Implementation of ergonomics in the management of parking increasing the quality of living parking park in mall Robinson Denpasar city

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Abstract. The problems that often arise in the area of Denpasar City mostly caused by parking problems at the centers of activities such as shopping centers. The problems that occur not only because of the large number of vehicles that parked but also the result of the condition of parking officers who have not received attention, there is no concern about the physical condition of parking attendants because doing night guard duty. To improve the quality of parking officer, ergonomic parking lot is improved through the application of appropriate technology with systemic, holistic, interdisciplinary and participatory approach. The general objective of the research is to know the implementation of ergonomics in parking management on the improvement of the quality of parking officer in Robinson shopping center. The indicator of the quality of the parking officer work is the decrease of musculoskeletal complaints, fatigue, workload, boredom and increasing work motivation. The study was conducted using the same subject design, involving 10 subjects as a simple random sample. Intervention is done by arrangement of ergonomic basement motorcycle parking. Measurements done before and after repair. Washing out (WO) for 14 days. The data obtained were analyzed descriptively, tested normality (shapiro-wilk) and homogeneity (Levene Test). For normal and homogeneous distribution data, different test with One Way Anova, different test between Period with Post Hoc. Normally distributed and non-homogeneous data, different test with Friedman Test, different test between periods using Wilcoxon test. Data were analyzed with significance level of 5%. The results showed that the implementation of ergonomic in the management of parking area of the court decreased musculoskeletal complaints by 15.10% (p <0.05), decreased fatigue rate by 22.06 % (p <0.05), decreased workload by 21, 90 % (P <0,05), decrease boredom 15,85% (p <0,05) and motivation improvement 37, 68% (p <0,05). It is concluded that the implementation of ergonomics in parking management of the parking lot improves the quality of the parking officer work from: (1) decrease of musculoskeletal complaints, (2) decrease of melting rate, (3) decrease of parking workload, decreasing boredom and increasing work motivation.

1. Introduction

The growth of Denpasar city development is so fast, causing the land in the city of Denpasar increasingly narrow and this gives an impact that is not comparable land that is used as a parking lot with the growth rate of vehicle users. Thus indirectly this affects the design of the city of Denpasar. Finally the government of Denpasar provides solutions by establishing an agency that can handle the problem of parking in the city of Denpasar is to form the Regional Company Parking Denpasar (PD Parking Denpasar). The problems that often arise in the area of Denpasar City mostly caused by
parking problems at the centers of activities such as shopping centers. Problems that occur not only because of the large number of vehicles parking but also the consequences of parking attendant parking behavior who have not provided good service [Anonymous, 2009].

The number of shopping centers in the city of Denpasar as many as 17 pieces (BPS, 2008). Management of parking at shopping center under PD. Parking Denpasar. In the implementation of parking management consists of: (a) four shopping malls parked the implementation of parking by means of contracted, which means parking management implemented by parking contracting companies, namely: Tiara Grosir, Tiara Dewata, Ramayana, Robinson; And (b) thirteen shopping centers for parking management carried out by Denpasar Parking PD.

The work schedule parking working determined by the company uses 2 shifts of work, namely: (a) morning shift at 08.00 - 16.00 Wita, break time at 14.00 - 15.00 Wita; (B) afternoon shift from 14.00 - 22.00 Wita, break time at 15.00 - 16.00 Wita. This condition causes problems for parking officers such as: (a) scheduling of irregular parking attendant; (B) uneven overtime hours among parking attendants. Expressed problem because proven from preliminary study found work quality of afternoon shift parking officer between before and after work assessed from indicator: (a) increase of musculoskeletal complaint equal to 12,86%; (B) increased fatigue by 19.20%; (C) an increase in workload of 10, 98%; (D) an increase in boredom by 22, 65%; And (e) decreased motivation by 17, 20%.

