Work Posture Analysis by Using Rapid Upper Limb Assessment (RULA) and Rapid Entire Body Assessment (REBA) Methods (Case Study: Rice Milling In Malang - East Java of Indonesia)

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Work Posture Analysis by Using Rapid Upper Limb Assessment (RULA) and Rapid Entire Body Assessment (REBA) Methods (Case Study: Rice Milling In Malang - East Java of Indonesia)

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Abstract. Problems rising in the process of moving grain sacks in rice milling in Malang, there was a monotonous work activities and it was still handled without tools. In one day, the workers' average of moving grain sack was 82 and the distance between the place of weighing and grinding was as far as 11 meters and the weight of the grain sacks moved was 40 kg_s. To do working posture analysis to the rice miling workers, Rapid Upper Limb Assessment (RULA) and Rapid Entire Body Assessment (REBA) methods were used. The results of the observation and calculation of working posture by using RULA method on a stage of lifting sack obtained score 7 with high risk level, and on a stage of carrying sack obtained score 7 with high risk level. The results of the observation and calculation of working posture by using REBA method on a stage of lifting sack obtained score 8 with high risk level, and on a stage of carrying sack obtained score 10 with high risk level. Based on the results of the calculation using REBA and RULA methods, immediate repairs on the transfer process of grain sacks of rice miling in Malang was needed.

1. Introduction

Rice milling in Malang is one of the activities in rice harvest season, so the rice milling services are very useful for farmers. In rice harvest season, rice milling does additional hours, originally from 14.00 – 17.00 be 08.00 – 17.00. Nowadays, the system of the production process on the rice milling is still traditional, it can be seen from the production process of workmanship which most are still handled manually, in the sense that many still use human power. On Grinding, there are two work stations in the production process, namely milling and weighing station. In weighing station, the process of sacks weighing occurs before the grain is brought to milling station. At the milling station, there are two machines used. The first machine is used to separate the grain from the chaff, and the second machine is used to process the results from the first machine. [1-2]. The results of this form of milling are rice and bran.

The transfer activities of extra grain sacks from weighing station to miling station is the most strenuous activities. This is because the average weight of the grain sacks lifted and transferred is 40 kg and the distance from where the weighing machine is about 11 meters. Outside of the harvest season, in one day the workers are able to move grain sacks in 21 times, and in the harvest season the workers can move up to 82 grain sacks. The workers do not use a tool for lifting and moving a sack of grain so that their body gets many aches especially at the harvest season. To find out the main problems, an analysis on

the working posture by using Rapid Upper Limb Assessment (RULA) and Rapid Entire Body Assessment (REBA) methods was conducted [3-4].

2. Research Objectives

Research begins with conducting preparation to get information early, so the problem solving can be identified, formulated and determined by considering the literature of studies. Further, data collection is conducted by doing a direct observations on the working posture of workers when they perform the transfer of grain sacks in rice milling. Working postures observed include the upper arm, forearm, wrist, neck, back and legs. The observations on the working posture is conducted in two stages, namely: lifting sacks and shouldering sack.

3. Technique of Data Analysis

Rapid Upper Limb Assessment (RULA), Data Processing of RULA method covers 3 parts, they are:

a. The development of method for working posture logging, body is divided into two parts, namely, Group A and group B. Group A includes upper arm, forearm, and wrist [1-2] while Group B includes neck, torso and legs.
b. The development of system for classification of parts of the body posture' score is conducted by determining the score for each group A and group B. Then the score is entered into table A to obtain score A and table B to obtain score B.
c. The development of Grand Score and List of Actions. Score determination to obtain the value of Action Level and the action that should be performed [2-3].
d. Rapid Entire Body Assissment (REBA). Data Processing using REBA method [4-5].
e. Inputs from REBA method is the working posture is of the upperarm, forearm, wrist, neck, back, legs, heavy load lifted, and *coupling* used based on observations in the workplace [6].
f. Data processing of working postures obtained by using REBA method is by providing appraisals according to the working posture [7-8]
g. Generating form of action level category. There are four categories of action level along with recommendation of actions that should be taken against these postures [9-10].

4. Results and Discussions

Characteristics of respondents in Rice Milling in Malang, East Java.

(a) Stage 1 (b) Stage 2

Figure 1. Work posture moving sacks of grain.

Table 1. Calculation of RULA and REBA Posture on stage 1.

