Anthropometric parameter consideration in designing lumbar support device for manufacturing industrial workers

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ABSTRACT – Global competition will influence many of these manufacturing industries in their product marketing and results in neglecting their workers' healthcare. Back pain is considered as a common disease in manufacturing field because of the condition during working. Anthropometry has been used as a guideline on designing this product of comfort and ergonomic. This parameter can create the design that can fit to Malaysian body shape. Measurement of the whole body, which are useful in lumbar support designs, is a method instead of an analysis. The data was collected using manual measuring method with standard equipment that measured human body shape. This parameter was described for three percentiles which is 5th, 50th and 95th percentile. This study provides a fit lumbar support parameter that suited to the Malaysian population.

1. INTRODUCTION

National Institute for Occupational Safety and Health Information System (NIOSHTIC) identified that back pain is one of the musculoskeletal disorder (MSD). This disease attacks the industries field workers because of their working condition [1]. Back area is the worst pain area of the body part during conducting the work like manual lifting, prolonged standing, and awkward position [2].

From the literature searches, the back belt or back supports is used as a way to protect the lifting mechanisms in protecting and reducing the back pain. Thus, this study investigated the effect of the used of lumbar support in improving the low back pain (LBP). These feedbacks on the back belt condition and it relevance in industry working environment as one of the reasons that may affect the functionality of the lumbar support [3].

Anthropometry measurements are measurement of size, shape, and composition of the human body. Besides that, each person has different body shape due to the body mass index (BMI), age, gender, and ethnicities [4]. Therefore, this method can integrate detail data in targeting to achieve the best fit between capabilities of human and design of products, workstations and system [5]. Rhie et al. [6] stated that anthropometric data has been proved as a successful method in suggesting and validating the design specification, to produce submarine-mounted multi-function consoles (MFCs) for the Korean.

2. METHODOLOGY

The total respondents involved in this study were 500 respondents from the manufacturing sector in production field. Group of respondents that participated in this experiment was male production workers. The measurement was taken using the anthropometer set as shown in Figure 1. For data collection, the dimensions of 101 body parts were measured based on ISO 4311:2007 standard [7]. The interpretation data of mean and standard deviation was calculated in Microsoft Excel for each parameter of body. These databases were inserted into CATIA software in way to build up the manikin [8]. This software also used to validate the lumbar support behaviour towards manikin. Figure 2 shows the part of parameter was taken to customise the lumbar support and build up the manikin.

Figure 1 Anthropometer set

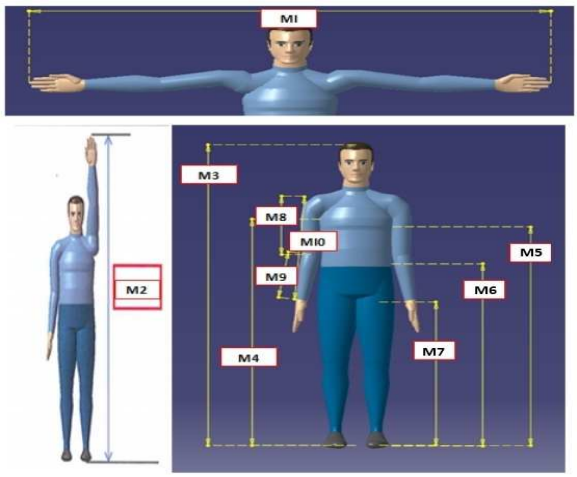

Figure 2 The parameters of anthropometry data

3. RESULT AND DISCUSSION

The subject has an experiences in lumbar support, thus the respondents can share their experiences and

suggestion in new designing lumbar support. Most of them feel discomfort due to the size of lumbar support that loose during working. The anthropometric data can create a manikin that being used in ergonomic analysis before fabricating and test it in real human.

There are several parameters required to focus on designing the lumbar support as shown in Table 1. The parameters were described in three percentiles which is 5th, 50th and 95th percentile. Figure 3 shows the parameters in designing the lumbar support device.

Table 1 Parameters in designing a lumbar support

References	Anthropometric dimension name	5th	50th	95th
M59	Biacromial breath	35.67	39.8	44.15
M182	Length	60.39	62	63.6
M21	Chest circumference at scye	81.15	93.90	112.00
M22	Chest circumference	79.5	89	110.46
M23	Chest circumference below breast	74.01	81.5	102.05
M24	Waist circumference, omphalion	70.73	87	105.92
M25	Buttock circumference	88.14	97.5	115.9
M45	Scye circumference	40	46	52.45

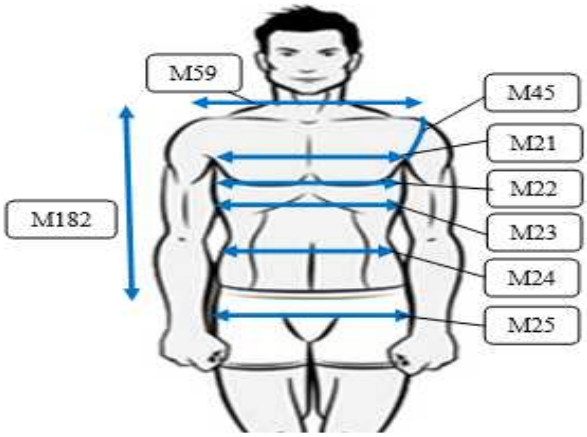

Figure 3 Reference of parameters

4. CONCLUSIONS

In conclusion, the working activities in long duration have high potential in developing MSD especially manual lifting, prolonged standing and backward posture. This anthropometry data can create the fit and comfortable design of lumbar support for a Malaysian body shape. There are several parameters that needed to focus in designing task which is biacromial breath, length of lumbar support, chest circumference at scye, chest circumference, chest circumference below breast, waist circumference omphalion, buttock circumference and scye circumference. The parameters were described in the 5th, 50th, and 95th percentile for each part of the body to create the size of lumbar support. Besides that, this database also can create manikin for the ergonomic assessment. Therefore, the assessment of product functionality and behaviour on ergonomic perspective can be analysed.

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