The basic problems that accompany the parking attendant during the work related to the eight aspects of ergonomics are: (a) the nutritional / nutrition status of the parking attendant who works the afternoon shift is carried out the diet with one meal at rest. Problems of nutritional status / nutrition need to be considered because parking officers thirst and weight after work down by 0.35kg; (B) the utilization of muscle power of the parking attendant at the entry post and exit is the utilization of lower body muscle energy is not used physiological / natural and unchanged work position. The utilization of muscle force of parking officer in building and court is the utilization of lower body muscle energy is not used physiological / natural and work position change according to parking condition condition. ; (C) non-physiological work attitude due to incompatibility between seat size and table height in parking post; (D) working condition of the parking attendant working for 8 hours day with one hour break for lunch and rest. The time conditions that have not been applied in the work process have not been applied active breaks on a scheduled basis; (E) Activity of social condition accompanying parking officer not yet optimal because not yet optimal schedule placement of parking officer, so impressed they can not take advantage of social condition at work, this can result boredom and work motivation; (F) the condition of information has not been properly ordered so that some information through unreadable beacons at some distance and information through the missing marks.

Based on this, it is necessary to research on the implementation of ergonomics in the management of parking at shopping centers. This needs to be done to determine the effect of improving parking conditions with total ergonomic approaches to parking attendants at Robinson's shopping center.

2. Concept and Methodologi

This study was an experimental study with the same subject design (Treatment by Subject Design) [Colton, 1974]. The study design is illustrated by a diagram such as Figure 1.
The research will be conducted at the Robinson shopping center, located on Jl. Sudirman no. 20 Denpasar. The choice of location is because Robinson Mall has a comparison of parking lot with the smallest number of vehicles is Robinson.

The scope of research is in the field of ergonomics-physiology work applied in the management of parking lot at Robinson Mall. In this case the total ergonomic approach is applied as a combination of SHIP and Appropriate Technology approaches.

The target population of parking attendants of this study were all parking attendants at Robinson Denpasar shopping center who worked on morning shifts and afternoon shifts. While the affordable population is all the parking attendants at the Robinson shopping center who work at the time of the afternoon shift. Of the affordable population determined: (a) names of parking attendants who will be subjects of research; And (b) the work schedule is adjusted to the research schedule.

The inclusion criteria considered in this study are:

A. Inclusion criteria for parking attendants:
   1) Age ranges from 18 to 35 years.
   2) Healthy bodies proven by doctor's testimony.
   3) Minimum high school education.
   4) Work experience at least 1 year.
   5) Willing to be involved as a sample in this study as evidenced by the filling of informed consent.

Criteria for drop out:

Parking officer criteria used as a consideration is not continued (drop out) as the sample of this study are as follows:

1) Suffered ill at the time of the study.
2) Resign as sample, for some reason.
3) At the time of the research did not come to work.

The number of samples used is the largest number of n that is as much as 7.72 and rounded to 8 people. In order to anticipate the selected sample having drop out and no substitution required, the minimum sample amount is 10% [Arikunto, 1998]. so the sample size is 15% so the total sample becomes: n = 8 + (0,15 x 8) = 9,20 and rounded up to 10 people.

The sampling of parking attendants was done by nonprobability sampling type, that is by saturated sampling method. Saturated sampling is a technique of determining the sample when all members of the population as a sample, because the population is relatively small, less than 30 people. Another term of this saturated sampling is the census, where all members of the population are sampled [Sugiyono, 1999]. The variables in this study can be identified and classified as follows:

1) Independent variables: ergonomic implementation of parking management.
2) The dependent variable is: the quality of the work of parking officers in the form of musculoskeletal complaints, fatigue level, work load, work boredom, work motivation.
3) The control variables are: subject conditions (age, sex, weight, work experience, education level, health and parking environment) and environmental conditions (wet temperature, dry temperature, humidity and wind speed, noise, light intensity).

To avoid any errors in data collection, then based on the identification and classification of variables above, made the operational definition of variables as follows.

1) Parking is the process of utilizing the parking space of the yard with cars and motorcycles in Robinson shopping center.