Step	RULA			REBA		
	The location of the	Description	Score	The location of the	Description	Score
1	Upper arm	Great corner position upper arm against the burden of 47^0 = (0^0 + 1, 20^0 -45^0 = + 2, 45^0–90^0 = + 3, > 90 = + 4) = + 3	3	Neck	Great corner position the movement of the neck against the back of the magnitude of 0^0 = (0^0-20^0 = +1, > 20^0 = +2) = +1	1
2	Lower arm	Great corner position forearm 24^0 = (0^0–60^0 = +2, 60^0-100^0 = +1, > 100 = +2) = +2	2	The back	Great corner position back with vertical line the magnitude of 26^0 = (0^0 = +1, 0^0–20^0 = +2, 20^0- 60^0 = +3, > 60^0 = +4) = +3	3
3	Palm of the hand	The position of the hands straight 30^0 = 1, to down/up < 15^0 = +2, down/to over 15^0 > = + 3	3	Walk	The foot of the tetopang when walking or sitting with balanced, + 1	1
4	Rotation of the Palms	Rotating half = +1, spinning full = +2	1	Table A from table REBA	The value of table A taken from the coordinates a line from step REBA 1, 2, 3.	2
5	Table A from table RULA	The of A table taken from the coordinates of the line straight from the step points 1, 2, 3.4	4	Load	Load value 40 kg = +2	2
6	The Value Of Muscle	Static posture, one or more parts static body, = +1	1	The Value Of A	Value score A retrieved from the addition of the step 4 and step 5, = +4	4
7	Power	The value of labor load > 10 kg = +3	3	Upper Arm	Great corner position upper arm against the burden of 47^0 = (0^0 = +1, 20^0-45^0 = +2, 45^0-90^0 = +3, > 90^0 = +4) = +3	3
8	Value Line C	Taken from the summation of points No. 5, 6, 7 = 4 + 1 + 3 = + 8	8	Lower Arm 24^0	Great corner position lower arm against the upper arm amounted to 24^0 = (0^0 - 60^0 = +2, 60^0-100^0 = +1, > 100^0 = +2) = +2	2
9	Neck	Great corner position the movement of the	1	Palm of the hand	The position of the Palm hands down	2

		neck against the back of the magnitude of 0^0 = (0^0-10^0 = +1,10^0-20^0 = +2, > 30^0 = +3, look up = +4) = +1			or to the top of 30^0 = (0^0-15^0 = +1, > 15^0 = +2) = +2	
10	The back	Great corner position back with vertical line magnitude 26^0 = (0^0 =+1, 0^0-20^0 = +2, 20^0-60^0 = +3, > 60^o = +4) = +3	3	Table B from table REBA	The value of table B taken from the Coordinates line of REBA step no. 7, 8, 9	5
11	Walk	If normal = feet +1, if not balanced = +2	1	Handle	Position hands (handle couple) = +2	2
12	Table B Table A from table RULA	Table B values taken from the coordinates of the line straight from no points 9, 10, 11	3	The value of B	The value of the step no. 10 plus the value of the No. 11 = 5 + 2 = +7	7
13	The value of muscle	Static posture, one or more parts static body, = +1	1	The value of C	The value of table C taken from the coordinates of the straight line No. 6 and no. 12	7
14	Power	Power value, the load > 10 kg, = +3	3	The value of the activities	Activity score	1
15	The value of the C column	Taken from the summation of the step No. 12, 13, 14	7	Final Score REBA	Score at table C Plus The Quantity Activity Score	8
	Final Score RULA		7			

Table 2. Calculation of RULA and REBA Posture on stage 2.

Step	RULA			REBA		
	The location of the	Description	Score	The location of the	Description	Score
1	Upper Arm	Great corner position upper arm against the burden of 127^0 = (0^0 = +1, 20^0-45^0 = +2, 45^0–90^0 = +3, > 90^0 = +4) = +4	4	Neck	Great corner position the movement of the neck against the back of the magnitude of 0^0 = (0^0-20^0 = +1, > 20^0 = +2) = +1	1
2	Lower arm	Great corner position forearm 21^0 = (0^0 – 60^0 = +2, 60^0-100^0 = +1, > 100^0 = +2) = +2	2	The back	Great corner position back with vertical line the magnitude of 69^0 = (0^0 = +1, 0^0–20^0 = +2, 20^0- 60^0 = +3, > 60^0 = +4) = +3	2

3	Palm of the hand	The position of the hands straight 24^0 = 1, to down/up < 15^0 = +2, down/to over > 15^0 = +3	3	Walk	The foot of the tetopang when walking or sitting with balanced, +1	3
4	Rotation of the Palms	rotating half = +1, spinning full = +2	4	Table A from table REBA	The value of table A taken from the coordinates a straight line from step REBA 1, 2, 3.	4
5	Table A from table RULA	The valueof A table taken from the coordinates of the line straight from the step points 1, 2, 3.4	4	Load	Load value 40 kg = +2	5
6	The Value Of Muscle	Static posture, one or more parts static body, = +1	1	The Value Of A	Value score A retrieved from the addition of the step 4 and step 5, = +5	5
7	Power	The value of labor load > 10 kg, = +3	3	Upper Arm	Great corner position upper arm against the burden of 127^0 = (0^0 = +1, 20^0-45^0 =+2, 45^0-90^0 = +3, > 90^0 = +4) = +4	4
8	Value Line C	Taken from the summation of points No. 5, 6, 7 = 4 + 1 + 3 = +8	8	Lower Arm 21^0	Great corner position lower arm against the upper arm amounted to 21^0 = (0^0–60^0 = +2, 60^0-100^0 = +1, > 100^0 = +2) = +2	2
9	Neck	Great corner position the movement of the neck against the back of the magnitude of 0^0 = (0^0-10^0 = +1,10^0-20^0 = +2, > 30^0= +3, Looked Up = +4) = +1	1	Palm Of The Hand	The position of the Palm hands down or to the top of 24^0 = (0^0-15^0 = +1, > 15^0 +2) = +2	2
10	The back	Great corner position back with vertical line magnitude 69^0 = (0^0 = +1, 0^0-20^0 = +2, 20^0-60^0 = +3 , > 60^0= +4) = +4	3	Table B from table REBA	The value of table B taken from the Coordinates line of REBA step no. 7, 8,9	6
11	Walk	If normal = feet +1, if not balanced = +2	1	Handle	Position hands (handle couple) = +3	3

