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# Workplace Ergonomic Risk Assessment Toward Small-Scale Household Business

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**Abstract.** The purpose of this research is to assess work risk caused by non-ergonomic of both facility layout and workplace at some Small Scale Medium Enterprises (SMEs) at nagari Batu Taba, sub-district IV Angkek, West Sumatera. The research samples are traditional food industrial and convection. The research participants are those who have been worked for more than ten years. Amongst the grievances experienced by the worker are tiredness and musculoskeletal disorders. This evaluation adopts the ergonomic facility layout and workplace through using Workplace Ergonomic Risk Assessment (WERA). The assessment result by implementing WERA shows that the worker does experience risk with final score 30 at medium level, as for the worker who cut the clothes pattern is at high level, 45. Task is not accepted and immediately changes. It means that some recommendations to improve the workplace are of vital importance. The ergonomic design introduced in this research has potential to reduce the risk at some small scale industrial at nagari Batu Taba, sub-district IV Angkek.

**Keywords:** MSDs, WERA, Facility Design

## 1. Introduction

Recently, the health and safety issues in the workplace have been a must [14]. These are now become a priority and are not to be abandoned by small scale, household and big scale industries. In fact, nowadays, some household industries in Indonesia are often neglecting the safety issue in the workplace. Small scale enterprises played a crucial role in the industrial economics. Low modal intensity and high worker production capacity are among the benefits of this small scale enterprise. According to the ergonomic principle, some of the small scale enterprises do not consider the facility layout and workplace when designing the industrial workstation. The activity of production process takes place in the non-specific place. Most of these small scale enterprises do not separate the production room, raw material room and finished goods room. The call to consider ergonomic principle when designing industrial workstation may reduce the musculoskeletal disorders. It is also to prevent injury toward the industrial operator [13].

The basic philosophy in every business organization is to produce particular goods and to sell it in order to obtain profit as to satisfy the consumer requirement. The useful system of performance evaluation depends on the working environment [10]. The goal of every company is to obtain maximum result by employing all facilities they owned [6]. Hence, it is necessarily important for the company to employ the ergonomic facility to avoid the worker for experiencing risk as to achieve the maximum result.

A very ergonomic workplace is of vital importance for all kind of industries, including small scale, big scale and household business. Some of the workers do not aware about the workplace condition.



Sometimes, the workplace is not properly design so that it may cause accident or injury at work in which it may harm the worker's physical. The appearance of the health issue as mentioned above give rise to the workplace risk assessment toward all kind of industries. The aim is to create safe and comfort workplace. It is all about arranging anything related with workstation, including the equipment and the environment to be properly design in order to avoid injury or any other negative effect toward health. The layout and workstation design have a significant impact toward health for both long and short terms. The factor to be considered in forming the cell or group work is decision in designing human (worker) along with the working system//working facility [26]

The existence of uncomfortable feeling resulted from inappropriate layout of the workstation may lead to the work injury and others negative impact toward worker's health. For example, inappropriate layout can cause eye fatigue, neck stiff, back pain, arm pain and the like. Improved good facility layout can reduce the comprehensive risk level on the upper body and increase productivity by 194% compared to the existing layout [1]. Inappropriate chair level adjustment may contribute stagnancy of blood flow to the leg part. Inappropriate sitting posture can cause injury at the lower back. Identification implemented toward traditional food making by using manual working equipment can cause injury risk toward neck, shoulder, back, wrist and leg [16]. The repetitive work particularly can cause tendon shoulder disorders [5]. Workplace ergonomic assessment assures that work system (equipment, tool, workstation and policy) is properly design in order to improve worker safety and health and optimized work business including productivity, efficiency, quality and profitability [24]. The main idea related with workstation planning is to reduce material maintenance cost and this plays a crucial role in the operational safety and productivity [12]. Ergonomic is one of the main components of safety program. The company has started to implement ergonomic as an effective program in the workplace [7]. Nowadays, it is much better to implement ergonomic workplace rather than cost savings like infestation toward the worker, machine and method [13]. The implementation of the ergonomic is of vital importance toward the industry, hence ergonomic assessment have to be the initial step in the safety and health assessment process [7,8].

Review shows that at small scale industry in particular, almost there is no ergonomic principle implemented. Most of the task is manually conducted in this kind of industry [13]. The practice of safety management is not appropriately conducted in most of the small scale industry, particularly at the facility implementation used by small scale industry (SMEs) due to financial problem, lack of awareness, rejection toward change, and lack of worker training, those are the main problems ([25]. Both the internal and external factors influence the fluency of small and middle class business (UKM). The daily operation may risk the UKM in terms of production, safety, and the business itself [11]. One of the form of the safety is the use of aid tool or supporting tool employed during the production process

Small scale and Medium scale industries (SMEs) play a very dominant role in subdistrict Ampek Angkek. Industry and craft are the second superior sector after agriculture sector in sub-district Ampek Angkek. In these two sectors there are 39.6% people who work at convection, embroidery, overlay and *suji*, small scale industry (food) and others [4]. This research conducted in Nagari Batu Taba which is one of the country located in subdistrict IV Angkek. Small scale industry in Nagari Batu Taba is traditional food production: Sakura cake and convection.

