Relationship between work position and the occurrence of low back pain among aircraft maintenance engineer of PT. GMF AeroAsia at Ngurah Rai International Airport

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Abstract. Low back pain is the most common musculoskeletal disorders, with the prevalence of 60% -70% in industrial countries. Working position, repetitive work, load, vibration are major risk factors of low back pain. Worker as an aircraft maintenance engineer is thought to be one of the risk factors for low back pain. The purpose of this study was to determine the correlation between working position with the occurrence of low back pain in aircraft maintenance engineers. This study used cross-sectional analytic design. The variables studied in this study were working position as independent variable and lower back pain as dependent variable. The samples of this research are aircraft maintenance engineers of PT. GMF AeroAsia at Ngurah Rai International Airport, comprising 48 employees selected by simple random sampling from 100 employees in the population. The data collected were primary data obtained by observation and questionnaires of Oswestry Low Back Pain Disability Questionnaire and REBA (Rapid Entire Body Assessment). Data analysis was performed by using cross-tab with chi square test ($\alpha = 0.05$). The results showed that most respondents aged 45-54 years (37.5%), working with high risk work position (56.3%), complaining minimal disability of low back pain 30 (62.5%). The analysis results indicated a moderate and significant positive correlation ($p=0.029; r=0.337$).

1. Introduction
Musculoskeletal disorders are skeletal muscle disorders whose complaints are felt in, muscles, tendons, cartilage, joints, nerves, ligaments, and vascular systems. Musculoskeletal disorders can be caused by repetitive motion, vibration, body position, work load, and sudden exposure. This disorder can affect the upper limbs, lower legs, neck, back and other parts of the body. Some of the most common musculoskeletal disorders are; lower back pain, neck and shoulder pain, upper limb disorders, and disorders in the lower extremities [1].

According to WHO, musculoskeletal disorders are a worldwide problem, and lower back pain is one of the musculoskeletal disorders that is the main cause of disability in workers. Lower back pain is defined as pain between the last ribs to the inferior gluteal fold with or without lower limb pain. The cause of low back pain can be specific and non-specific [2]. The prevalence of low back pain in industrialized countries is 60% -70%, and 35-55 years old are most commonly suffering from low back pain [3]. Millions of workers in various jobs in Europe suffers from musculoskeletal disorders each year, where lower back pain is one of the most commonly reported job-related disorders (38,9%), neck and shoulder pain (23%), and in lower extremities disorders (22%) [4]. A report on work-related morbidity
in the UK mentions 41% of musculoskeletal disorders.[1] Lower back pain is a very common complaint in the UK where around 60%-80% of the population have reported low back pain complaints [5]. The incidence of musculoskeletal disorders in Indonesia based on diagnosis by health personnel is 11.9% and based on diagnosis or symptoms is 24.7% [6]. There is no data on the incidence of low back pain in Indonesia, but the prevalence of low back pain in Jatinagor mentioned 38.4% [7].

2. Material and methods

2.1. Research location and time
This research was conducted in PT. GMF AeroAsia at Ngurah Rai International Airport from September to December 2017.

2.2. Research subject and design
This research is a cross-sectional analytic research and the sample in this research were aircraft maintenance engineer of PT. GMF AeroAsia at Ngurah Rai International Airport

2.3. Variable, data collection method, and data analysis method
The independent variable in this research is the working position and the dependent variable in this research is lower back pain. The data collected in this study is the primary data obtained through the provision of questionnaires filled by research subjects. Prior to conducting the research, a permission application to conduct research at PT. GMF AeroAsia at Ngurah Rai international airport. After obtaining a permit, the signing of informed consent by the respondent as an agreement was agreed to be examined. In this research, univariate and bivariate data are analyzed. Univariate analysis was performed to analyze the characteristic of the sample, and bivariate analysis was done by cross-tab, using chi square test (α = 0.05) The significant relationship between the free variable and the dependent variable was determined when p value <α, whereas if the relationship between variables free and the dependent variable is not significant if p value > α.

