

Analysis of Operator Body Posture Packaging Using Rapid Entire Body Assessment (REBA) Method: A Case Study of Pharmaceutical Company in Bogor, Indonesia

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ABSTRACT

In production activities, there is manual material handling activities which can cause work accidents. Pharmaceutical Company in Bogor has a packaging material warehouse that is still doing activities manually, such as using a hand pallet, taking cartons from trucks, moving cartons, putting cartons on a pallet. This activity causes injury to the muscles known as Musculoskeletal Disorders (MSDs). In 2018 the high absence of operators in the warehouse of packaging materials reached 26.89%, caused by injuries to the muscles of the body or Musculoskeletal Disorders (MSDs). The injury resulted in an inefficient packaging material warehouse, which could affect the production process, so a study was conducted to analyze the posture of the container material warehouse operator in carrying out its activities using the REBA method of the three packaging material warehouse operators. The REBA method is a method in the field of ergonomics that is used quickly to assess the posture of a worker's neck, back, arms, wrists, and legs. Based on these problems, the purpose of this study is to analyze the operator's posture when carrying out work activities in the packaging material warehouse using the REB method and provide suggestions for improving the activities that cause complaints.

Key Words: Rapid Entire Body Assessment (REBA), Manual Handling, Musculoskeletal Disorders (MSDs), Boxed Material Storage.

1. INTRODUCTION

In the current era of globalization, good working conditions are a right for workers who must be obtained. The company must provide a safe and comfortable working environment and conditions for workers to do their jobs. Working conditions need to be considered because they are strictly related to work health and safety. Workers will be more comfortable working if they have favorable working conditions.

Supporting working conditions can be in the form of tools that suit the needs of workers. At this time, the dominance of the use of labor in a production process is still mostly done manually; this activity requires a significant human role. One form of social function is the activity of material transfer manually (Material Manual Handling). Manual Material Handling (MMH) is a transportation activity carried out by one or more workers by carrying out lifting, lowering, pushing, pulling, transporting, and moving goods (Siska, 2018). The advantage of material handling compared to material handling equipment is the flexibility of movement that can be done for light loads. Still, the lack of manual material handling can cause work accidents for operators.

Work accidents that occur in employees are caused by improper material manual handling (MMH) activities. As a result of manual handling can cause complaints on the musculoskeletal. Operators who receive repetitive static loads over long periods cause damage to the joints, ligaments, and tendons. A disease that can be caused by musculoskeletal injury (MSDs) is called Low Back Pain or back pain (Wahyuniardi, 2018). The causes of occupational diseases consist of various kinds, including physician groups, chemical groups, biological groups, physiological disorders (ergonomics), and psychological disorders. Physiological disorders (ergonomics) are problems that often occur in causing musculoskeletal disorders in workers (Joanda & Suhardi, 2017). Working conditions that often lift, carry, pull manually, repeat the same movements throughout the workday, work in odd or static positions, lift heavy or awkward items, use excessive force to perform tasks, be exposed to excessive vibration, or work in

extreme temperatures. The work of assembling with high assembling speed is an ergonomic problem that will occur a lot (Wahyuniardi, 2018).

According to the International Labor Organization (ILO), every year, 1.1 million deaths occur due to illness or accidents due to work relationships. Around 300 thousand deaths occur from 250 million accidents, and the rest are deaths due to disease due to work relationships. In the profile of health problems in 2005 showed that about 40.5% of illnesses suffered by workers related to their work, health problems experienced by workers according to a study of 482 workers in 12 districts/cities in Indonesia, generally in the form of disorders Musculoskeletal Disorders (MSDs) (16%) (Rinawati & Health, 2016).

Pharmaceutical Company in Bogor produces liquid and reliable medicines. This company has the vision to provide the best service to the community, so that attention is needed on human resources. The company has a warehouse for packaging materials that actively receives packaging materials from suppliers, lifts, pushes the goods required for drug packaging activities carried out by operators every day. Therefore it must be considered the condition of the operator who works so as not to experience diseases associated with musculoskeletal. The picture shows one of the manual handling activities at PT Farmasi in Bogor.