One of the steps in the making of sakura cake is printing process of the batter made of flour, egg, butter or margarine and salt. This printing process consumes the biggest portion of making time comparing with other processes such as stirring, frying and caramelizing. The cake printing process is one of the process which requires worker to bend as the result of traditional equipment being used and sitting position which may cause injury risk toward the worker. The purpose of this research is to identify the worker posture/position during work hour at Kue Cangking small scale industry in order to provide solution to improve the worker posture/position, so that it may reduce the musculoskeletal disorder which is often experienced by operator at work. This research use WERA method. The result of the initial Nordic Body Map survey indicates pain at neck, shoulder, wrist, back and leg [16].

The making process of the clothes pattern still conducted manually and using inappropriate working facility. The worker position is sitting on the floor, bent back and folded legs. The disorders appeared due to inappropriate workplace and work facility. In many industry and service sectors, inappropriate working posture can cause problems to many parts of the body, particularly toward musculoskeletal disorders [2]. In order to avoid health and safety issue at workplace, appropriate method and well-designed equipment for the worker are among the solutions. For example by implementing risk estimation tools which designed especially for small scale and medium scale enterprises [15].

Musculoskeletal symptom is the main cause of the inefficient working time and cost expansion. Inappropriate body posture is the most important risk factor which indicates the musculoskeletal symptom existence related with work and workplace [3]. WERA provides a good indication toward musculoskeletal disorders related with the job which probably reported as pain, illness or discomfort at relevant parts of the body [17]. The operator who works for more than 8 hours on repetitive work type with leg position sustaining the operator's body tend to experience fatigue at hip, thigh and leg [12]. The experts and management team agree that WERA tool prototype is easy and fast to be used. This prototype can be used as workplace to variety of job/task and is precious in the workplace [19].

Observation is the most common one to be used in assessing musculoskeletal disorders related with work (WMSDs). The reason is it is cheap and practice to use in different kinds of workplace. However, there is no equipment which includes many physical risk factors in the workplace. Hence, a new observation technique is develop. This new observation technique is well known as WERA method [18]. As a tool, WERA is a pen and paper technique without necessarily using any special equipment. This method can be implemented in every room in the workplace without disturbing the worker. WERA includes many physical risk factor such as posture, repetition, strength, vibration, contact stress and task duration and involving five main body parts that has to be assessed (shoulder, wrist, back, neck and leg) [18].

Musculoskeletal prevalent symptoms are high at neck, hip and activity at hand. The best strategies to reduce musculoskeletal symptom are depend on the activity, appropriate working method, appropriate seat and ergonomic tool [3].

## **2. Methodology**

This research focus on small scale industry about traditional food making and convection at Nagari Batu Taba. The observed workers have been working for more than 10 years with repetitive working pattern. This is a direct observation. The researcher records the working process and interview the worker. The main focus at this primary data collection is to know the production process of sakura cake and the arrangement of fabric that will be turn into pattern. The making of sakura cake takes time until 10 hours per day. Meanwhile, it took 5 hours to move the pattern onto the fabric. These activities cause fatigue and give rise to work risk among the worker. Ergonomic static posture analysis conducted by capture the production process picture using camera. The worker body posture and the movement of the other body parts captured and analyzed by using WERA method. WERA assessment signifies good working indication of musculoskeletal disorders toward pain and discomfort relevant parts of the body [18] No 6, particularly the musculoskeletal disorders related with workplace, especially in the printing making industry [21].

WERA covers the risk of 6 physical factors including posture, repetition, strength, vibration, contact stress and task duration. WERA also involve 5 main parts of the body (shoulder, wrist, back and leg). As a tool, WERA is a pen and paper technique without necessarily using any special equipment. This method can be implemented in every room in the workplace without disturbing the worker. It has assessment system and the act level which provide guidance about risk level and requires act to do a detail assessment [19].

### 2.1. Existing Condition

In the initial conditions of workers in the household business do not pay attention to the work position that can cause the risk of injury as shown in Figure 1.




**Figure 1.** Leg position which causes fatigue and numb


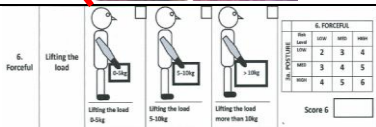



### 3. Result and Discussion

The worker conducts the food making process and the cut process of the pattern right on the floor. These cause the worker's leg to experience pain after working. During working, the worker tends to choose not to lean against the wall but bent to the front. Table 1 shows the possible risk of injury to each part of the body caused by work position and does not pay attention to ergonomic devices.



