# Analysis of cashiers' work postures using the Quick Exposure Check (QEC): a case study in Yogyakarta

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**Abstract.** *The analysis of cashiers' work postures aims to minimize or avoid musculoskeletal problems. The research uses Quick Exposure Check (QEC) to identify working condition problems that focus on the back, shoulders, arms, and neck. The goal is to improve working conditions by reducing the risk of worker fatigue, unergonomic work postures, and musculoskeletal pain, which leads to increased productivity. To determine the extent of musculoskeletal disorders, the research method uses a quick exposure check that focuses on the upper body, including the back, neck, arms/shoulders, and wrists, which are common problem areas for workers. Based on the collected data, the exposure score and level are calculated to determine the follow-up to the research. The data shows that 50% of cashiers have an exposure level of 50 - 60%, and further research and changes are required. Meanwhile, another 50% of cashiers have an exposure level value above 70%, requiring immediate research and changes. The conclusion of this analysis is that it is essential to continuously check and maintain the ergonomics of the cashier's work. Regular inspections and necessary corrective actions must be conducted to ensure ergonomic working conditions and protect the health of cashiers.*

*Keywords: cashier, ergonomics, musculoskeletal disorders, Quick Exposure Check.*

## 1. Introduction

Work involves modifying specific aspects of the environment to preserve and maintain their survival. Ergonomics concentrates on evaluating and restructuring work procedures to improve the workers' effectiveness, efficiency, welfare, and safety. Workers with non-ergonomic work positions are likely to be more fatigued, contributing to decreased concentration and accuracy in working, leading to lower productivity. Ergonomics utilizes information to design products, equipment, facilities, environments, and work systems to achieve optimal work quality while still considering human health, safety, and comfort (Akbar et al., 2022). Industrial ergonomics programs are useful to reduce occupational diseases and all possible risks (Fayomi et al., 2021), to achieve the balance between human needs within their limits and work itself (Nismah & Amir, 2019). Excessive load of work out of human capability creates pain, stress, fatigue, accidents, wounds, injuries, and even illness (Meilani et al., 2018).



**Figure 1.** Cashier's work posture when providing the service
Source: Private Document

Work postures involve configuring the body during work, influenced by the shape, arrangement, dimensions, tool placement, and maintenance, including movement, direction, and force applied (Erliana et al., 2022). A study found that people spend 50% to 86% of their workdays doing sedentary work depending on their work. The association between sedentary work and adverse health risks showed consistent evidence (Ding et al., 2020). On the other hand, cashier is also a profession that affects body posture. A cashier as in Figure 1, is a worker who corresponds to take the customer's payment, provides goods or services, and gives changes to the customer in supermarkets, hypermarkets, mini-markets, hotels, malls, restaurants, hospitals, or stores (Nurhaipah, 2019).

Workers who conduct repetitive activities for a long time create dominant body posture patterns, for example, the activities conducted by cashiers are standing for long periods, repetitive hand movements, and frequently lifting items as shown in Figure 2. These factors contribute to discomfort and pain in various parts of the cashiers' bodies (Bastuti et al., 2019).



**Figure 2.** The cashier's repetitive hand movements
Source: Private Document

Engaging in manual tasks for prolonged periods frequently leads to musculoskeletal injuries, with musculoskeletal disorders (MSDs) standing out as the most frequently reported work-related diseases. The strain on muscles from prolonged manual labor significantly contributes to the high prevalence of work-related musculoskeletal disorders (WMSDs) (Akbar et al., 2023).

Musculoskeletal Disorders (MSDs) represent work-related injuries and illnesses worldwide and demand high costs for both employees and their organizations. MSDs encompass a range of conditions affecting joints, the spine and intervertebral discs, synovium, muscles, tendons, and related tissues, as well as soft tissues and connective tissues (Afsharian et al., 2023). The primary causes of workplace disability, sick leave, and presenteeism resulting in the loss of productivity are MSDs (Paskins et al., 2022). According to statistical data from The Health and Safety Executive (HSE) 2009/10, MSDs account for 53% of sickness-related absenteeism, leading to a 37% loss in working days (Erliana et al., 2022). These factors contribute to the discomfort experienced by workers and exacerbate their health issues (Sohrabi et al., 2021). Therefore, a work posture analysis and changes in the work environment for cashier professions are needed and aimed to reduce the workload and address MSDs using the Quick Exposure Check (QEC) method (Rizaldi & Cahyana, 2021).

The Quick Exposure Check (QEC) is a method utilized to assess the risk of musculoskeletal disorders, focusing on the upper body, particularly the back, neck, arms/shoulders, and wrists. This method considers the situations experienced by employees from two perspectives: that of the observer and the user themselves (Yuslistyari & Adhadin, 2018). The developed QEC is used as an observational tool for OHS practitioners to evaluate the risk exposure for work-related musculoskeletal disorders, providing a basis for ergonomic interventions. The checklist in QEC assesses the exposure level in four main body areas to identify risk factors contributing to WMSDs. QEC encompasses various risk factors such as body posture, load/force, movement/frequency, duration, vibration, and others (Ibrahim et al., 2020).

This study aims to analyze the work postures of cashiers in their workplace using the QEC method. QEC is used to assess work-related exposures associated with occupational diseases. This method addresses issues arising in the back, shoulders, arms, and neck. The benefits of this study are in enhancing working conditions, consequently lowering the likelihood of employee fatigue. Anticipated outcomes involve adjustments in work positions that can mitigate non-ergonomic

postures and alleviate musculoskeletal pain, fostering increased efficiency and productivity among workers.

## 2. Method

Quick exposure check (QEC) was used to determine the extent of musculoskeletal disorders focusing on the upper body, specifically the back, neck, arms/shoulders, and wrists, which often occur in workers. The data was collected by using a questionnaire. capturing particulars such as names, ages, dates, current tasks of the respondents, and questions focusing on the neck, back, shoulder/arms, and hands (Hawari et al., 2022).

In the first step, exposure scores can be determined using an exposure scoring sheet to assign scores to each body part. The final score will combine responses from user questionnaires and observational questionnaires, providing scores for each created group. Exposure scores are calculated for each body part such as the back, shoulders or upper arms, hands, or neck. Instances of functional associations include position with force or load, displacement with force or load, length with force or load, position with length, or movement with length. Subsequently, the determination of exposure level depends on the calculated exposure score, followed by the calculation of exposure levels to determine problem categories and subsequent steps (Rizaldi & Cahyana, 2021).