3. Results and discussion
Most of the respondents aged 45-54 years are as many as 18 people (37.5%). While based on gender all respondents 48 people (100%) are male (Table 1).

| Characteristic | Frequency | Percentage (%) |
|----------------|-----------|----------------|
| Age (year)     |           |                |
| 25-34          | 16        | 33.3           |
| 35-44          | 10        | 20.8           |
| 45-54          | 18        | 37.5           |
| 55-64          | 4         | 8.3            |
| Gender         |           |                |
| Male           | 48        | 100            |
| Female         | 0         | 0              |

3.1. Work organization
All respondents have a duration of work for ≤ 8 hours and duration of rest for > 30 minutes table 2.

| Work organization | Frequency | Percentage (%) |
|-------------------|-----------|----------------|
| Work duration     |           |                |
| ≤ 8 hours         | 48        | 100            |
| > 8 hours         | 0         | 0              |
| Rest duration     |           |                |
| ≤ 30 minutes      | 0         | 0              |
| > 30 minutes      | 48        | 100            |
3.2. Work position
In this study, 48 respondents of aircraft maintenance engineer mostly do work with high risk work position which is 27 people (56.3%). None of the respondents had negligible working positions, low risk, and medium risk, as presented in Table 3. According to a study done by Ansari and Sheikh (2014) on the evaluation of work positions using REBA on industrial workers in India. The study shows that most workers do work with high-risk job positions with a prevalence of 53% and no one does work with no-risk work positions [8]. Another study done by Concepcion-Batiz et al. (2016) on the assessment of the working position of the metal casting in Brazil also shows that most workers do their work with high risk work positions with 36.1% prevalence and no worker doing work with Negligible work positions [9].

Table 3. Work position (n=48).

| Working position  | Frequency | Percentage (%) |
|-------------------|-----------|----------------|
| Negligible risk   | 0         | 0              |
| Low Risk          | 0         | 0              |
| Medium Risk       | 0         | 0              |
| High Risk         | 27        | 56.3           |
| Very High Risk    | 21        | 43.8           |

This research is not accordance with a research done by Jalajuwita and Paskarini (2015) about work position relation with musculoskeletal complaint at welding unit of PT. X Bekasi, which shows that most workers do work with moderate risk work positions with a prevalence of 68.6% .10 This study is accordance because in a study done by Juwita and Paskarini (2015) most of the welding workers who responded did their job with the position of the body stands on one leg while bending and lifting one shoulder, while in aircraft maintenance engineer most of the work is done with the position of the body standing with knees bent, body bent, and hands raised more than 90° [10].

This unnatural attitude of work can be caused by the demands of work, work tools and work stations that are inconsistent with the capabilities and limitations of work, other than that the lack of understanding of ergonomic work attitude also can causes unnatural work attitude [11].

3.3. Low back pain
In this study of 48 respondents there were 30 people (62.5%) suffered low back pain with minimal disability, and 18 people (37.5%) with moderate disability. None of the respondents had severe disability, crippled and 81% -100% low back pain (table 4).

Table 4. Low back pain (n=48).

| Low Back pain     | Frequency | Percentage (%) |
|-------------------|-----------|----------------|
| Minimal Disability| 30        | 62.5           |
| Moderate Disability| 18      | 37.5           |
| Severe Disability | 0         | 0              |
| Crippled          | 0         | 0              |
| 81%-100%          | 0         | 0              |

A study done on the maintenance engineer fighter jet Sukhoi 30MKM obtained 58.8% lower backache prevalence and on aircraft technicians Ethiopian Airlines got the prevalence of low back pain as much as 47.1% [12]. Another study done by Meilita et al. (2017) on the relationship between work attitudes and lower back pain complaints to PT Sumber Alam Sejahtera workers in Manado showed that most workers (60%) frequently complained of lower back pain [13].

