4 | | | | |
| REBA score | 4 + 1 (Activity score) = 5 | | | | |

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This work element is also an activity in the printing process of tofu so that it can make it easier to remove the filter fabric at the core of the tofu and this activity are also categorized on heavy work because it has to lift the Mold with a Mold weight of about 20 Kg and done using worker power, therefore, this work element needs to be considered the working posture.
It can be seen at the following figure.


**Figure 5.**
Elements of compressing load lifting work.

The following table displays the calculation of Group A scores.

**Table 7.**
Scoring group C.

| **Table C** | **Score A** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Score B | 1 | 1 | 1 | 2 | 3 | 4 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| | 2 | 1 | 2 | 3 | 4 | 4 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| | 3 | 1 | 2 | 3 | 4 | 4 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| | 4 | 2 | 3 | 3 | 4 | 5 | 7 | 8 | 9 | 10 | 11 | 11 | 12 |
| | 5 | 3 | 4 | 4 | 5 | 6 | 8 | 9 | 10 | 10 | 11 | 12 | 12 |
| | 6 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 10 | 11 | 12 | 12 |
| | 7 | 4 | 5 | 6 | 7 | 8 | 9 | 9 | 10 | 11 | 11 | 12 | 12 |
| | 8 | 5 | 6 | 7 | 8 | 8 | 9 | 10 | 10 | 11 | 12 | 12 | 12 |
| | 9 | 6 | 6 | 7 | 8 | 9 | 10 | 10 | 10 | 11 | 12 | 12 | 12 |
| | 10 | 7 | 7 | 8 | 9 | 9 | 10 | 11 | 11 | 12 | 12 | 12 | 12 |
| | 11 | 7 | 7 | 8 | 9 | 9 | 10 | 11 | 11 | 12 | 12 | 12 | 12 |

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| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 12 | 7 | 8 | 8 | 9 | 9 | 10 | 11 | 11 | 12 | 12 | 12 | 12 |

The following are the results of the REBA score determination can be seen in Table 8 as follows:

**Table 8.**
REBA score work elements flipping the mold.

| Score group C | Use group | Load/ Force | Coupling | Activity score | Information |
|---|---|---|---|---|---|
| Group A | 7 | 1 | | | Medium level of risk, further investigation, immediate changes |
| Group B | 5 | | 0 | 1 | |
| Group C | 9 | | | | |
| REBA score | 9 + 1 (Activity score) = 10 | | | | |

*4.3. Working Posture Analysis Based on REBA Method*

From the results of data processing at the printing workstation tofu using the REBA method can be seen in Table 9 as follows:

**Table 9.**
Recapitulation of REBA working posture assessment.

| No | Work posture | Grand score | Action level | Risk level | Action |
|---|---|---|---|---|---|
| 1 | Pouring Soybeans | 7 | 2 | Medium | Further investigation, immediate changes |
| 2 | Compressing Load Lifting | 5 | 2 | Medium | Further investigation, immediate changes |
| 3 | Flipping the Mold | 10 | 3 | High | Investigate and make changes |

*4.4. Proposed Design*

*4.4.1. Participatory Ergonomics Approach*

Based on observations and interviews in an effort to improve work facilities by involving workers on the ground, operators at the printing station know that the pressing process is not done manually by lifting the weight of ballast and should be innovated in the form of pressing by using hydraulics then in the process of pouring sari tahu into the mold position of the sari container tofu not too low from the mold or be on the floor because it can slow down. work, preferably the position of the container parallel to the table of tofu molds that correspond to the calculation of anthropometric data. Based on this the state of position referred to by the worker which can be seen in Figure 6 as follows:

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**Figure 6.**
Position of Sari Tahu container under mold (Left), manual press tool (Right).

*4.4.2. The Calculation of Antropometry for Redesign*

The following is a table of body dimension data collection which can be seen in Table 10 as follows:

**Table 10.**
Observation data of workers' body dimension measurements.

| No | Body dimension | | | | |
|---|---|---|---|---|---|
| | Shoulder height stand | Range distance hand | Shoulder width | Diameter of hand grip | Standing waist height |
| 1 | 141 | 71 | 50 | 4,5 | 105 |
| 2 | 139 | 69 | 49 | 5 | 106.5 |
| 3 | 140 | 71 | 50 | 4.5 | 105 |
| 4 | 141 | 70 | 48.5 | 4 | 106 |
| 5 | 139.5 | 69.5 | 49.5 | 5 | 106 |

The step taken is to determine the uniformity of the data with the aim of knowing the exist or absence of data that is above the control limit, Here is one of the calculations of the uniformity test of each body dimension measured can be seen as follows:

**Table 11.**
Parameters of standing shoulder height data uniformity test.

| Worker | Shoulder height stand (cm) | | | |
|---|---|---|---|---|
| | $Xi$ | $\bar{X}$ | $X-\bar{X}$ | $(X-\bar{X})^2$ |
| 1 | 141 | 140.1 | 0.9 | 0.81 |
| 2 | 139 | 140.1 | -1.1 | 1.21 |
| 3 | 140 | 140.1 | -0.1 | 0.01 |
| 4 | 141 | 140.1 | 0.9 | 0.81 |
| 5 | 139.5 | 140.1 | -0.6 | 0.36 |
| $\sum$ | 700.5 | | | 3.2 |

To test the uniformity of the data, you can find the average value, standard deviation and Upper Control Limit (UCL) and Lower Control Limit (LCL) as follows:

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a. Average, $\bar{X} = \frac{\sum Xi}{n} = \frac{700.5}{5} = 140.1$

b. Standard Deviation, $\delta = \sqrt{\frac{\sum(X-\bar{X})^2}{n-1}} = \sqrt{\frac{3.2}{4}} = 0.8$

c. Upper Control Limit and Lower Control Limit using a 95% confidence rate k = 95 % = 2

Upper control limit = $\bar{X}+2\sigma$

$= 140.1 + 2(0.8)$

$= 141.7$

Lower control limit = $\bar{X}-2\sigma$

$= 140.1- 2(0.8)$

$= 138.5$

Based on the limits of the controls that have been obtained, it can be created a graph of uniformity of standing shoulder height data that can be seen in Figure 7 as follows:

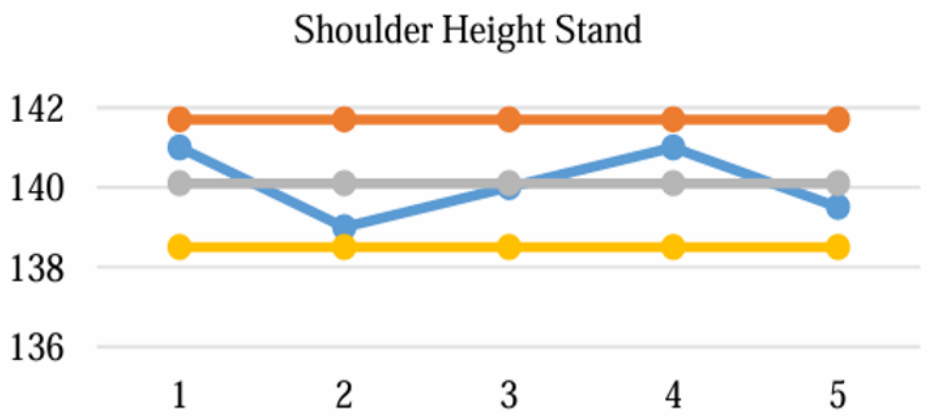


**Figure 7.**
Graph of uniformity of shoulder height data.

From the data that has been obtained, the percentile calculation can be done using the following calculation formula:

a. For 5-th Size = X- 1.645 $\sigma$x
b. For 50-th Size = X
c. For 95-th Size = X+ 1.645 $\sigma$x

Where $\sigma x$=S=Standard deviation Based on the results of anthropometric measurements, it will be discussed about the redesign of ergonomic tofu printing desks. From the results of the calculation obtained presentil results that can be seen in Table 12 as follows:

**Table 12.**
Percentile calculation.

| No | Body dimension | | Percentile (cm) | | |
|---|---|---|---|---|---|
| | | Symbol | 5-Th | 50-Th | 95-Th |
| 1 | Standing shoulder height | SSH | 139.6 | 141.1 | 142.56 |
| 2 | Hand range distance | HRD | 68.78 | 70 | 71.29 |
| 3 | Shoulder width | SW | 48.33 | 49.4 | 50.46 |
| 4 | Diameter of hand grip | DHG | 3.79 | 4.54 | 5.28 |
| 5 | Standing waist height | SWH | 103.85 | 105.5 | 107.1 |

Once the size of the percentile is obtained, it further determines the size of the tofu printing press. the size of the tofu print can be seen in Table 13 as follows:

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**Table 13.**
Percentile usage.

| No | Print tools section | Size (cm) |
|---|---|---|
| 1 | Height of press buttresses and cutting tools | 141.1 |
| 2 | Pres support range | 68.78 |
| 3 | Print tools width | 49.4 |
| 4 | Tray height | 4.54 |
| 5 | High place tray | 103.85 |