2) Implementation of ergonomics is an improvement by using total ergonomic rules on parking management in Robinson in Post I, Post II, in which is contained the concept of SHIP and Appropriate Technology.

3) Parking management before implemented total ergonomic approach has spatial arrangement of parking.

Data obtained in the research carried out data processing as follows:

1. Data obtained both before and after the improvement of parking conditions processed with excel program and multiple linear regression analysis with the help of SPSS 17.0 for windows program.
2. Descriptive analysis to find the average, standard intersection of the frequency distribution based on the subject characteristic (age, work experience, height, weight, body mass index) and environmental conditions. Normality test of data with Shapiro-Wilk, and homogeneity test against data with Levene Test, to see distribution of each sample of Parking Post I, Parking Lot II, to parking attendant sample.
3. The treatment effect test is performed by using One Way Anova if the data is normally distributed and homogeneous. There is a significant difference Post then the effect test is done with Hoc (Tukey HSD) test at 5% significance level. The treatment effect test was performed by using Friedman Test for normal and non-homogeneous distribution data. There is a significant difference then the effect test is done with Wilcoxon test at 5% significance level.
4. Test the Validity and Reliability Questionnaire.
   Calculation of the validity of the questionnaire using product moment correlation formula or known as Pearson with a significance level of 5% (α = 0.05). The accuracy and consistency of the questionnaire answers with the actual situation analyzed by application of SPSS 17.0 for windows, that is Reliability Cronbach Alpha (α) with significance level 5% (α = 0,05).
3. Result and Discussion

The sample in this study were 10 people of male sex with the same subject design (within subject design) at parking officer Robinson Mall. Characteristics of subjects in Period I and II include age, weight, height, body mass index (BMI), and work experience. The mean and standard deviation (SB) values are described in Table 1.

| Description          | Average | Standard Deviation |
|----------------------|---------|--------------------|
| Age (year)           | 26.70   | 4.31               |
| Weight (kg)          | 42.83   | 7.12               |
| Height (cm)          | 162.53  | 9.49               |
| Body mass index (kg/m²) | 18.35   | 1.14               |
| Work experience (th) | 2.33    | 0.81               |

Based on Table 1, it can be said that the average age of the sample is 26.70 ± 4.31 years with a range of 25-37 years. The mean sample weight was 42.83 ± 7.12 kg with a range of 40 - 62 kg and the sample average height was 162.53 ± 9.49 cm with a range of 155.45-171.22 cm. The mean body mass index was 18.35 ± 1.14 kg / m² with a range of 18.42 – 19.43 kg / m². The average working experience of the sample is 2.33 ± 0.81 with a range of 2.00 to 3.00 years. Weight and height can be used to determine the body mass index (BMI) in kg / m² which is the ratio of body weight in kg to square height in meters [Heryudarini, et al., 2005].

The results showed that the work experience of parking officers was 2.33 ± 0.81 with a range of 1.00 to 3.00 years. Which means the work experience of the parking attendant is good, as it is generally understood and experienced about carrying out the parking duty.

Anthropometric measurements are tailored to the needs of the design of the auxiliary equipment as needed. In this study anthropometry measured included: height (TB), height of sitting elbow (TSD), popliteal height (TP), hip width (LP) and popliteal buttock length (PBP). Average values, standard deviations (SB), range, percentile value 5 and 95th percentile value of anthropometry are described in Table 2.

| Table 2. Anthropometry |
|------------------------|
| Antropometry           | Average | Percentile 5 | Percentile 95 |
| Height(cm)             | 164.53  | 9.61         | 148.7         | 180.3         |
| Height of sitting elbow (cm) | 65.14  | 2.83         | 60.5          | 69.8          |
| Popliteal Height (cm)  | 38.74   | 4.65         | 31.1          | 46.4          |
| Hip Width (cm)         | 32.41   | 2.11         | 28.9          | 35.9          |
| Popliteal buttock length (cm) | 45.94  | 3.79         | 39.7          | 52.2          |
The high-seat seating tool is based on the anthropometry of the popliteal height with a value of 5 percentiles, the width of the seat to the side is based on the width of the hips and the width of the seat toward the front or depth based on the length of the buttock-popliteal with the 95th percentile. Regarding height adjusted to high elbow anthropometry sitting with a value of 5 percentiles. The seats used are the result of agreement with the participation approach of the owner of the company, the workers based on the anthropometric measurement results of selected seats that already exist in the market while the table is made based on the anthropometry of the subject.