Cashier is a profession that is often found in urban areas, especially in minimarkets. In the city of Yogyakarta, Indonesia, there are 14 sub-districts. Based on data from the Yogyakarta City Government, of the 14 sub-districts, only one sub-district does not have a minimarket, namely Kraton sub-district. The distribution of the number of minimarkets in the city of Yogyakarta can be seen in Figure 3 (Yogyakarta City Government, 2022). Based on the availability of 13 sub-districts that have minimarkets, researchers took samples in 10 sub-districts with one sub-district sampling one minimarket and one cashier as representatives.
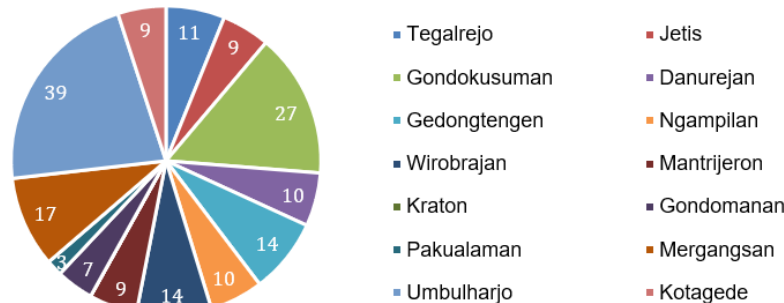


**Figure 3** Distribution of Minimarkets in Yogyakarta City, Indonesia
Source: Yogyakarta City Government (2022).

## 3. Result and Discussion

The work postural evaluation, employing the QEC questionnaire, was performed on ten cashier employees across various work settings and scrutinized by ten observers in line with the existing circumstances, in Yogyakarta. The outcomes of the research/community service are detailed and thorough discussion. The results may be illustrated through figures, graphs, tables, and other formats to enhance reader comprehension (Akbar et al., 2023). The discussion may unfold across multiple subsections.

**Quick Exposure Check (QEC) Questionnaire**
Employees are provided with a quick exposure check questionnaire that considers their situations from two perspectives: the observer's viewpoint and the operator or worker's perspective. The QEC questionnaires were administered to all workers at the workplace and supervisors or observers familiar with the employees' working conditions. The QEC questionnaire differs for observers and workers, but both are utilized to assess the employees' conditions. The questionnaire places a greater emphasis on the body postures adopted by users during their work. Workers have a better

understanding of their tasks, such as the loads they need to lift and the duration of their work. User and observer questionnaires are outlined in Table 1 and Table 2.

**Table 1** QEC questionnaire for observer's assessment

| *Quick Exposure Check* | | |
|---|---|---|
| Name : | | |
| Age : | | |
| Observation date : | | |
| Instruction: Choose the condition that corresponds to your work positions | | |
| **Back** | | |
| a. **When performing the work, is the back** | | |
| A.1 Almost neutral? | A2. Moderately flexed or twisted or side bent (30-60 degrees)? | A3. Excessively flexed or twisted or side bent? |
| b. **Is the movement of the back** | | |
| B1. Infrequent (around 3 times per minute or less)? | B2. Frequent (around times per minute)? | B3. Very frequent (around 12 times per minute or more)? |
| c. **For seated or standing stationary work. Does the back remain in a static position most of the time?** | | |
| B4. No | B5. Yes | |
| **Shoulder / Arm** | | |
| d. **When the task is performed, are the hands** | | |
| C1. At or below waist height? | C2. At about chest height? | C3. At or above shoulder height? |
| e. **Is the shoulder/arm movement** | | |
| D1. Infrequent (some intermittent movement)? | D2. Frequent (regular movement with some pauses)? | D3. Very frequent (almost continuous movement)? |
| **Wrist / Hand** | | |
| f. **Is the task performed with** | | |
| E1. An almost straight wrist? | E2. A deviated or bent wrist? | |
| g. **Are similar motion patterns repeated** | | |
| F1. 10 times per minute or less? | F2. 11 to 20 times per minute? | F3. More than 20 times per minute? |
| **Neck** | | |
| h. **When performing the task, is the head/neck bent or twisted?** | | |
| G1. No | G2. Yes, occasionally | G3. Yes, continuously |

**Table 2** QEC questionnaire for worker's assessment

| **Quick Exposure Check** | | |
|---|---|---|
| Name : | | |
| Age : | | |
| Observation date : | | |
| Instruction: Choose the condition that corresponds to the worker's positions | | |
| a. **What is the maximus weight handled in the work?** | | |
| a1. Light | a2. Moderate | a3. Heavy |
| b. **On average, how much time do you spend per day on this work?** | | |
| b1. Less than 4 hours | b2. 4 to 6 hours | b3. More than 6 hours |
| c. **When performing this work, is the maximum force level exerted by one hand?** | | |
| c1. Low (e.g. less than 1 kg) | c2. Medium (e.g.1 to 4 kg) | c3. High (e.g. more than 4 kg) |
| d. **At work do you feel vibration when doing the work?** | | |
| d1. Low | d2. Moderate | d3. High |
| e. **Is the visual demand of this work** | | |
| e1. Low | e2. High | |
| f. **Do you have difficulty keeping up with this work?** | | |
| f1. Never | f2. Sometimes | f3. Often |
| g. **How much stress do you feel while doing the work?** | | |
| g1. Not at all stressful | g2. Mildly stressful | g3. Moderately stressful |
| g4. Very stressful | | |

The development of the QEC method for recording the cashiers' work postures were divided into several sections with observer questionnaires grouped into A, B, C, D, E, F, and G. Meanwhile, worker questionnaires are categorized into groups a, b, c, d, e, f, and g. This is conducted to

ensure that all positions are captured so that every issue or limitation related to the structure of the back or neck is associated with upper limb positions (Rizaldi & Cahyana, 2021).

**Exposure Score Results**

The subsequent stage involves creating a scoring system or grouping exposure scores for various body parts based on the assessment results from groups A to G, specifically focusing on the back, shoulders, arms, hands, and wrists. This determination is contingent on the frequency of each examined position. The scores were entered into an exposure score table to derive the overall score. Presented below is an illustrative checklist for the Quick Exposure Check (QEC) method. The level of injury risk for workers is contingent on the test scores, subsequently transferred to a table to ascertain the injury risk for each individual. Moreover, the data processing platform derived from observer/customer and worker/employee surveys is integrated into the QEC score sheet, where the test scores are computed for the four body parts in each study area. The computed outcomes on the QEC sheet are accessible in the attached tables 3 through 12, delineating the rapid report calculation sheet for 10 employees in the cashier section (Rizaldi & Cahyana, 2021).

In Table 3, Table 4, Table 5, and Table 6, there are results from respondents who are cashiers from minimarkets at Tegalrejo, Jetis, Gondokusuman, and Danurejan sub-districts in Yogyakarta city.