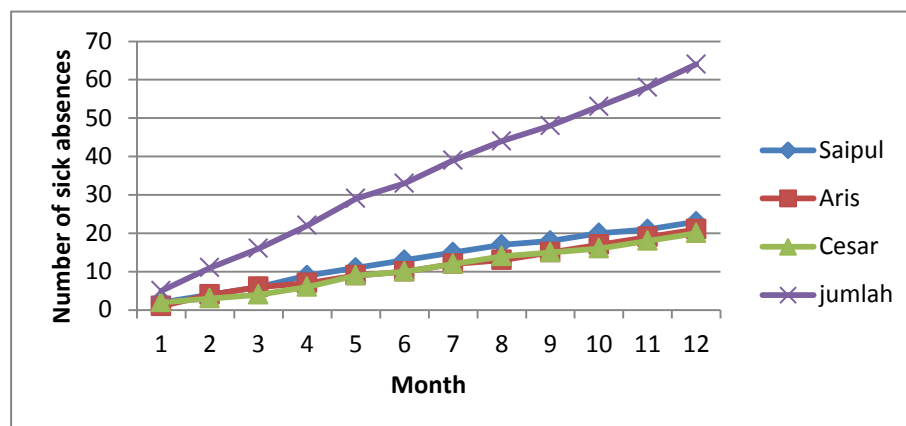


Figure 2 Cumulative absences for 2018

Figure 2 explains that:

- I. Operator Saipul was absent 23 times in 2018 due to illness.
- II. Operator Aris was absent 21 times in 2018 due to illness.
- III. The Caesar operator was absent 20 times in 2018 due to illness.
- IV. The level of operator absence in one year is 64 times.

Figure 1.2 shows the cumulative graph of the absence of the packaging warehouse operator on the grounds of illness. The total percentage of absences is 26.89% of the maximum absenteeism in one section, which is 20%. Therefore, it is necessary to research the analysis of work postures on the PT. Bogor Pharmacy using REBA. In his research, Majid, A. et al. (2018) concluded that using body posture analysis using the REBA method can analyze body posture and provide suggestions for improving activities that cause complaints. By doing this work posture analysis, it will be known the physical condition of the operator and

the actions that can cause complaints that require treatment to prevent excessive pain in the body, which will reduce the risk of work accidents. The effectiveness of workers will be better.

2. LITERATURE SURVEY

2.1. The Rapid Entire Body Assessment

The Rapid Entire Body Assessment (REBA) is a method in the ergonomics field that is used quickly to assess the posture of the worker's neck, back, arms, wrists, and feet. The REBA method was introduced by Sue Hignett and Lynn Mc Atamney and published in Applied Ergonomics in 2000. This method is the result of collaborative work by an ergonomic team, physiotherapists, occupational experts, and nurses who identify about 600 positions in the manufacturing industry. According to Tarwaka (2010), the REBA method is a postural analysis tool that is very sensitive to work that involves sudden changes in position, usually due to handling unstable or unexpected containers. This method's application is intended to prevent the risk of injury-related to position, especially on the skeletal muscles. Therefore, this method can be useful for risk prevention and can be used to warn that there are inappropriate working conditions in the workplace (Rinawati & Health, 2016).

The REBA method has followed the characteristics, which have been developed to provide answers for the need to obtain equipment that can be used to measure the aspects of the physical loading of workers. Analysis can be made before or after interference to demonstrate the risk that has been stopped from an injury that arises. This gives speed to the systematic assessment of the risk of the whole body's posture that workers can get from their work.

3. OBJECTIVE OF THE RESEARCH

The objective of the research is to study and analysis of work postures on the PT. Bogor Pharmacy, Indonesia, using REBA.

The Rapid Entire Body Assessment (REBA) is adopted for evaluating risk, especially in the musculoskeletal system.

1. The Body segments that will be coded individually, and evaluate the upper members and the body, neck, and legs.
2. This method is used to analyze the effect on postural load during the handling of containers carried by hand or other body parts.
3. The study is conducted to evaluate muscle activity caused by static, dynamic body positions, or sudden or unexpected changes in posture.
4. to determine the level of risk of injury by setting the corrective action level needed and intervening for immediate improvement.