Work tool planning should refer to the anthropometry of the wearer and the percentile value. The percentile value of the body dimension can not be said the same for all body dimensions [Panero & Zelnik, 2003]. In this study, the anthropometric size of the study subjects with a mean height of 164.53 ± 9.61 with a range of 140 - 175 cm, height is not used in determining tool planner but is part of the characteristics of the subject in determining the body mass index. Elbow height sits 65.14 ± 2.83 with a range of 60.50 - 71.30 cm and a 5 percentile value of 60.49 cm. This 5th percentile value is used to plan table height. The use of the 5th percentile value is intended so that high table planning results can accommodate at least 95 percent of the sample population.

From the results of the data shows the height of the table is able to accommodate a sample of 100% with the closest value of the height of the table and the height of the sitting elbow is 60.50 cm. Thus the size of the table made can be said to be able to provide a sense of comfort for workers viewed from aspects of anthropometry. Seating planning refers to popliteal height, hip width and long popliteal buttocks [Panero & Zelnik, 2003]. The amount of workload changes (BK) on the duty of guard parking officer mall Robinson Denpasar in this study measured in Period I and II. This workload is determined by the difference or difference of the resting pulse (DNI) with the work pulse (DNK). The change of workload on this activity is determined by the activity of the parking duty task. The resting pulse in period 1 is taken at 09.00 wita while the working pulse is taken at 11.00:13.00 and 116.00 wita. Pulse and load measurement results Table 3.

| Variable | Period I | Period II |
|----------|----------|-----------|
|          | Average  | SD        | Average  | SD        |
| DNI      | 74,24    | 3,44      | 74,16    | 3,28      |
| DNK      | 103,04   | 1,41      | 96,67    | 1,25      |
| BK       | 28,80    | 3,28      | 22,51    | 2,77      |

Discription :
DNI : Rest Heart Rate
DNK : Work Heart Rate
BK : Work Load

To know that the change of work load is not caused by the influence of activities outside the research, it can be tested the normality and test of different pulse rest before work in Period I and II, while to know the change of workload Period I to Period II caused by the intervention , Then tested the normality and test of different workload in Period I and II. It can be said that the results of normality test (Shapiro-Wilk) resting pulses in Period I and II are normally distributed (p> 0.05) and the t-paired test states that there is no significant difference Between the resting pulses of Period I with II (p> 0.05). The result of normality test (Shapiro-Wilk) of work load in Period I and II is normally distributed (p> 0.05) and t-paired indicates that there is a significant difference between work load period I and II (p <0, 05).

The work load is determined from the difference between the resting pulse and the working pulse, where the mean is 28.80 ± 3.28 with a range of 24.20 - 35.71 pulses / min in Period I and 22.51 ± 2.77 with stretch 18.51 - 28.39 beats / min, or a significant decrease in workload of 21.90% from Period I.
to II. A decrease in workload means that work becomes lighter. The decrease in workload will theoretically increase worker productivity, this is one of the characteristics of increasing quality of work so that workers can become healthier and better life.