**Table 3** *Exposure score* on Worker 1

Exposure Level — Name: Ema Novalita P — Date: 16/05/2023 — Age: 29

Assessment Of The Back

| | A1 | A2 | A3 | Score | B1 | B2 | B3 | Score 2 | b1 | b2 | b3 | Score |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| a1 | 2 | 4 | 6 | 1 | 2 | 4 | 6 | | 2 | 4 | 6 | 3 |
| a2 | 4 | 6 | 8 | | 4 | 6 | 8 | 6 | 4 | 6 | 8 | |
| a3 | 6 | 8 | 10 | 6 | 6 | 8 | 10 | | 6 | 8 | 10 | 8 |
| a4 | 8 | 10 | 12 | | 8 | 10 | 12 | | 8 | 10 | 12 | |

| | | | | Score | | | | B4 | B5 | Score 5 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| b1 | 2 | 4 | 6 | 4 | 2 | 4 | 6 | 2 | 4 | | |
| b2 | 4 | 6 | 8 | | 4 | 6 | 8 | 4 | 6 | 8 | 36 |
| b3 | 6 | 8 | 10 | 8 | 6 | 8 | 10 | 6 | 8 | | |

Assessment of the shoulder/arm

| | C1 | C2 | C3 | Score | D1 | D2 | D3 | Score 2 | b1 | b2 | b3 | Score |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| c1 | 2 | 4 | 6 | 1 | 2 | 4 | 6 | | 2 | 4 | 6 | 3 |
| c2 | 4 | 6 | 8 | | 4 | 6 | 8 | 8 | 4 | 6 | 8 | |
| c3 | 6 | 8 | 10 | 4 | 6 | 8 | 10 | | 6 | 8 | 10 | 8 |
| c4 | 8 | 10 | 12 | | 8 | 10 | 12 | | 8 | 10 | 12 | |

| | | | | Score | | | | | Score 5 | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| b1 | 2 | 4 | 6 | 4 | 2 | 4 | 6 | | 10 | | 36 |
| b2 | 4 | 6 | 8 | | 4 | 6 | 8 | | | | |
| b3 | 6 | 8 | 10 | 6 | 6 | 8 | 10 | | | | |

Wrist/Hand Assessment

| | F1 | F2 | F3 | Score | E1 | E2 | Score 2 | b1 | b2 | b3 | Score |
|---|---|---|---|---|---|---|---|---|---|---|---|
| c1 | 2 | 4 | 6 | 1 | 2 | 4 | | 2 | 4 | 6 | 3 |
| c2 | 4 | 6 | 8 | | 4 | 6 | 6 | 4 | 6 | 8 | |
| c3 | 6 | 8 | 10 | 6 | 6 | 8 | | 6 | 8 | 10 | 8 |

| | | | | Score | | | Score 5 | | Total | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| b1 | 2 | 4 | 6 | 4 | 2 | 4 | | | 36 | | |
| b2 | 4 | 6 | 8 | | 4 | 6 | 8 | | | | |
| b3 | 6 | 8 | 10 | 8 | 6 | 8 | | | | | |

Neck Assessment

| | G1 | G2 | G3 | Score | e1 | e2 | Score 2 | Total |
|---|---|---|---|---|---|---|---|---|
| b1 | 2 | 4 | 6 | 1 | 2 | 4 | | |
| b2 | 4 | 6 | 8 | | 4 | 6 | 8 | 18 |
| b3 | 6 | 8 | 10 | 10 | 6 | 8 | | |

**Table 4** *Exposure score* on worker 2

Exposure Level — Name: Watik Wahyuni L — Date: 16/05/2023 — Age: 28

Assessment Of The Back

| | A1 | A2 | A3 | Score | B1 | B2 | B3 | Score 2 | b1 | b2 | b3 | Score |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| a1 | 2 | 4 | 6 | 1 | 2 | 4 | 6 | | 2 | 4 | 6 | 3 |
| a2 | 4 | 6 | 8 | | 4 | 6 | 8 | 4 | 4 | 6 | 8 | |
| a3 | 6 | 8 | 10 | | 6 | 8 | 10 | | 6 | 8 | 10 | 8 |
| a4 | 8 | 10 | 12 | | 8 | 10 | 12 | | 8 | 10 | 12 | |

| | | | | Score | | | | B4 | B5 | Score 5 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| b1 | 2 | 4 | 6 | 4 | 2 | 4 | 6 | 2 | 4 | | |
| b2 | 4 | 6 | 8 | | 4 | 6 | 8 | 4 | 6 | 6 | 32 |
| b3 | 6 | 8 | 10 | 8 | 6 | 8 | 10 | 6 | 8 | | |

Assessment of the shoulder/arm

| | C1 | C2 | C3 | Score | D1 | D2 | D3 | Score 2 | b1 | b2 | b3 | Score |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| c1 | 2 | 4 | 6 | 1 | 2 | 4 | 6 | | 2 | 4 | 6 | 3 |
| c2 | 4 | 6 | 8 | | 4 | 6 | 8 | 6 | 4 | 6 | 8 | |
| c3 | 6 | 8 | 10 | 6 | 6 | 8 | 10 | | 6 | 8 | 10 | 8 |
| c4 | 8 | 10 | 12 | | 8 | 10 | 12 | | 8 | 10 | 12 | |

| | | | | Score | | | | | Score 5 | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| b1 | 2 | 4 | 6 | 4 | 2 | 4 | 6 | | 8 | | 36 |
| b2 | 4 | 6 | 8 | | 4 | 6 | 8 | | | | |
| b3 | 6 | 8 | 10 | 8 | 6 | 8 | 10 | | | | |

Wrist/Hand Assessment

| | F1 | F2 | F3 | Score | E1 | E2 | Score 2 | b1 | b2 | b3 | Score |
|---|---|---|---|---|---|---|---|---|---|---|---|
| c1 | 2 | 4 | 6 | 1 | 2 | 4 | | 2 | 4 | 6 | 3 |
| c2 | 4 | 6 | 8 | | 4 | 6 | 6 | 4 | 6 | 8 | |
| c3 | 6 | 8 | 10 | 8 | 6 | 8 | | 6 | 8 | 10 | 8 |

| | | | | Score | | | Score 5 | | Total | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| b1 | 2 | 4 | 6 | 4 | 2 | 4 | | | 40 | | |
| b2 | 4 | 6 | 8 | | 4 | 6 | 8 | | | | |
| b3 | 6 | 8 | 10 | 10 | 6 | 8 | | | | | |

Neck Assessment

| | G1 | G2 | G3 | Score | e1 | e2 | Score 2 | Total |
|---|---|---|---|---|---|---|---|---|
| b1 | 2 | 4 | 6 | 1 | 2 | 4 | | |
| b2 | 4 | 6 | 8 | | 4 | 6 | 8 | 18 |
| b3 | 6 | 8 | 10 | 10 | 6 | 8 | | |

**Table 5** *Exposure score* on worker 3

Exposure Level — Name: Dhifa — Date: 16/05/2023 — Age: 24

Assessment Of The Back

| | A1 | A2 | A3 | Score | B1 | B2 | B3 | Score 2 | b1 | b2 | b3 | Score |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| a1 | 2 | 4 | 6 | 1 | 2 | 4 | 6 | | 2 | 4 | 6 | 3 |
| a2 | 4 | 6 | 8 | | 4 | 6 | 8 | 4 | 4 | 6 | 8 | |
| a3 | 6 | 8 | 10 | 6 | 6 | 8 | 10 | | 6 | 8 | 10 | 8 |
| a4 | 8 | 10 | 12 | | 8 | 10 | 12 | | 8 | 10 | 12 | |

| | | | | Score | | | | B4 | B5 | Score 5 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| b1 | 2 | 4 | 6 | 4 | 2 | 4 | 6 | 2 | 4 | | |
| b2 | 4 | 6 | 8 | | 4 | 6 | 8 | 4 | 6 | 6 | 32 |
| b3 | 6 | 8 | 10 | 8 | 6 | 8 | 10 | 6 | 8 | | |