According Minematsu (2012) Lower back pain is a pain between the last ribs to the inferior gluteal fold with or without lower extremity pain [2]. Specific causes of 5% -15% of low back pain occurrence are osteoporosis, neoplasm and infection, whereas the specific cause of 85 % - 95% incidence of low back pain is not known for certain [3]. Risk factors for lower back pain are physical factors such as
heavy physical work, lifting, pushing, pulling, body position, repetitive work and vibration. In addition psychosocial factors and individual factors also become risk factors for lower back pain [2].

3.4. Relationship between working position and occurrence of low back pain
The analysis result of the relationship between variables showed that in the group of respondents with high risk work position, there were 21 (77.8%) with lower back pain minimal disability and 6 people (22.2%) with moderate disability lower back pain. In respondents with very high risk work positions there were 9 people (42.9%) with lower back pain minimal disability and 12 people (57.1%) with moderate disability lower back pain. No respondents did work with negligible work positions, low risk, moderate risk, and no respondents who had lower back pain severe disability, crippled and 81% -100% pain in table 5. The result of analysis with chi square test showed positive and light positive correlation ($p = 0.029; r = 0.337$).

Table 5. Relationship between working position and occurrence of low back pain.

| Work position | Minimal Disability f (%) | Moderate Disability f (%) | Total (%) |
|---------------|--------------------------|---------------------------|-----------|
| High risk     | 21 (77.8)                | 6 (22.2)                  | 27 (100)  |
| Very high risk| 9 (42.9)                 | 12 (57.1)                 | 21 (100)  |
| Total         | 30 (62.5)                | 18 (37.5)                 | 48 (100)  |

$p = 0.029; r = 0.337$

According to research done by Ghazali and Mohammad (2016) about lower back pain associated with work on maintenance technicians of fighter jets. The study suggests that there is a significant relationship between physical risk factors such as work position and lower back pain, lower back pain is more complained by workers who work with unnatural attitudes [12]. Research done by Wai et al (2010) on position relations unnatural bodies, bending, twisting and lower back pain suggest that respondents who did the job with that position complained of lower back pain with a prevalence of 38.7% [14].

This study is not accordance with the research done by Fathoni et al (2012) on the relationship of attitude and working position with low back pain on Purwalingga Hospital nurses who stated that there is no significant relationship between job positions with lower back pain complaints [15]. This study is not in line with the research conducted by Fathoni et al., (2012) most respondents do work with a job position is not risky.

There are several risk factors that can cause lower back pain in addition to physical factors, psychosocial factors such as stress, job dissatisfaction, job demands, length of service, work time and rest, workplace interaction, and colleagues may be risk factors for lower back pain. Individual factors may also be a risk factor for lower back pain, such individual factors, namely; age, sex, education level, body mass index, history of disease, physical activity, and lifestyle [2].

Musculoskeletal disorders that include neck and shoulder pain, lower back pain, upper extremity disturbances and disturbances in the lower extremities have several risk factors, namely; repetitive work, an exhausting or painful position, carrying or moving heavy loads, vibrations, sitting or standing for long periods of time. Chronic musculoskeletal disorders can cause limitations in work and even disability that will lead to a decrease in performance [4]. One of the risk factors of musculoskeletal disorders has an unnatural work attitude, unnatural work attitude is a work attitude that causes the body to move away from the natural position or away from the center of gravity body, such as; the movement of the hands is raised, the back is too bent, the head is raised [11]. Physical factors are one of the risk factors of lower back pain. Heavy physical work, lifting, pushing, pulling, body position, repetitive work, vibration are the physical factors, the load on the spine and back muscles causes the lower back pain [2].
4. Conclusion
From the above elaborated findings, it can be concluded that most (56.3%) aircraft maintenance engineer PT. GMF AeroAsia does work with high risk work positions; most (62.5%) aircraft maintenance engineer PT. GMF AeroAsia has lower back pain complaints of minimal disability; there is a significant relationship with a mild positive correlation between the working position and lower back pain in aircraft maintenance engineer PT worker. GMF AeroAsia, Ngurah Rai International Airport.

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