Musculoskeletal Complaints. Measurement data of musculoskeletal complaints were obtained by using Nordic Body Map questionnaire using scores based on Likert scale. Pre-employment data collection (SBK) conducted in Period I and II at 11.00 Wita. The results of data retrieval are shown in Table 4.

| Variable | Period I | Period II |
|----------|----------|-----------|
|          | Average  | SD        | Average  | SD        |
| Period I | 29.60    | 0.61      | 29.71    | 0.40      |
| Period II| 39.73    | 0.94      | 38.31    | 0.87      |
| Different| 10.13    | 1.08      | 8.60     | 0.93      |

Diskription: SD = Standard of Deviation

Table 4 shows that there is a change in the worker's musculoskeletal complaint score from Period I to II before work or after work. Period I the average of worker musculoskeletal complaints before work is 29.60 ± 0.61 with a range of 28.33 - 30.67. Period II the average of worker's musculoskeletal complaints before work was 29.71 ± 0.40 with a range of 29.00 - 30.33. Period I the average worker musculoskeletal complaints after work is equal to 39.73 ± 0.94 with a range of 38.00 - 41.33. Period II mean worker musculoskeletal complaint after work is equal to 38.31 ± 0.87 with range 37.00 - 40.00. The mean difference of worker's musculoskeletal complaint score after work period I period is 10,13 ± 1,08 with range 9.00 - 12.33 while in period II is 8,60 ± 0,93 with range of 7.33 - 10.33. To know that the change of musculoskeletal complaint is not caused by the influence of activity outside the research, then tested the normality and test of musculoskeletal complaint before work in Period I and II, while to know the change of musculoskeletal complaint Period I to II caused by intervention, Test of normality and test of different musculoskeletal complaints that are different musculoskeletal complaints before work with different musculoskeletal complaints after work in Period I and II.

The results of the normality test (Shapiro-Wilk) as presented in suggest that work-before musculoskeletal complaints (KM SBK) in Period I and II are normally distributed (p> 0.05) and the t-paired test states that there is no difference Meaningful between musculoskeletal complaints before work Period I and II (p> 0.05). The results of normality test (Shapiro-Wilk) for different musculoskeletal complaints in Period I and II were normally distributed (p> 0.05) and t-paired test stated that there was a significant difference between musculoskeletal period I and II (p<0.05).

Fatigue can be activity fatigue, motivation and physical that can affect the success of a production process. In this research to know the fatigue of worker done objective fatigue measurement through pulse measurement, whereas subjective fatigue (KS) measured by using questionnaire 30 items of symptoms of fatigue and scoring value based on Likert scale. Data collection Period I and II at 11.00 Wita. The measurement results are shown in Table 5.
Table 5. Fatigue activity (Ak), Motivation (Mot), Fisic (Fis) Parking worker Period I and II

| Variable | Period I |       |       | Period II |       |       |
|----------|----------|-------|-------|-----------|-------|-------|
|          | Average  | SD    | Average | SD        | Average | SD    |
| Ak.Period I | 11,58 | 0,57 | 11,67 | 0,38 | Ak.Period II | 22,20 | 0,69 | 17,71 | 0,68 |
| Beda     | 10,62 | 0,60 | 6,04  | 0,73 | Mot.Period I  | 10,53 | 0,48 | 10,53 | 0,48 |
|          | Mot.Periode II | 20,24 | 0,43 | 18,49 | 0,55 | Mot.Periode II | 9,71  | 0,64 | 7,96  | 0,69 |
| Fis.Period I | 10,11 | 0,72 | 10,00 | 0,80 | Fis.Period II | 19,07 | 0,78 | 18,78 | 0,47 |
| Beda     | 8,96  | 0,65 | 8,78  | 0,67 | Beda       | 9,22  | 0,64 | 7,96  | 0,69 |

Note: SBK= before of work, SSK= After of Work, SB= Standard of Deviation

Table 5 shows that there was a change in sub-scores of subjective subjective fatigue of workers from Period I to II on sub-activity, motivation and physical fatigue. Average score of activity fatigue in period I is equal to 10,62 ± 0,60 with span 9,67 - 11,67 while at period II is equal to 6,04 ± 0,73 with range 5,00 - 7,33. Average score of motivational fatigue in Period I is 9,71 ± 0,64 with range 9,00 - 11,00 while in period II is equal to 7,96 ± 0,69 with range of 7,00 - 9,00.