Assessment of the shoulder/arm

| | C1 | C2 | C3 | Score | D1 | D2 | D3 | Score 2 | b1 | b2 | b3 | Score |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| c1 | 2 | 4 | 6 | 1 | 2 | 4 | 6 | | 2 | 4 | 6 | 3 |
| c2 | 4 | 6 | 8 | | 4 | 6 | 8 | 4 | 4 | 6 | 8 | |
| c3 | 6 | 8 | 10 | | 6 | 8 | 10 | | 6 | 8 | 10 | 8 |
| c4 | 8 | 10 | 12 | 6 | 8 | 10 | 12 | | 8 | 10 | 12 | |

| | | | | Score | | | | | Score 5 | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| b1 | 2 | 4 | 6 | 4 | 2 | 4 | 6 | | 6 | | 32 |
| b2 | 4 | 6 | 8 | | 4 | 6 | 8 | | | | |
| b3 | 6 | 8 | 10 | 8 | 6 | 8 | 10 | | | | |

Wrist/Hand Assessment

| | F1 | F2 | F3 | Score | E1 | E2 | Score 2 | b1 | b2 | b3 | Score |
|---|---|---|---|---|---|---|---|---|---|---|---|
| c1 | 2 | 4 | 6 | 1 | 2 | 4 | | 2 | 4 | 6 | 3 |
| c2 | 4 | 6 | 8 | | 4 | 6 | 4 | 4 | 6 | 8 | |
| c3 | 6 | 8 | 10 | 4 | 6 | 8 | | 6 | 8 | 10 | 8 |

| | | | | Score | | | Score 5 | | Total | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| b1 | 2 | 4 | 6 | 4 | 2 | 4 | | | 28 | | |
| b2 | 4 | 6 | 8 | | 4 | 6 | 6 | | | | |
| b3 | 6 | 8 | 10 | 6 | 6 | 8 | | | | | |

Neck Assessment

| | G1 | G2 | G3 | Score | e1 | e2 | Score 2 | Total |
|---|---|---|---|---|---|---|---|---|
| b1 | 2 | 4 | 6 | 1 | 2 | 4 | | |
| b2 | 4 | 6 | 8 | | 4 | 6 | 8 | 14 |
| b3 | 6 | 8 | 10 | 6 | 6 | 8 | | |

**Table 6** *Exposure score* on worker 4

Exposure Level — Name: Sabila — Date: 16/05/2023 — Age: 20

Assessment Of The Back

| | A1 | A2 | A3 | Score | B1 | B2 | B3 | Score 2 | b1 | b2 | b3 | Score |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| a1 | 2 | 4 | 6 | 1 | 2 | 4 | 6 | | 2 | 4 | 6 | 3 |
| a2 | 4 | 6 | 8 | | 4 | 6 | 8 | 6 | 4 | 6 | 8 | |
| a3 | 6 | 8 | 10 | 4 | 6 | 8 | 10 | | 6 | 8 | 10 | 8 |
| a4 | 8 | 10 | 12 | | 8 | 10 | 12 | | 8 | 10 | 12 | |

| | | | | Score | | | | B4 | B5 | Score 5 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| b1 | 2 | 4 | 6 | 4 | 2 | 4 | 6 | 2 | 4 | | |
| b2 | 4 | 6 | 8 | | 4 | 6 | 8 | 4 | 6 | 8 | 32 |
| b3 | 6 | 8 | 10 | 6 | 6 | 8 | 10 | 6 | 8 | | |

Assessment of the shoulder/arm

| | C1 | C2 | C3 | Score | D1 | D2 | D3 | Score 2 | b1 | b2 | b3 | Score |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| c1 | 2 | 4 | 6 | 1 | 2 | 4 | 6 | | 2 | 4 | 6 | 3 |
| c2 | 4 | 6 | 8 | | 4 | 6 | 8 | 6 | 4 | 6 | 8 | |
| c3 | 6 | 8 | 10 | 4 | 6 | 8 | 10 | | 6 | 8 | 10 | 8 |
| c4 | 8 | 10 | 12 | | 8 | 10 | 12 | | 8 | 10 | 12 | |

| | | | | Score | | | | | Score 5 | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| b1 | 2 | 4 | 6 | 4 | 2 | 4 | 6 | | 10 | | 34 |
| b2 | 4 | 6 | 8 | | 4 | 6 | 8 | | | | |
| b3 | 6 | 8 | 10 | 6 | 6 | 8 | 10 | | | | |

Wrist/Hand Assessment

| | F1 | F2 | F3 | Score | E1 | E2 | Score 2 | b1 | b2 | b3 | Score |
|---|---|---|---|---|---|---|---|---|---|---|---|
| c1 | 2 | 4 | 6 | 1 | 2 | 4 | | 2 | 4 | 6 | 3 |
| c2 | 4 | 6 | 8 | | 4 | 6 | 6 | 4 | 6 | 8 | |
| c3 | 6 | 8 | 10 | 4 | 6 | 8 | | 6 | 8 | 10 | 8 |

| | | | | Score | | | Score 5 | | Total | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| b1 | 2 | 4 | 6 | 4 | 2 | 4 | | | 32 | | |
| b2 | 4 | 6 | 8 | | 4 | 6 | 8 | | | | |
| b3 | 6 | 8 | 10 | 6 | 6 | 8 | | | | | |

Neck Assessment

| | G1 | G2 | G3 | Score | e1 | e2 | Score 2 | Total |
|---|---|---|---|---|---|---|---|---|
| b1 | 2 | 4 | 6 | 1 | 2 | 4 | | |
| b2 | 4 | 6 | 8 | | 4 | 6 | 8 | 16 |
| b3 | 6 | 8 | 10 | 8 | 6 | 8 | | |

Furthermore, in Table 7, Table 8, Table 9, Table 10, Table 11, and Table 12, are the results of the questionnaire from respondents were taken from minimarkets in six sub-districts, such as: Gedongtengen, Ngampilan, Wirobrajan, Mergangsan, Umbulharjo, and Kotagede.