**Table 1.** Worker Risk Factor (Traditional food making)

No	Risk Factor	Worker position picture	Explanation	Score R
1	Shoulder/neck		The shoulder is moderate bent up with hand position closer to the chest. Hence the score is medium. Next, the repetition does exist. However, pause position during working does exist as well, hence the score is light.	3
2	Wrist		Wrists are moderate bent up or bent down at about $>15^{\circ}$ at the cake making process. The position at printing process is by pressing it. This position is at the moderate working risk position. The repetition does exist in this kind of position at about 11-20 times/minutes. Therefore this position is categorized as moderate.	4
3	Back		The back is moderate bent to the front between $0-20^{\circ}$ and $20^{\circ}-60^{\circ}$ . This position last for 4-8 minutes. Hence, this position is categorized as moderate.	4
4	Neck		The neck is low bent between $0-20^{\circ}$ . In one printing, worker may rest for 60 seconds. Hence this position is categorized as low.	4

**Table 1.** Worker Risk Factor (Traditional food making) (cont.)



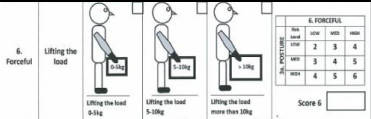
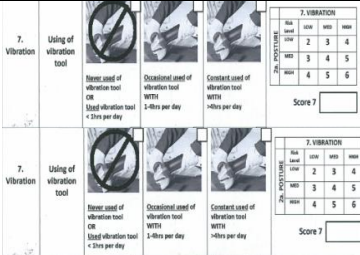

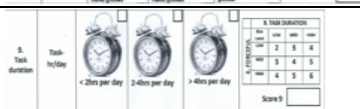
No	Risk Factor	Worker position picture	Explanation	Score R
5	Leg		The next position is leg. The worker's legs are extremely bent forward or sitting with feet do not touch floor. This position last for 4 minutes. This position is categorized as high working risk.	5
6	Forceful		The forceful experienced by the worker during one time production process is at about 0-5 kg. At this position the worker is categorized as low working risk.	2
7	Vibration		There is no vibration caused by the tool since the worker never uses the vibration tool.	2
8	Stress Contact		Stress contact caused by the conditions of workplace environment such as: small, dirty and messy.	2
9	Task Duration		In the production process of dry cake making, worker only work 3-6 hours per day.	4

**Table 2.** Worker Risk Factor (Fabric pattern cut)

No	Risk Factor	Worker position picture	Explanation	Score R
1	Shoulder/neck		The shoulder is moderate bent up with hand position closer to the chest. Hence the score is medium. Next, the repetition does exist. However, pause position during working does exist as well, hence the score is moderate.	4
2	Wrist		Wrists are moderate bent up or bent down at about $>15^\circ$ at the cake making process. The position at printing process is by pressing it. This position is at the moderate working risk position. The repetition does exist in this kind of position at about 20 times per minute.	6



**Table 2.** Worker Risk Factor (Fabric pattern cut) (cont.)

No	Risk Factor	Worker position picture	Explanation	Score R
3	Back		The back is moderate bent to the front between $0-20^{\circ}$ and $20^{\circ}-60^{\circ}$ . This position last for 9-12 minutes. Hence, this position is categorized as high.	6
4	Neck		The neck is extremely bent forward at about $>20^{\circ}$ , and movement with some pauses. Hence, this position is categorized as moderate.	5
5	Leg		The next position is leg. The worker's legs are extremely bent forward at about $>60^{\circ}$ . This position last for one hour. This position is categorized as high working risk.	6
6	Forceful		The forceful experienced by the worker during one time production process is at about 0-5 kg. At this position the worker is categorized as low working risk.	2
7	Vibration		Occasional used of vibration tools with 1-4 hours per day and posture is categorized as high.	5
8	Stress Contact		Soft/sharp shape of tool handle with posture categorized as high.	5
9	Task Duration		The task last for more than 4 hours per day with forceful categorized as high.	6

The scores above show that the risk experienced by the worker with final score 30 are at medium level. Hence, working posture improvement shall be conducted immediately, so the worker will experience no more grievances toward body posture in conducting continuous work in a long term which can cause damage toward the worker's body. The common working position performed by the printing worker is sitting. Most the workers experience grievance toward shoulder, neck, back, wrist due

to inappropriate working facility. The leg position where one leg is bent/fold and the other leg is straight in the printing process should be evaluated. The risk experienced including paralyzed and painful up to the waist particularly when it is about to stand up.