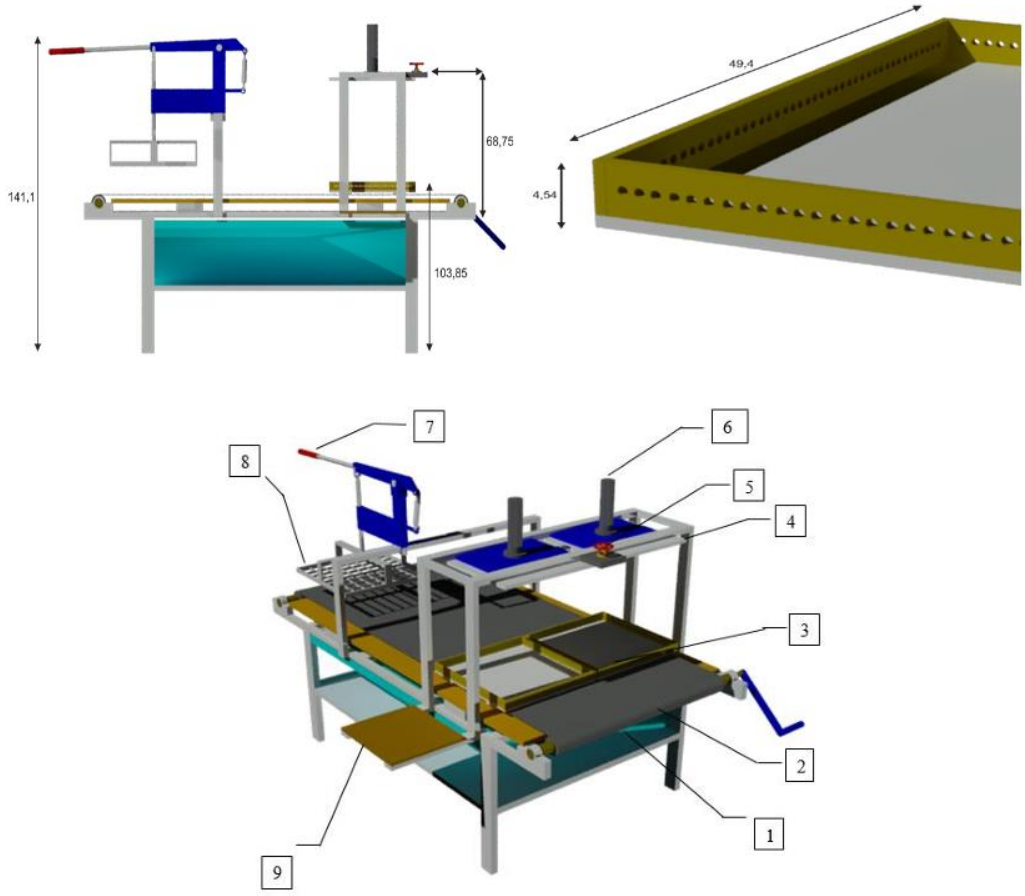


**Figure 8.**
Graph of uniformity of shoulder height data.

**Table 14.**
Components size of tofu mold.

| No | Mold tool components | Size (cm) |
|---|---|---|
| 1 | Water crossing container | Length 180 x Width 120 |
| 2 | Conveyor | Length 200 x Width 100 |
| 3 | Tofu mold | 49,4 square |
| 4 | Close Mold | 46,4 square |
| 5 | Wind faucet | 15 square |
| 6 | Hydraulic | Diameter 6 Length 30 |
| 7 | Cutting lever | Diameter 3 Length 25 |

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| | | |
|---|---|---|
| 8 | Cutting knife | 46,4 square |
| 9 | Tofu pulp container | 40 square |

The comparison of the actual tofu printing equipment with the proposal can be seen in Table 15 as follows:

**Table 15.**
Comparison of actual and proposed tofu printing equipment.

| No | Actual | Proposal |
|---|---|---|
| 1 | The initial position of the tofu container which will be poured into the mold is at the bottom which requires the operator to do continuous bending work | The proposal is to design and place the position of the tofu container parallel to the height of the mold table |
| 2 | The pressing process is done manually by lifting the ballast | Hidrolik Proposal to design a pressing device using a hydraulic pressure tool |
| 3 | This tool is used as a tofu mold only | The proposal to design this tool is used as a tool for printing and cutting tofu |
| 4 | Previously, the pressing water was wasted, causing the floor to be slippery | The proposal is to design a water reservoir under the mold table so that it is not wasted on the floor. |
| 5 | The process of transferring the resulting mold is lifted to the cutting station | The proposal is to design the addition of a conveyor to transfer the printouts to the cutting tool so that the cut products can be directly placed in the storage container. |

## 5. Conclusion

Based on the assessment of work posture using the REBA method, the highest work risk score was found in the work element of flipping tofu Molds, with a score of 10 indicating a high-risk level. Therefore, immediate corrective actions need to be taken. The physical indicator that leads to a high score involves workers manually lifting a 20 kg load. Thus, the work element with the load lifting task in pressing with a score of 5 and a medium risk level requires action with the physical indicator of lifting a heavy load weighing ± 20 kg. Next, the work element of pouring soybeans, which has a score of 7 and a medium risk level, necessitates action with the indicator of lifting tofu into Molds while in a bent-over position. The result of the participatory ergonomics approach is redesigning the tofu press and cutting tool with sizes adjusted to the workers' Anthropometry. The working system is simple and is expected to reduce work risk.

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