**Table 7** *Exposure score* on worker 5

| Exposure Level | | | | Name : Anita | | | | Date : 16/05/2023 | | | | Age : 31 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Assessment Of The Back | | | | | | | | | | | | |
| | A1 | A2 | A3 | Score 1 | B1 | B2 | B3 | Score 2 | b1 | b2 | b3 | Score 3 |
| a1 | 2 | 4 | 6 | e1 | 2 | 4 | 6 | | 2 | 4 | 6 | e3 |
| a2 | 4 | 6 | 8 | | 4 | 6 | 8 | | 4 | 6 | 8 | |
| a3 | 6 | 8 | 10 | 4 | 6 | 8 | 10 | 8 | 6 | 8 | 10 | 8 |
| a4 | 8 | 10 | 12 | | 8 | 10 | 12 | | 8 | 10 | 12 | |
| | | | | Score 4 | | | B4 | B5 | Score 5 | | | Total |
| b1 | 2 | 4 | 6 | | 2 | 4 | 6 | 2 | 4 | 10 | | | 36 |
| b2 | 4 | 6 | 8 | | 4 | 6 | 8 | 4 | 6 | | | | |
| b3 | 6 | 8 | 10 | 6 | 6 | 8 | 10 | 6 | 8 | | | | |
| Assessment of the shoulder/arm | | | | | | | | | | | | |
| | C1 | C2 | C3 | Score 1 | D1 | D2 | D3 | Score 2 | b1 | b2 | b3 | Score 3 |
| c1 | 2 | 4 | 6 | e1 | 2 | 4 | 6 | | 2 | 4 | 6 | e3 |
| c2 | 4 | 6 | 8 | | 4 | 6 | 8 | 6 | 4 | 6 | 8 | |
| c3 | 6 | 8 | 10 | 8 | 6 | 8 | 10 | | 6 | 8 | 10 | 8 |
| c4 | 8 | 10 | 12 | | 8 | 10 | 12 | | 8 | 10 | 12 | |
| | | | | Score 4 | | | | Score 5 | | | | Total |
| b1 | 2 | 4 | 6 | | 2 | 4 | 6 | | 8 | | | 40 | |
| b2 | 4 | 6 | 8 | | 4 | 6 | 8 | | | | | | |
| b3 | 6 | 8 | 10 | 10 | 6 | 8 | 10 | | | | | | |
| Wrist/Hand Assessment | | | | | | | | | | | | |
| | F1 | F2 | F3 | Score 1 | E1 | E2 | | Score 2 | b1 | b2 | b3 | Score 3 |
| c1 | 2 | 4 | 6 | e1 | 2 | 4 | | | 2 | 4 | 6 | e3 |
| c2 | 4 | 6 | 8 | | 4 | 6 | | 6 | 4 | 6 | 8 | |
| c3 | 6 | 8 | 10 | 4 | 6 | 8 | | | 6 | 8 | 10 | 8 |
| | | | | Score 4 | | | | Score 5 | | | | Total |
| b1 | 2 | 4 | 6 | | 2 | 4 | | | 8 | | | 32 | |
| b2 | 4 | 6 | 8 | | 4 | 6 | | | | | | | |
| b3 | 6 | 8 | 10 | 6 | 6 | 8 | | | | | | | |
| Neck Assessment | | | | | | | | | | | | |
| | G1 | G2 | G3 | Score 1 | e1 | e2 | | Score 2 | | | | Total |
| b1 | 2 | 4 | 6 | e1 | 2 | 4 | | | | | | 16 | |
| b2 | 4 | 6 | 8 | | 4 | 6 | | 8 | | | | | |
| b3 | 6 | 8 | 10 | 8 | 6 | 8 | | | | | | | |

**Table 8** *Exposure score* on worker 6

| Exposure Level | | | | Name : Rania | | | | Date : 16/05/2023 | | | | Age : 25 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Assessment Of The Back | | | | | | | | | | | | |
| | A1 | A2 | A3 | Score 1 | B1 | B2 | B3 | Score 2 | b1 | b2 | b3 | Score 3 |
| a1 | 2 | 4 | 6 | 1 | 2 | 4 | 6 | | 2 | 4 | 6 | 3 |
| a2 | 4 | 6 | 8 | | 4 | 6 | 8 | | 4 | 6 | 8 | |
| a3 | 6 | 8 | 10 | 6 | 6 | 8 | 10 | 8 | 6 | 8 | 10 | 8 |
| a4 | 8 | 10 | 12 | | 8 | 10 | 12 | | 8 | 10 | 12 | |
| | | | | Score 4 | | | B4 | B5 | Score 5 | | | Total |
| b1 | 2 | 4 | 6 | | 2 | 4 | 6 | 2 | 4 | 10 | | | 40 |
| b2 | 4 | 6 | 8 | | 4 | 6 | 8 | 4 | 6 | | | | |
| b3 | 6 | 8 | 10 | 8 | 6 | 8 | 10 | 6 | 8 | | | | |
| Assessment of the shoulder/arm | | | | | | | | | | | | |
| | C1 | C2 | C3 | Score 1 | D1 | D2 | D3 | Score 2 | b1 | b2 | b3 | Score 3 |
| c1 | 2 | 4 | 6 | 1 | 2 | 4 | 6 | | 2 | 4 | 6 | 3 |
| c2 | 4 | 6 | 8 | | 4 | 6 | 8 | 4 | 4 | 6 | 8 | |
| c3 | 6 | 8 | 10 | 6 | 6 | 8 | 10 | | 6 | 8 | 10 | 8 |
| c4 | 8 | 10 | 12 | | 8 | 10 | 12 | | 8 | 10 | 12 | |
| | | | | Score 4 | | | | Score 5 | | | | Total |
| b1 | 2 | 4 | 6 | | 2 | 4 | 6 | | 6 | | | 32 | |
| b2 | 4 | 6 | 8 | | 4 | 6 | 8 | | | | | | |
| b3 | 6 | 8 | 10 | 8 | 6 | 8 | 10 | | | | | | |
| Wrist/Hand Assessment | | | | | | | | | | | | |
| | F1 | F2 | F3 | Score 1 | E1 | E2 | | Score 2 | b1 | b2 | b3 | Score 3 |
| c1 | 2 | 4 | 6 | 1 | 2 | 4 | | | 2 | 4 | 6 | 3 |
| c2 | 4 | 6 | 8 | | 4 | 6 | | 6 | 4 | 6 | 8 | |
| c3 | 6 | 8 | 10 | | 6 | 8 | | | 6 | 8 | 10 | 8 |
| | | | | Score 4 | | | | Score 5 | | | | Total |
| b1 | 2 | 4 | 6 | | 2 | 4 | | | 8 | | | 40 | |
| b2 | 4 | 6 | 8 | | 4 | 6 | | | | | | | |
| b3 | 6 | 8 | 10 | 10 | 6 | 8 | | | | | | | |
| Neck Assessment | | | | | | | | | | | | |
| | G1 | G2 | G3 | Score 1 | e1 | e2 | | Score 2 | | | | Total |
| b1 | 2 | 4 | 6 | 1 | 2 | 4 | | | | | | 16 | |
| b2 | 4 | 6 | 8 | | 4 | 6 | | 8 | | | | | |
| b3 | 6 | 8 | 10 | 8 | 6 | 8 | | | | | | | |