3.1 RESEARCH METHODOLOGY

This study uses the Employee Assessment Worksheet (REBA) method because it evaluates all parts of the body. Moreover, use the Nordic Body Map as the initial questionnaire to discover complaints of Musculoskeletal Disorders (MSDs) for each operator. The data processing is done manually by using a score to assess the risk level (risk level) to find out each operator. The results will then be added using the REBA Employee Assessment table, after which the results of the scoring can be seen in the Level of MSD risk table to see the level of risk from MSDs. Data processing as follows:

1. Give value to Group A, which consists of the torso, neck, and legs. The value is entered into Table A. After the values obtained from Table A are then added to the weight of the load raised.
2. Give value to Group B, which consists of the upper arm, lower guard, and wrist. The value is entered into Table B. After getting the value from Table B, then added to the value of the Hand Grip.
3. After the value of Group A and Group B is obtained, then it is entered into Table C. Then, the value of C. Then, the value of C is added to the Activity Value.
4. After the C value is added to the Activity Value, REBA values and risk categories are obtained.

Table 1 Work standards based on final scores

Final Score	Level of risk	Risk Category	Action
1	0	Very low	No action is required.
2-3	1	Low	Action may be required.
4-7	2	Moderate	Action required.
8-10	3	High	Immediate action is required.
11-15	4	Very High	Action is needed as soon as possible.

4. RESULT AND DISCUSSION

The results in this chapter concern the results of the questionnaire and the results of body posture measurements using the REBA method.

Table 2 The questionnaire Nordic Body Map

No	Operator	Score	Level of risk	Risk Category	Action
1.	Saipul	48	2	High	Immediate action is required.
2.	Aris	48	2	High	Immediate action is required.
3.	Cesar	42	2	High	Immediate action is required.

Table 2 shows that the level of MSDs by using a questionnaire on each operator has a high score in the high-risk category, indicating the need for follow-up to determine the activities that cause MSDs problems. In table 3 shows the pain in the body that has the most significant percentage. With a score of 1, which is a pain but does not interfere with work, the most significant pain is in the right upper arm, left upper arm, left knee, right knee, left leg, right ankle. While the highest score on score 2 is pain that can interfere with work but can disappear when resting, namely in the upper neck, neck, back, left forearm, right forearm, left hand, right hand, left thigh, right thigh, left calf, right calf, left foot and right foot.

Table 3 The Questionnaire Percentage Nordic Body Ma

Musculoskeletal System		Percentage			
0	Pain / stiffness in the upper neck	0	1	2	3
1	Neck pain			100%	
4	Pain in the left upper arm			100%	
5	Back pain		100%		
6	Pain in the right upper arm			100%	
12	Pain in the left forearm		100%		
13	Pain in the right forearm			100%	
16	Pain in the left hand			100%	
17	Pain in the right hand			100%	
18	Pain in the left thigh			100%	
19	Pain in the right thigh			100%	
20	Pain in the left knee			100%	
21	Pain in the right knee		100%		
22	Pain in the left calf		100%		
23	Pain in the right calf			100%	
24	Pain in the left ankle			100%	
25	Pain in the right ankle		100%		
26	Pain in the left leg		100%		
27	Pain in the right leg			100%	

Table 4 Result Body Posture REBA

No.	Activity	Score	Level of risk	Category Risk
1	Activities encourage hand pallet to put the pallet.	3	1	Low
2	The activity of delivering goods by hand pallet is carried out by 2 operators (pushing operators).	10	3	High
	The activity of delivering goods by hand pallet is carried out by 2 operators (interesting operators).	9	3	High
3	The activity of arranging packaged goods comes from trucks by hand and arranged on a pallet.	11	4	Very high
4	The activity of putting cartons that will be used on a pallet to be carried by using a hand pallet.	9	3	High
5	Lift cartons to be taken down to see a batch of cartons.	7	2	moderate
6	The activity of pushing cartons on a hand pallet.	10	3	High
7	The activity of pulling a hand pallet into a packaging material warehouse.	9	3	High
8	Hand pallet pull activity (2nd operator).	7	3	High
9	The activity of moving cardboard from behind by using a thrust is moved to the front	9	3	High
10	Push packaging material on the hand pallet.	9	3	High
11	The activity of putting packaging materials in place	9	3	High
12	Activity taking samples from trucks.	9	3	High
13	The activity of laying the top stacked cardboard.	9	3	High

