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Workstation Design based on Ergonomics in Animal feed Packing Process

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***Abstract*—**The intention of this study to design the probability optimized sewing sack's workstation based on ergonomics for productivity improvement and decreasing musculoskeletal disorders. The physical dimensions of two workers were using to design the new workstation. The physical dimensions are (1) sitting height, (2) mid shoulder height sitting, (3) shoulder breadth, (4) knee height, (5) popliteal height, (6) hip breadth and (7) buttock-knee length. The 5th percentile of buttock knee length sitting (51 cm), the 50th percentile of mid shoulder height sitting (62 cm) and the 95th percentile of popliteal height (43 cm) and hip breadth (45 cm) applied to design the workstation for sewing sack's operator and the others used to adjust the components of this workstation. The risk assessment by RULA before and after using the probability optimized workstation were 7 and 7 scores and REBA scores were 11 and 5, respectively. Body discomfort-abnormal index was used to assess muscle fatigue of operators before adjustment workstation found that neck muscles, arm muscles area, muscles on the back and the lower back muscles fatigue. Therefore, the extension and flexion exercise was applied to relief musculoskeletal stresses. The workers exercised 15 minutes before the beginning and the end of work for 5 days. After that, the capability of flexion and extension muscles' workers were increasing in 3 muscles (arm, leg, and back muscles).

***Keywords*—**animal feed, anthropometry, ergonomics, sewing sack, workstation design

I. Introduction

THAI workmen's compensation reported in 2008, musculoskeletal disease is the highest occupational diseases (3,407 persons) caused by working postures and overweight lifting [1]. Accordingly, many industries interested in principle of ergonomics.

Ergonomics approach to design the conventional workstation balancing between capability of worker and productivity improvement. Furthermore, ergonomics' design could reduce awkward work posture.Inadequate posture from an improperly designed workstation causes static muscle efforts, eventually resulting in acute localized muscle fatigue, and consequently in decreased performance and productivity, and in enhanced possibility of operator related health hazards [2].

The objective of this study is to design the proper workstation for sewing sack procedure. RULA and REBA are employed to determine work posture before and after using the probability optimized workstation.

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II. Methods

A. Determination of the Workstation Dimensions

The workstation design is using the physical dimensions from the population (2 operators in this process). Anthropometric measures in 7 dimensions are (1) sitting height, (2) mid shoulder height sitting, (3) shoulder breadth, (4) knee height, (5) popliteal height, (6) hip breadth and (7) buttock-knee length, as shown in Table 1. Calculating the physical dimensions for designing workstation: Percentile(r) =

TABLE I
Anthropometric Measures of the Population in 7 Physical Dimensions

Anthropometry	Physical dimensions of Worker (cm)	
	1st	2nd
Sitting height	123	125
Mid shoulder height sitting	62	61
Shoulder breadth	51	42
Knee height	52	54
Popliteal height	43	42
Hip breadth	45	38
Buttock-knee length	48	46

r (N+1)/100, the physical dimensions were shown in Table 2.

TABLE II
The 4 Physical Dimensions Design The Probability Optimized Workstation

Anthropometry	Dimensions (cm)
Mid shoulder height sitting	62
Popliteal height	43
Hip breadth	45
Buttock-knee length	51 (46+5)

The workstations were presented in figure 1 (the existing workstation) and 2 (the new workstation).

Fig. 1 The existing workstation for sewing sack procedure

Fig. 2 The probability optimized workstation for sewing sack procedure

B. Risk Assessment of Worker Postures The present study assesses risk score of work postures by RULA and REBA when the operators applied the old and the probability optimized workstation.

C. Muscles Exercise to Relief Musculoskeletal Stresses

The flexion and extension postures was using to relief injury of 4 muscles (neck muscles, arm muscles area, muscles on the back and lower back muscles), as shown in figure 3. The workers practiced 15 minutes before the beginning and the end of work for 5 days.

Fig. 3 Eight Postures for Flexion and Extension Muscle for left and right side

III. Results

The results of risk assessment, productivity, and the postural angles measurement were summarized as below:

A. Risk Assessment of Work Posture

Based on the results of the present study, it was found that the risk assessment by RULA before and after using the probability optimized workstation were 7 and 7 scores and REBA scores were 11 and 5, respectively.

B. Productivity Determination

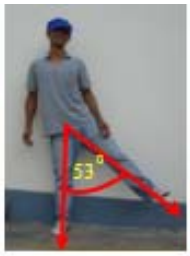
The comparison of productivity was measured when workers were used to the existing and the new designed workstation. Workers performed a number of average sewing sacks when using the former was 12 sacks/min, and using the latter was 14 sacks/min. A time study of the simulated sewing sack's task was shown an 16.67% improvement in operator productivity.

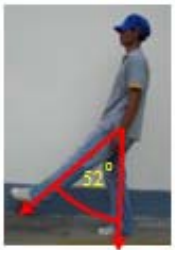
C. Results of Flexion and Extension Exercise

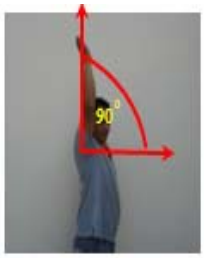
The postural angles were measured from the workers as shown in Table 3. The capability of flexion and extension muscles' workers were increasing in arm, leg and back muscles.

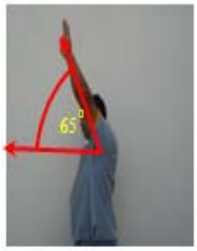
TABLE III
THE POSTURAL ANGLES OF SEWING SACK'S WORKER

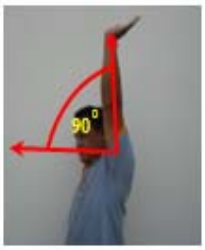
Before exercise	After exercise
	
	
	














IV. Conclusion

From this study, the design of workstation for sewing sack procedure found that the score's risk assessment by REBA, it decreased which presented in the designing workstation based on the principle of ergonomics can reduce awkward posture and improve productivity in sewing sack process (from 12 to 14 sacks/min). In addition, the angles measurement of the operators showed that the exercise of flexion and extension muscles increase the suitable workstation or the exercise should apply in this process for a good posture and productivity improvement.

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