Meanwhile the score obtained by the worker who works to cut and make the cloth pattern is 45. This score is at high level and action task is not accepted, immediately change. It is due to the sitting position where two legs are fold and the position of the back is extremely bent when cutting the fabric. The worker legs position are extremely bent forward as  $>60^\circ$ . This position last for 1 hour, hence it is a high risk work. The worker back position is bent forward between  $0-20^\circ$  and  $20^\circ-60^\circ$ . Next, the worker neck position is  $>20^\circ$ , neck is extremely bent forward and movement with some pauses/moderate.

The result of WERA assessment would be used to assess developed work ergonomic risk to provide the method of fast filtering task on physical risk factor exposure in relation with musculoskeletal disorders. WERA sees object directly and is able to measure the physical risk factor related with the WMSDs in the workplace including body posture, repetition, weight lift, vibration, contact voltage and task duration [20]. In the cake printing process, WERA provides score toward the development of pain discomfort feeling felt at shoulder, wrist, back, neck and leg. This demonstrates that WERA assessment provides a good indication about musculoskeletal disorders related with the work that reported as grievance, illness, or discomfort in the relevant part of body. Following are the final scores of WERA body parts that have been analyzed in the cake making and cutting the fabric pattern:

**Table 3.** WERA Body Parts Final Score

No	Item WERA	Score		No	Item WERA	Score	
		Cake making	Cutting the fabric			Cake making	Cutting the fabric
1	Shoulder	3	4	6	Forceful	2	2
2	Wrist	4	6	7	Vibration	2	5
3	Back	4	6	8	Contact Stress	2	5
4	Neck	3	5	9	Task Duration	4	6
5	Leg	6	6		Total	30	45

The Head of Industry, Agam's UMKM Industry and Trade Cooperative Office, Ediwar in Lubuk Basung, said on Monday that 5,850 SMIs consisted of 2,297 food or food industries, 2,635 clothing or clothing industries. "This industry is spread in 16 districts with a workforce of 24,975 people. In order for the early industry to remain active, it will provide guidance and provide training on how to produce good products and have selling points.

In principle, the attention is not only to the quality of the product, but to how the equipment used by workers does not pose a risk of injury to their limbs. Research conducted on SMEs shows that workers do not pay attention to the risk of injury caused by the use of non-ergonomic work tools.

#### 4. Conclusion

The purpose of working posture assessment is to provide act level toward worker body posture during activity. Act level is obtained by filling the NBM questionnaire which later processed by using WERA measurement. Score determination is a stage to know the risk level of analyzed factor, so that the appropriate act can be discovered in order to reduce the risk factor.

In the cake making process and the cut of fabric pattern, the worker conducts the activity on the floor. The worker has to bend and the two legs are extremely bent. These may cause injury. The worker would suffer pain after working. The scores obtained shows that the risk experienced by the worker with final score 30 are at medium level. Hence, immediate working posture improvement is of vital importance. The purpose is to avoid worker grievance on the body part in conducting a continuous work in a long term which can cause disorders to the worker's body part.



The common work position performed by the printing worker is sitting. Most of the workers experience grievance toward shoulder, neck, back, wrist due to the inappropriate working facility. Like the traditional print tools made of coconut shells and workplace facilities there are on the floor or on the table without thinking of the risks that will occur if this continues to continue. The legs position in this printing process is indeed to be considered in which one leg is folded and the other one is straight. The possible risks in relation to these legs position are paralyzed and painful up to the waist when it is about to stand up.

Meanwhile the score obtained by the worker who works to cut and make the cloth pattern is 45. This score is at high level and action task is not accepted, immediately change. The high score was found at leg, back, and neck positions. Both the workplace and these working position are really risky and dangerous toward the workers.

Hence, improvement may take place toward the facility such as the workbench/desk. This desk has to be adjusted with the body posture of the worker. The height of this desk has to be adjusted with the elbows. Meanwhile, the width and the length of the desk has to be in line with the hand position. This design is to facilitate the worker to conduct the operation of the working activities. Moreover, this design is also to reduce the grievance particularly toward neck, leg, shoulder, wrist and back which is caused by the non-ergonomic position during working.

The printing worker sits for all the time in conducting the job. Most of the worker experience grievance or pain at shoulder, neck, back, wrist and leg since the worker still has to deal with inappropriate facility. For example, the use of traditional printing tool which is made of coconut shell, working on the floor or on the desk without aware about the long term effect.

The 2 SMEs taken in this research show that the workplace, the work facility and the worker work risk caused by tend to be neglected. These used to be considered as common and generally accepted. Hopefully with this paper, researchers, SME, and government can pay more attention to the aspect of ergonomics and health to the perpetrators in this industry. It is expected that in the future research, the practitioners of the SMEs would be able to determine the working productivity of their companies. However, the performance indicator of the SMEs should be first determined since the work indicator of the SMEs is slightly different from the big companies. Furthermore, this research can also be developed to examine the use of work facilities and their impact on the overall worker's limbs.

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