Table 4 is a table of REBA calculation results showing that almost all activities in the Pack Material Warehouse have a high risk, affecting the operator's health, especially the operator's high pain complaints. This problem is the reason for the operator's high absenteeism because of the high complaints on body pain called MSDs.

In the results of body posture measurements using REBA in table 4, it can be seen that the activities carried out in the packaging material warehouse have a high risk and require immediate action because it will cause risks that can be more dangerous. Activities in the packaging material warehouse are carried out manually, where the packaging material carried almost entirely weights above 5 kg. The highest risk activity is the activity of arranging containerized materials from trucks manually, because the activity will cause the body shape to bend 102.81° so that the arrangement does not fall apart, making the arms have to be wide open following the shape of the carton carried, making the arms and hands must carry durable packing materials in its preparation, the foot that has to be bent in order to lay down the carton and support the body. This activity takes place often in a day. This will make the tendons can be damaged.

Activities in the Container Material Warehouse have a high risk of MSDs, as shown in the Nordic Body Map Questionnaire, which shows a high risk of MSDs. This activity is because all activities are carried out manually by using human power directly, and these activities are carried out repeatedly in a day. The operators' standard posture requires considerable movement in using the arms, the shape of the legs that are bent, and the shape of the body so that it greatly influences the level of MSDs.

Warehouse storage activities can cause MSDs that will affect the health of container storage operators so that they will affect warehouse storage activities, which can affect other activities at PT. Pharmacy in Bogor. Improvements are needed to reduce the risk of higher MSDs.

The researchers' proposed improvement is to review from the ergonomics side for the storage of packaging materials as follows:

1. The proposed improvement given by researchers is to improve the work station. The thing that needs to be improved is the preparation of packaging materials according to the production schedule; this is done to eliminate or reduce activities that move goods from one place to another but are still in the same warehouse environment so that if the packaging materials are arranged according to the production plan, the activities this does not happen, and this reduces excess posture and can reduce MSDs.

Table 5 Proposed Improvements

No	Before	After
1		This activity was not carried out because the packaging materials had been arranged according to the plan.
2		The activity of raising / lowering packaging materials is not necessary if the arrangement is following the correct arrangement.

2. Reducing the load being pulled or pushed by using a hand pallet. This load reduction will affect the operator's posture; the posture will be more upright so that it can reduce the Flexi of the body's final shape so that the original body score of 9 becomes 5.



Figure 3 Proposed Improvements

3. It provides portable ladder aids to take containers that are on a rack that has a height higher than the height of the operator so that the operator's neck posture does not lift because the neck can be parallel to the tool carried. The upper arm does not form an angle above 100° . The activity before the improvement has a 9; when using a portable ladder, it scores 5.



Figure 4 Proposed improvement

4. Provide training to operators on how to obtain or install jewelry properly.



Figure 5 Illustration of placing / retrieving jewelry

With an upright posture, an upright head, and bent legs will reduce the level of risk, as illustrated by using Catia in figure 6



Figure 6 Illustration of placing items correctly

The final score becomes four, and the risk level becomes 1. In this study, the body posture in placing items has a score of 9 and 11 because the bent posture is up to 76.63° and 102.81° , and the bent head also affects the level of MSDs. A good position in lifting

or putting things is with the legs bent first, the body and neck upright, the hand holding the bottom of the carton, and the body or head not rotating.

5. Providing space by ordering goods twice delivery because the truck is too full, and there is no space for the operator to carry out activities. Provision of this space to put the sample from the truck that is taken out by the operator to be placed on a pallet, thereby reducing the activity to reach by the operator. Initial body score from 9 to 5.