12	Table B Table A from table RULA	Table B values taken from the coordinates of the line straight from no points. 9, 10, 11	3	The value of B from table REBA	The value of the step no. 10 plus the value of the No. 11 = 6 + 3 = +9	9
13	The value of muscle	Static posture, one or more parts static body, = + 1	1	The value of C from table REBA	The value of table C taken from the coordinates of the straight line No. 6 and no. 12	9
14	Power	Power value, the load > 10 kg, = +3	3	The value of activities	Taken from the summation of the step No. 12, 13, 14	1
15	The value of the C column	Taken from the summation of the step No. 12, 13, 14	7	Final Score REBA	Score at table C Plus The Quantity Activity Score	10
	Final Score RULA		7			

In the daily life, activities of lifting and transferring have become the main activity for the human. In the world of work, lifting and transferring activities are principal matter or can be called essential, because almost every job found the transferring activities. Transferring and lifting activities are usually found at the plantation, mining, industrial, port, market, even in government offices and private. If the job of lifting and transferring are not done properly and carefully, it can lead a work accident or occupational disease [1-2]. Therefore, lifting and transfering techniques as well as the correct ergonomic lifting and transferring are indispensable to realize the effectiveness and efficiency of a work. Lifting and transferring activities are affected by many things, such as: allowable load transport, distance and intensity of loading, conditions of work's environment that is slippery, rough, up and down, work skills, work equipment, the size of the load to be transported and the method of transport [5-6]. The result finding showed difference when shouldering the existence with additional time for 6 hours again from 14.00 – 17.00 be 08.00-17.00 [7]. The activities of the transfer of extra grain sacks weighing to the mill is the most strenuous activities as showed in figure 1(a) and (b). This is because the average weight of the grain sacks lifted and transferred is 40 kg and the distance from the weighing machine is about 11 meters [8-9]. Outside the harvest season, the workers are able to move grain sacks in 21 times, and in the harvest season, they can move 82 grain sacks. The workers did not use the tools for lifting and transferring a sack of grain, so that complaints occur on the body especially at the harvest season.

To find out the existing problems, then an analysis on the working posture by using Rapid Upper Limb Assessment (RULA) and Rapid Entire Body Assessment (REBA) was conducted [1-2]. Lifting bag and shouldering a sack is using REBA method [2]. Input from REBA method of working posture is upper arm, forearm, wrist, neck, back, legs of heavy load lifted, and the coupling used based on observations in the workplace [3-4]. Previous investigators said that the high risk happened at the moment of the lift or at the time of the bear, some parts of the body most affected are at risk from lifting and carrying are not true i.e. spine [5-6,11]. This is certainly very dangerous because the spine has hyracodon nerves that connect the sensory nerves and motor with the regulator of central nervous or brain. Besides that, there are also other risks that can occur if the process of lifting and transferring performed incorrectly [7,12]. As for example, the spinal damage due to the technique of lifting and carrying the loads that are too heavy, among others, over exertion of lifting and carrying, namely body tissue damage caused by excessive cargo load, HNP (Herniated Nucleus Pulposus) that is tearing the inner part of the plate jutting out and may suppress the nerves surrounding the result of excess cargo load and loading all of a sudden [6,7]. Back Injury i.e. the onset of pain in the lower back, it happens when work or attitude of lifting is improperly influenced by the direction of the load lifted [8-9,13]. After conducting the analysis using RULA and REBA methods on the working posture, lifting bag and shouldering the sack, the result in table 1 final score RULA = 7, REBA= 8, and table 2

final score RULA= 7, REBA= 10 showed that the dangerous risk level of handling should be done so immediately and needed improvements in the grain sack transferring of rice milling in Malang.

5. Conclusions

On the working posture of lifting bag and shouldering the sack, the analysis using RULA and REBA methods obtained dangerous risk level of handling should be done so immediately and needed improvements in the transfer of grain sacks rice milling in Malang.

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