**Table 9** *Exposure score* on worker 7

| Exposure Level | | | | Name : Annisa Putri | | | | Date : 16/05/2023 | | | | Age : 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Assessment Of The Back | | | | | | | | | | | | |
| | A1 | A2 | A3 | Score 1 | B1 | B2 | B3 | Score 2 | b1 | b2 | b3 | Score 3 |
| a1 | 2 | 4 | 6 | 1 | 2 | 4 | 6 | | 2 | 4 | 6 | 3 |
| a2 | 4 | 6 | 8 | | 4 | 6 | 8 | 4 | 4 | 6 | 8 | |
| a3 | 6 | 8 | 10 | 6 | 6 | 8 | 10 | | 6 | 8 | 10 | 8 |
| a4 | 8 | 10 | 12 | | 8 | 10 | 12 | | 8 | 10 | 12 | |
| | | | | Score 4 | | | B4 | B5 | Score 5 | | | Total |
| b1 | 2 | 4 | 6 | | 2 | 4 | 6 | 2 | 4 | 6 | | | 32 |
| b2 | 4 | 6 | 8 | | 4 | 6 | 8 | 4 | 6 | | | | |
| b3 | 6 | 8 | 10 | 8 | 6 | 8 | 10 | 6 | 8 | | | | |
| Assessment of the shoulder/arm | | | | | | | | | | | | |
| | C1 | C2 | C3 | Score 1 | D1 | D2 | D3 | Score 2 | b1 | b2 | b3 | Score 3 |
| c1 | 2 | 4 | 6 | 1 | 2 | 4 | 6 | | 2 | 4 | 6 | 3 |
| c2 | 4 | 6 | 8 | | 4 | 6 | 8 | 4 | 4 | 6 | 8 | |
| c3 | 6 | 8 | 10 | 4 | 6 | 8 | 10 | | 6 | 8 | 10 | 6 |
| c4 | 8 | 10 | 12 | | 8 | 10 | 12 | | 8 | 10 | 12 | |
| | | | | Score 4 | | | | Score 5 | | | | Total |
| b1 | 2 | 4 | 6 | | 2 | 4 | 6 | | 8 | | | 30 | |
| b2 | 4 | 6 | 8 | | 4 | 6 | 8 | | | | | | |
| b3 | 6 | 8 | 10 | 8 | 6 | 8 | 10 | | | | | | |
| Wrist/Hand Assessment | | | | | | | | | | | | |
| | F1 | F2 | F3 | Score 1 | E1 | E2 | | Score 2 | b1 | b2 | b3 | Score 3 |
| c1 | 2 | 4 | 6 | 1 | 2 | 4 | | | 2 | 4 | 6 | 3 |
| c2 | 4 | 6 | 8 | | 4 | 6 | | 4 | 4 | 6 | 8 | |
| c3 | 6 | 8 | 10 | 2 | 6 | 8 | | | 6 | 8 | 10 | 6 |
| | | | | Score 4 | | | | Score 5 | | | | Total |
| b1 | 2 | 4 | 6 | | 2 | 4 | | | 8 | | | 26 | |
| b2 | 4 | 6 | 8 | | 4 | 6 | | | | | | | |
| b3 | 6 | 8 | 10 | 6 | 6 | 8 | | | | | | | |
| Neck Assessment | | | | | | | | | | | | |
| | G1 | G2 | G3 | Score 1 | e1 | e2 | | Score 2 | | | | Total |
| b1 | 2 | 4 | 6 | 1 | 2 | 4 | | | | | | 16 | |
| b2 | 4 | 6 | 8 | | 4 | 6 | | 8 | | | | | |
| b3 | 6 | 8 | 10 | 8 | 6 | 8 | | | | | | | |

**Table 10** *Exposure score* on worker 8

| Exposure Level | | | | Name : Yoga Arief P | | | | Date : 16/05/2023 | | | | Age : 23 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Assessment Of The Back | | | | | | | | | | | | |
| | A1 | A2 | A3 | Score 1 | B1 | B2 | B3 | Score 2 | b1 | b2 | b3 | Score 3 |
| a1 | 2 | 4 | 6 | 1 | 2 | 4 | 6 | | 2 | 4 | 6 | 3 |
| a2 | 4 | 6 | 8 | | 4 | 6 | 8 | 4 | 4 | 6 | 8 | |
| a3 | 6 | 8 | 10 | 6 | 6 | 8 | 10 | | 6 | 8 | 10 | 6 |
| a4 | 8 | 10 | 12 | | 8 | 10 | 12 | | 8 | 10 | 12 | |
| | | | | Score 4 | | | B4 | B5 | Score 5 | | | Total |
| b1 | 2 | 4 | 6 | | 2 | 4 | 6 | 2 | 4 | 4 | | | 26 |
| b2 | 4 | 6 | 8 | | 4 | 6 | 8 | 4 | 6 | | | | |
| b3 | 6 | 8 | 10 | 6 | 6 | 8 | 10 | 6 | 8 | | | | |
| Assessment of the shoulder/arm | | | | | | | | | | | | |
| | C1 | C2 | C3 | Score 1 | D1 | D2 | D3 | Score 2 | b1 | b2 | b3 | Score 3 |
| c1 | 2 | 4 | 6 | 1 | 2 | 4 | 6 | | 2 | 4 | 6 | 3 |
| c2 | 4 | 6 | 8 | | 4 | 6 | 8 | 8 | 4 | 6 | 8 | |
| c3 | 6 | 8 | 10 | 4 | 6 | 8 | 10 | | 6 | 8 | 10 | 6 |
| c4 | 8 | 10 | 12 | | 8 | 10 | 12 | | 8 | 10 | 12 | |
| | | | | Score 4 | | | | Score 5 | | | | Total |
| b1 | 2 | 4 | 6 | | 2 | 4 | 6 | | 8 | | | 30 | |
| b2 | 4 | 6 | 8 | | 4 | 6 | 8 | | | | | | |
| b3 | 6 | 8 | 10 | 8 | 6 | 8 | 10 | | | | | | |
| Wrist/Hand Assessment | | | | | | | | | | | | |
| | F1 | F2 | F3 | Score 1 | E1 | E2 | | Score 2 | b1 | b2 | b3 | Score 3 |
| c1 | 2 | 4 | 6 | 1 | 2 | 4 | | | 2 | 4 | 6 | 3 |
| c2 | 4 | 6 | 8 | | 4 | 6 | | 6 | 4 | 6 | 8 | |
| c3 | 6 | 8 | 10 | | 6 | 8 | | | 6 | 8 | 10 | 6 |
| | | | | Score 4 | | | | Score 5 | | | | Total |
| b1 | 2 | 4 | 6 | | 2 | 4 | | | 6 | | | 30 | |
| b2 | 4 | 6 | 8 | | 4 | 6 | | | | | | | |
| b3 | 6 | 8 | 10 | 6 | 6 | 8 | | | | | | | |
| Neck Assessment | | | | | | | | | | | | |
| | G1 | G2 | G3 | Score 1 | e1 | e2 | | Score 2 | | | | Total |
| b1 | 2 | 4 | 6 | 1 | 2 | 4 | | | | | | 12 | |
| b2 | 4 | 6 | 8 | | 4 | 6 | | 6 | | | | | |
| b3 | 6 | 8 | 10 | 6 | 6 | 8 | | | | | | | |