Figure 7 Proposed Improvements

5. CONCLUSION

1. Based on the results of the analysis using the Rapid Entire Body Assessment (REBA) method, the posture of the packaging material warehouse operator has a high level of risk in almost all activities in the packaging material warehouse; this is due to the burden being pulled or pushed more than 100 kg. Activities in the warehouse of packaging materials include bending over to place items, pulling a hand pallet, pushing a hand pallet, lifting goods. This activity causes a high level of risk in the packaging material warehouse operator posture.

2. The proposal given is to reduce the goods carried by the operator so that the operator's posture remains straight, as well as the ladder to assist the operator in reaching items that are above the height of the packaging material warehouse operator. The existence of training or training on how to lift or put things to avoid the body shape that is bent and twisted, the preparation of packaging materials according to the planning schedule to reduce activity in the warehouse of packaging materials, and make room in the truck in the process of decreasing containerized materials from the truck carried out by the operator.

Suggestions

The suggestions given for further research are:

1. Implementing the proposals submitted in this study to find out these proposals can help overcome problems that occur at the PT. Pharmacy in Bogor.
2. Analyze the posture of all departments at PT Farmasi Bogor to determine the workers' situation so that the workers can work comfortably. Comfortable workers will help the company productivity run well.
3. The need for training or learning about how to work well so that workers know the working posture fits ergonomics. Activities with excellent ergonomics can create welfare for workers.

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REFERENCES

1. Bridger, R.S. (2003). *Introduction to Ergonomics*. International Second Editions. New York: MCGraw-Hill Book Co.
2. Hignett, S., & McAtamney, L. (2000). *Rapid Entire Body Assessment (REBA)*. *Applied Ergonomics*, 31(2), 201–205.
3. Iridiastadi, H., Yassierli. (2014). *Ergonomi Suatu Pengantar*. Bandung: PT. Remaja Rosdakarya.
4. Haekal, J., & Setio, H. (2017). Selection of Raw Material Suppliers Using Analytical Hierarchy Process in Food and Beverage Company, South Jakarta. *ComTech: Computer, Mathematics and Engineering Applications*, 8(2), 63-68.