Based on the above table submitted that there is a significant difference between different subjective fatigue Period I and II. Data of this difference is submitted that in the form of decreasing value of fatigue difference score in three sub fatigue activity, motivation and physical. Fatigue which is the accumulation of a burden of the body due to work activities undertaken too long to produce a production or decrease work capacity in the form of activity fatigue, motivation and physical that can affect the success of a production process activities. This fatigue is the turning point of maximum ability and skill of the worker or a person as a natural cue or sign for immediate rest. Fatigue in this study was measured by difference or different subjective fatigue before work and after work.

Boredom is a convenience that is felt directly by workers as a result of the use of parking guard post used. In this study the measurement of boredom is done by providing questionnaires of 8 items of questions. Before the questionnaire is used for data retrieval, then first test reliability and validation. After the questionnaire is valid, then the data is collected by giving questionnaire in Period I and II. The results of data retrieval are shown in Table 6.

Table 6. Boredom Parking worker Test Period I dan II

| Description | Sample (n) | Average | SD | Average different | Value p Test (Shapiro-Wilk) | Value p Test (t-paired) |
|-------------|------------|---------|----|-------------------|-----------------------------|------------------------|
| Period I    | 10         | 15,58   | 1,43| 9,22              | 0,103                       | 0,000                  |
| Period II   | 10         | 24,80   | 1,85|                   | 0,689                       |                        |

Discription : SD= Standard of Deviation
Table 6 shows that there is a decrease in parking officers' boredom from Period I to II. Average score of employee boredom in Period I of 15.58 ± 1.43 with a range of 13.67 - 18.33. Average score of workers boredom in the Period II of 24.80 ± 1.85 with a range of 22.00 - 29.00 and the average difference of parking officers boredom score is 9.22.

The result of normality test (Shapiro-Wilk) on the mean of boredom in period I and II was normal distribution (p> 0.05) and t-paired test stated that there was a significant difference between the mean of boredom Period I and II (p <0.05).

Motivation is a perceived directly by the workers as a result of the use of parking guard post used. In this study the measurement of motivation is done by giving questionnaire 10 items of questions. Before the questionnaire is used for data retrieval, then first test reliability and validation. After the questionnaire is valid, then the data is collected by giving questionnaire in Period I and II. The results of data retrieval are shown in Table 7.

| Description | Sample (n) | Average | SD | Average different | Value p Test (Shapiro-Wilk) | Value p Test (t-paired) |
|-------------|------------|---------|----|------------------|-----------------------------|------------------------|
| Period I    | 10         | 15.32   | 1.22 | 9.31             | 0.106                       | 0.000                  |
| Period II   | 10         | 24.63   | 1.74 |                  |                             |                        |

Table 7 shows that there is a decrease in parking officers' boredom from Period I to II. Average score of employee boredom in Period I of 15.32 ± 1.22 with a range of 13.25 - 17.63. Average score of workers boredom in the Period II of 24.63 ± 1.74 with a range of 21.00 - 28.00 and the average difference of parking officers boredom score is 9.31.

The result of normality test (Shapiro-Wilk) on the mean of boredom in period I and II was normal distribution (p> 0.05) and t-paired test stated that there was a significant difference between the mean of boredom Period I and II (p <0.05).

4. Conclusions

Based on the results of research and discussion described in this study can be summarized. Implementation of ergonomics on the management of parking of the court improve the quality of work seen from the decrease in complaints musculoskeletal parking attendant at Mall Robinson by 15.10%.

Implementation of ergonomics on the management of parking area improve the quality of work seen from the decrease in the fatigue level of parking attendants at Mall Robinson by 22.06%. Implementation of ergonomics on the management of parking of the court improve the quality of work seen from the decline in the workload of parking attendants at Robinson Mall of 21.90%.

Implementation of ergonomics on the management of parking of the court improve the quality of work seen from the decrease in the boredom of parking attendants at Robinson Mall by 15.85%. Implementation of ergonomics on the management of parking area improve the quality of work seen from the increased motivation of parking officers at the Robinson Mall 37, 68%.

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