**Table 11** *Exposure score* on worker 9

| Exposure Level | | | | Name : Muhammad Rifqi F | | | | Date : 16/05/2023 | | | | Age : 21 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Assessment Of The Back | | | | | | | | | | | | |
| | A1 | A2 | A3 | Score 1 | B1 | B2 | B3 | Score 2 | b1 | b2 | b3 | Score 3 |
| a1 | 2 | 4 | 6 | 1 | 2 | 4 | 6 | | 2 | 4 | 6 | 3 |
| a2 | 4 | 6 | 8 | | 4 | 6 | 8 | 6 | 4 | 6 | 8 | |
| a3 | 6 | 8 | 10 | 6 | 6 | 8 | 10 | | 6 | 8 | 10 | 8 |
| a4 | 8 | 10 | 12 | | 8 | 10 | 12 | | 8 | 10 | 12 | |
| | | | | Score 4 | | | B4 | B5 | Score 5 | | | Total |
| b1 | 2 | 4 | 6 | | 2 | 4 | 6 | 2 | 4 | 8 | | | 34 |
| b2 | 4 | 6 | 8 | | 4 | 6 | 8 | 4 | 6 | | | | |
| b3 | 6 | 8 | 10 | 6 | 6 | 8 | 10 | 6 | 8 | | | | |
| Assessment of the shoulder/arm | | | | | | | | | | | | |
| | C1 | C2 | C3 | Score 1 | D1 | D2 | D3 | Score 2 | b1 | b2 | b3 | Score 3 |
| c1 | 2 | 4 | 6 | 1 | 2 | 4 | 6 | | 2 | 4 | 6 | 3 |
| c2 | 4 | 6 | 8 | | 4 | 6 | 8 | 10 | 4 | 6 | 8 | |
| c3 | 6 | 8 | 10 | 8 | 6 | 8 | 10 | | 6 | 8 | 10 | 10 |
| c4 | 8 | 10 | 12 | | 8 | 10 | 12 | | 8 | 10 | 12 | |
| | | | | Score 4 | | | | Score 5 | | | | Total |
| b1 | 2 | 4 | 6 | | 2 | 4 | 6 | | 10 | | | 46 | |
| b2 | 4 | 6 | 8 | | 4 | 6 | 8 | | | | | | |
| b3 | 6 | 8 | 10 | 8 | 6 | 8 | 10 | | | | | | |
| Wrist/Hand Assessment | | | | | | | | | | | | |
| | F1 | F2 | F3 | Score 1 | E1 | E2 | | Score 2 | b1 | b2 | b3 | Score 3 |
| c1 | 2 | 4 | 6 | 1 | 2 | 4 | | | 2 | 4 | 6 | 3 |
| c2 | 4 | 6 | 8 | | 4 | 6 | | 6 | 4 | 6 | 8 | |
| c3 | 6 | 8 | 10 | 8 | 6 | 8 | | | 6 | 8 | 10 | 10 |
| | | | | Score 4 | | | | Score 5 | | | | Total |
| b1 | 2 | 4 | 6 | | 2 | 4 | | | 6 | | | 38 | |
| b2 | 4 | 6 | 8 | | 4 | 6 | | | | | | | |
| b3 | 6 | 8 | 10 | 8 | 6 | 8 | | | | | | | |
| Neck Assessment | | | | | | | | | | | | |
| | G1 | G2 | G3 | Score 1 | e1 | e2 | | Score 2 | | | | Total |
| b1 | 2 | 4 | 6 | 1 | 2 | 4 | | | | | | 16 | |
| b2 | 4 | 6 | 8 | | 4 | 6 | | 8 | | | | | |
| b3 | 6 | 8 | 10 | 8 | 6 | 8 | | | | | | | |

**Table 12** *Exposure score* on worker 10

| Exposure Level | | | | Name : Daniel | | | | Date : 16/05/2023 | | | | Age : 22 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Assessment Of The Back | | | | | | | | | | | | |
| | A1 | A2 | A3 | Score 1 | B1 | B2 | B3 | Score 2 | b1 | b2 | b3 | Score 3 |
| a1 | 2 | 4 | 6 | 1 | 2 | 4 | 6 | | 2 | 4 | 6 | 3 |
| a2 | 4 | 6 | 8 | | 4 | 6 | 8 | | 4 | 6 | 8 | |
| a3 | 6 | 8 | 10 | 6 | 6 | 8 | 10 | 4 | 6 | 8 | 10 | 8 |
| a4 | 8 | 10 | 12 | | 8 | 10 | 12 | | 8 | 10 | 12 | |
| | | | | Score 4 | | | B4 | B5 | Score 5 | | | Total |
| b1 | 2 | 4 | 6 | | 2 | 4 | 6 | 2 | 4 | 6 | | | 32 |
| b2 | 4 | 6 | 8 | | 4 | 6 | 8 | 4 | 6 | | | | |
| b3 | 6 | 8 | 10 | 6 | 6 | 8 | 10 | 6 | 8 | | | | |
| Assessment of the shoulder/arm | | | | | | | | | | | | |
| | C1 | C2 | C3 | Score 1 | D1 | D2 | D3 | Score 2 | b1 | b2 | b3 | Score 3 |
| c1 | 2 | 4 | 6 | 1 | 2 | 4 | 6 | | 2 | 4 | 6 | 3 |
| c2 | 4 | 6 | 8 | | 4 | 6 | 8 | 6 | 4 | 6 | 8 | |
| c3 | 6 | 8 | 10 | 4 | 6 | 8 | 10 | | 6 | 8 | 10 | 8 |
| c4 | 8 | 10 | 12 | | 8 | 10 | 12 | | 8 | 10 | 12 | |
| | | | | Score 4 | | | | Score 5 | | | | Total |
| b1 | 2 | 4 | 6 | | 2 | 4 | 6 | | 8 | | | 32 | |
| b2 | 4 | 6 | 8 | | 4 | 6 | 8 | | | | | | |
| b3 | 6 | 8 | 10 | 8 | 6 | 8 | 10 | | | | | | |
| Wrist/Hand Assessment | | | | | | | | | | | | |
| | F1 | F2 | F3 | Score 1 | E1 | E2 | | Score 2 | b1 | b2 | b3 | Score 3 |
| c1 | 2 | 4 | 6 | 1 | 2 | 4 | | | 2 | 4 | 6 | 3 |
| c2 | 4 | 6 | 8 | | 4 | 6 | | 6 | 4 | 6 | 8 | |
| c3 | 6 | 8 | 10 | 4 | 6 | 8 | | | 6 | 8 | 10 | 8 |
| | | | | Score 4 | | | | Score 5 | | | | Total |
| b1 | 2 | 4 | 6 | | 2 | 4 | | | 8 | | | 32 | |
| b2 | 4 | 6 | 8 | | 4 | 6 | | | | | | | |
| b3 | 6 | 8 | 10 | 6 | 6 | 8 | | | | | | | |
| Neck Assessment | | | | | | | | | | | | |
| | G1 | G2 | G3 | Score 1 | e1 | e2 | | Score 2 | | | | Total |
| b1 | 2 | 4 | 6 | 1 | 2 | 4 | | | | | | 16 | |
| b2 | 4 | 6 | 8 | | 4 | 6 | | 8 | | | | | |
| b3 | 6 | 8 | 10 | 8 | 6 | 8 | | | | | | | |

### *Exposure Level*

After obtaining the exposure score for each worker, the next step involves determining the exposure level, which is calculated from the exposure score using equation 1.

$$E(\%) = \frac{X}{Xmax} \times 100\%$$ (1)

E(%) = the exposure level in percentage.