5. HAEKAL, J. (2018). *PERANCANGAN DAN EVALUASI IMPLEMENTASI SISTEM MANAJEMEN MUTU ISO 9001: 2015 MELALUI KEPUASAN PELANGGAN DI UNIVERSITAS ISLAM AS-SYAFI'YAH* (Doctoral dissertation, Universitas Mercu Buana Jakarta).
6. Joanda, A. D., & Suhardi, B. (2017). Analisis Postur Kerja dengan Metode REBA untuk Mengurangi Resiko Cedera pada Operator Mesin Binding di PT. Solo Murni Boyolali. *Paper presented at the Seminar dan Konferensi Nasional IDEC*.
7. Kazemi, S., Savas, S., & Aydos, L. (2016). Evaluation of Ergonomic Postures of Physical Education and Sport Science by REBA and Its Relation to Prevalence of Musculoskeletal Disorders. *International Journal of Science Culture and Sport*, 4(3), 2148-1148.
8. Kuswana, SW. (2014). *Ergonomi dan K3 Kesehatan Keselamatan Kerja*. Bandung:PT. Remaja Rosdakarya Offset.
9. MacLeod, Dan. (2000). *The Rules of Work: A Practical Engineering Guide of Ergonomic*. Taylor and France, New York: USA.
10. Majid, A., & Arifah, D. A. (2018). Posture Analysis Of Manual Handling At PT. X's Workshop By Reba Method. *Journal of Industrial Hygiene and Occupational Health*, 2(2), 177-191.
11. Musyarofah, S., Setiorini, A., Mushidah, M., & Widjasena, B. (2019). Analisis Postur Kerja Dengan Metode Reba Dan Gambaran Keluhan Subjektif Musculoskeletal Disorders (Msd)(Pada Pekerja Sentra Industri Tas Kendal Tahun 2017). *Jurnal Kesehatan*, (1), 24-32.
12. NIOSH. (1997). *Musculoskeletal Disorders and Workplace Factors: A Critical Review of Epidemiologic Evidence for Work Related Musculoskeletal Disorders*. USA: CDC.
13. OSHA. (2000). *Ergonomics: The Study of Work*. U.S Departement of Labor. Occupation Safety and Health, Administration: USA.
14. Restuputri, D. P. (2017). Metode REBA Untuk Pencegahan Musculoskeletal Disorder Tenaga Kerja. *Jurnal Teknik Industri*, 18(1), 19-28.
15. Rinawati, S. (2016). Analisis Risiko Postur Kerja Pada Pekerja Di Bagian Pemilahan Dan Penimbangan Linen Kotor RS. X. *Journal of Industrial Hygiene and Occupational Health*, 1(1), 39-52.
16. Sahebagowda, V. K., & Kapali, C. (2016). Ergonomics Study for Injection Moulding Section using RULA and REBA Techniques. *International Journal of Engineering Trends and Technology*, 36(6), 294-301.
17. Samudra, P. A. (2018). Analisis Keamanan Aktivitas Penyablonan Pada Morfo Industries Dengan Menggunakan Metode Rula (Rapid Upper Limb Assessment) Dan Reba (Rapid Entire Body Assessment). *Jurnal PASTI, Volume XII No. 2*, 235 – 248.
18. Shukriah, A., Baba, M. D., & Jaharah, A. G. (2017). REBA evaluation on garage worker: a case study. *Journal of Fundamental and Applied Sciences*, 9(5S), 1080-1086.
19. Siska, M. (2018). Analisis Postur Kerja Manual Material Handling Pada Aktivitas Pemindahan Pallet Dengan Menggunakan Metode Biomekanika Rula (Studi Kasus: Pt. Alam Permata Riau). *Jurnal Sains dan Teknologi Industri*, 15(2), 77-86.
20. Soheili-Fard, F., Rahbar, A., & Marzban, A. (2017). Ergonomic investigation of workers in tea factories using REBA and OWAS methods—case study:(Langroud region, Guilan, Iran). *Agricultural Engineering International: CIGR Journal*, 19(3), 112-119.
21. Sugiyono. (2012). *Memahami Penelitian Kualitatif*. Bandung: Alfabeta.
22. Sugiyono. (2016). *Metode Penelitian Kuantitatif, Kualitatif dan R&D*. Bandung: PT Alfabet.
23. Tarwaka, et al. (2004). *Ergonomi Untuk Kesehatan Keselamatan dan Produktivitas. Edisi 1, Cetakan 1*. Surakarta: UNIBA,Press.
24. Tarwaka. (2015). *Ergonomi Industri, dasar-dasar pengetahuan ergonomi dan aplikasi di tempat kerja*: Edisi Kedua. Surakarta: harapan press
25. Union of Needletrades, Industrial and Textile Employees, the Institute for Work & Health, and the Occupational Health

Clinics. (2001). *Ergonomic Handbook for the Clothing Industry*. Ontario

26. Wahyuniardi, R., & Reyhanandar, D. M. (2018). Penilaian Postur Operator dan Perbaikan Sistem Kerja dengan Metode RULA dan REBA (Studi Kasus). *J@ ti Undip: Jurnal Teknik Industri*, 13(1), 45-50. 44
27. Yadi, Y. H., Kurniawidjaja, L. M., & Susilowati, I. H. (2018). Ergonomics Intervention Study of the RULA/REBA Method in Chemical Industries for MSDs' Risk Assessment. *KnE Life Sciences*, 4(5), 181-189.
28. Zen, Z. H., & Zamora, B. (2016). Analisis Postur Kerja Pada Bagian Gudang Barang Jadi Menggunakan Metode Rapid Entire Body Assessment (REBA). *Jurnal Photon*, 7(01), 113-119.
29. Suhada, R. T., Manurung, A., Kholil, M., & Mardikawati, Y. (2018, December). ERGONOMIC WORK ENVIRONMENTAL MANAGEMENT FOR INFORMAL SECTOR WORKERS (CRAFTSMEN EMPING AND CRIPPERS) IN CILEGON CITY. In *ICCD* (Vol. 1, No. 1, pp. 628-633).

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