X = The total score obtained from the injury exposure score for the neck, shoulder/arms, back, and wrist.

Xmax = The maximum total score obtained from the injury exposure score for the neck, shoulder/arms, back, and wrist (Pambayung et al., 2015).

The result of the exposure level is then compared with the action level, as shown in Table 13 (Subakti & Subhan, 2016).

**Table 13** Action level QEC

| Exposure Level | Action |
|---|---|
| < 40% | Acceptable risk |
| 41 – 50% | Moderate risk (further investigation needed; changes may be required) |
| 55 – 70% | High risk (investigation and changes needed soon) |
| >70% | Investigation and changes required immediately |

Source: (Ratih et al., 2021)

Here is a summary of the calculated exposure level values for the ten workers along with the corresponding actions that can be taken. Please refer to Table 14 for details.

**Table 14** Results of Exposure level on 10 cashiers

| Worker | Action | Value |
|---|---|---|
| 1 | 71,6% | Investigation and changes required immediately |
| 2 | 71,6% | Investigation and changes required immediately |
| 3 | 60,2% | High risk (investigation and changes needed soon) |
| 4 | 63,6% | High risk (investigation and changes needed soon) |
| 5 | 70,5% | Investigation and changes required immediately |
| 6 | 72,7% | Investigation and changes required immediately |
| 7 | 59,1% | High risk (investigation and changes needed soon) |
| 8 | 55,7% | High risk (investigation and changes needed soon) |
| 9 | 76,1% | Investigation and changes required immediately |
| 10 | 63,6% | High risk (investigation and changes needed soon) |

## Discussion

Based on the collected data, the calculated exposure scores and summarized exposure level values indicate that five workers have exposure levels in the range of 50–60%, suggesting the need for further research and prompt modifications. Additionally, five other workers have exposure levels above 70%, necessitating further investigation and immediate adjustments.

The results of the obtained exposure levels will impact productivity, with the highest productivity observed at moderate stress levels and a decline in productivity at higher or lower stress levels, as viewed from a psychological perspective. Improved worker productivity provides significant benefits for both the company and the employees themselves (Kawakubo et al., 2023).

In this particular job, there are increased visual and cognitive demands associated with visual display work linked to symptoms involving the eyes/neck and vision (Richter et al., 2019). As indicated by the exposure scores, each worker must perform tasks for extended periods with a high level of precision and frequent bending, which can be uncomfortable for the eyes and neck. Musculoskeletal complaints range from mild to severe discomfort in the skeletal muscles. In the cashier profession, it is evident that in musculoskeletal disorders (MSDs), dominant pain is located in the upper arms, followed by shoulder pain due to repetitive movements such as scanning product prices, typing on the keyboard, and placing items in plastic bags at a high frequency

(Santoso & Prihono, 2021).To reduce MSD levels in cashier professions, the addition of tall chairs for cashiers could be considered. Tall chairs can alleviate back or neck pain resulting from prolonged standing and also facilitate hand movements. This fact can be observed in Figure 4.



**Figure 4** Back of the cashier while working (left) and Side of the cashier while working (right)
Source: Private Document

To determine the ideal table height for cashier workers, several factors need to be considered, starting with adjustments related to the average height of cashier workers compared to the average height of Indonesians, which is 158.17 cm. The average height for men is 163.55 cm, while for women it is 152.79 cm (Soviyati et al., 2023). The next factor is the working position when serving as a cashier, whether the cashier worker will sit or stand during operations. This will affect the comfortable table height. Then, the type of work performed, such as whether it involves a lot of typing, handling goods, or more interaction with customers. This will determine the comfort and efficiency of the working position.

An effective way to measure the table height can be done as follows: Measure the worker's height while standing upright (1). For a sitting position, measure the distance from the floor to the elbow when the arm is hanging at the side of the body. The table height should be slightly below the elbow height (2). For a standing position, measure the distance from the floor to the middle of the wrist when the arm is hanging at the side of the body. The table height should be slightly below this height (3). Consider adjustments for comfort and efficiency of the tasks performed (4). In essence, by considering anthropometry, work posture, and type of work, the table height can be optimized to increase the comfort and productivity of cashier workers.

In addition to using QEC to analyze the work postures of cashier professions to minimize or avoid MSDs, there are also environmental factors to consider. One of them is the workplace environment, which can be too hot, too cold, or cramped due to poor ventilation. Working in a hot environment for long hours with high intensity can lead to worker susceptibility to physical discomfort (Amoadu et al., 2023). Similarly, a room that is too cold or cramped due to poor ventilation can exacerbate physical discomfort for workers during their tasks.

The results of this study are in line with the research conducted by Silva et al., 2024 which also found that the cashier profession has a high risk of experiencing musculoskeletal disorders. However, this study is more specific by using the QEC method and involving respondents from various minimarkets in Yogyakarta. The finding of high exposure levels, particularly shoulder and neck pain reaching more than 70% in supermarket cashiers, is consistent with the study by Algarni & Alkhaldi, 2021 which revealed that the static work posture of cashiers over an extended period contributes to the risk of musculoskeletal disorders.

## 4. Conclusion and Suggestion

Based on the analysis of cashier job positions using the Quick Exposure Control (QEC) ergonomic evaluation method, it is evident that this profession involves several common movements that tend to cause musculoskeletal disorders and other health issues. Upon analyzing the exposure level results from 10 cashier workers from 10 different minimarkets in 10 sub-districts in Yogyakarta City, it is found that 5 workers have action level values between 55% and 70%, indicating the need for further research and changes. Additionally, 5 other workers have action level values exceeding 70%, requiring immediate further investigation and prompt modifications. The results highlight that ergonomic work practices are crucial in maintaining health and comfort while working; inappropriate or non-ergonomic work positions can lead to musculoskeletal disorders. To ensure ergonomic working conditions and safeguard the health of cashiers, regular examinations and necessary corrective actions must be implemented.

For future research regarding the analysis of cashiers' work postures and the risk of musculoskeletal disorders, it is recommended to involve more cashiers from various other retail stores and businesses. This will provide a more comprehensive understanding of the working conditions for cashiers across different types of businesses. Additionally, other ergonomic methods besides QEC can be used for validation and comparison of the results in evaluating the risk of musculoskeletal disorders. In subsequent research, workplace environmental factors such as lighting, temperature, and noise, which also potentially affect the comfort and health of cashiers, should be examined in depth. Lastly, further study is needed to determine the most effective and applicable ergonomic interventions to mitigate the risk of MSDs in the cashier profession.

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