ORIGINAL ARTICLE

Effect of Back Support Belt on Musculoskeletal Discomfort During Simulated Manual Handling of Loads Among Male Agricultural Workers

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ABSTRACT

Introduction: The usage of back support belt for manual handling activities particularly lifting/lowering of loads in occupational setting has been a sore point of conflicting agreement between industrial practitioners and academician on its effectiveness in prevention of back injuries. As such, this pre-test and post-test experimental study was designed to investigate the effectiveness of back support belt in reducing localized musculoskeletal discomfort among male agricultural workers. **Methods:** A total of 38 subjects were randomly assigned into control and intervention groups (19 subjects in each group). The subjects were required to carry out a series of lifting and lowering of incremental weight load similar to the protocol as described in Progressive Isoinertial Lifting Evaluation (PILE) techniques. After completing each lift, subjects were required to rate the discomfort felt in the back region using the Localized Musculoskeletal Discomfort questionnaire. **Results:** Results showed that only several pairs showing statistically significant differences with no discernible trend. Within the control group, the median calculated from group data showed an overall increased discomfort rating as the weight load increases except for 19.4kg but an overall decreased discomfort within intervention group. Comparison between control and intervention group for post-test results showed significant difference between 5.9kg and middle back although the trend of LMD ratings across body part investigated may suggest interesting relationship. **Conclusion:** Despite positive subjective perception amongst the wearer as conveyed by industrial practitioners, the epidemiological data, clinical trials, and various other experimental studies in the past few decades including in this study has not shown sufficient evidence of effectiveness.
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INTRODUCTION

Manual handling activities are tasks which requires significant level of forces being exerted such as lifting, lowering, pushing, pulling, or carrying. In occupational setting, manual handling remains to be one of the main causes of musculoskeletal disorders in the workplace attributable to the various ergonomics risk factors and practices amongst the workers (1). Despite the increased mechanization and automation, it is expected that manual handling activities will continues to be significant in developing countries especially in the micro, small and medium industries as well as informal sector.

Forceful exertion remains to be the main ergonomics risk factors during handling of heavy loads that it is often compounded by other co-existing ergonomics risk factors such as awkward posture as well as repetitiveness (high frequency) of load handling. As manual handling tasks impose excessive force on joint and overload the muscles and tendons particularly of the lower back, low back pain, or injuries remains to be one of the most debilitating effects suffered by manual handling workers who carry out manual handling incorrectly (2, 3).

In addressing the low back injuries amongst the manual handling workers, the usage of back support belt in the industrial workplaces can be traced back to late 1980s. This was followed by an abundant of publication on the effectiveness of back support belt usage in the early 1990s and continues being explored and debated to date. The back support belt is designed to be worn externally around the lower back, constructed of light-weighted and elastic material to accommodate a broad range of users using suspender or fastener to hold in place while some has harness that are worn over the shoulder (4).

While the primary goal of the back support belt is to stabilize an unstable lumbar spine and relieve pain (5), studies has shown that back support belt can be regarded as a useful assistive device to provide abdominal support for reducing muscle activity and increasing body stability during manual handling (6) while many has shown contradictory effectiveness. As such, this preliminary experimental study intended to investigate the effects of the back support belt on localized musculoskeletal discomfort during simulated manual handling of loads among male agricultural workers.

MATERIALS AND METHODS

Research Design

This was a pre-test and post-test experimental study designed to determine the subjective localized musculoskeletal discomfort (LMD) among the subjects in the usage of back support belt in a series of lifting and lowering of different loads weight.

All 38 subjects involved in this study were allocated into control or intervention group equally into each group using random sampling (19 subjects). The O_1 represents pre-test study which is consider as baseline data whereas O_2 represents post-test study. In this study, the intervention is given to the subjects in intervention group only to test the effect on localized musculoskeletal discomfort.

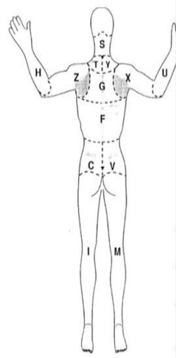
Sample Population

Subjects were purposively recruited among agricultural workers at Taman Pertanian Universiti (TPU) in Universiti Putra Malaysia considering their job description which primarily involves intensive manual handling. The selection criteria of the subject were male worker, age between 18-35 years old, normal BMI (18.5-24.9) and does not suffer from any acute or chronic musculoskeletal disorder or taking any medication which is screened prior to the study. A total of 38 subjects who fulfilled the criteria aforementioned were recruited for this study.

Instrumentations

The instruments used for this study were questionnaires, measurement tape, weighing scale, table, plastic box/cart, dumbbell (pre-fixed weight), Polar Heart Rate Monitor wristwatch, and back support belt. A screening questionnaire which contains questions on the selection criteria (age, gender, height, weight, and musculoskeletal health) were developed based on the study inclusion and exclusion criteria used to determine the eligibility of subjects to participate in the study. Subsequently, the localized musculoskeletal discomfort questionnaire (LMD) was used for pre-test and post-test for all eligible subjects throughout this study.

As described by Reenen et al. (7), the LMD method which was first described by Van der Grinten and Smitt (8) adapted the Borg category ratio (CR-10) scale as well as a rear view of human body (map) that have been modified (9). The scale used in LMD ranges from 0 being "no discomfort at all" to 10 indicating "extreme discomfort, almost maximum" allows subjects to psychophysically choose the numbers with corresponding intensity descriptors which reflect the degree of subjective discomfort on various body parts (Figure 1).



	No discomfort at all	Extremely little discomfort	Very little discomfort	Little discomfort	Moderate discomfort	Somewhat high discomfort	High discomfort	-----	Very high discomfort	-----	-----	Extreme discomfort
	0	½	1	2	3	4	5	6	7	8	9	10
Neck (S, T and/or Y)												
Upper Back (G)												
Middle Back (F)												
Lower Back (C and/or V)												

Figure 1: Localized Musculoskeletal Discomfort Questionnaire

For the purpose of this study, the LMD questionnaire were modified and adapted to include only 4 body parts; neck, upper back, middle back, and lower back which reflects the body region of interest in the use of back support belt. SECA Body Meter was used to measure the subject's body height, and SECA Weighting Scale was used to measure the subject's body weight. The dimension of table used was 45cm width x 140cm length x 75cm height. The size of the plastic box is (35cm Width x 35cm Length x 25 High). Total weight of dumbbell plate is 19.4kg with several of proportions.

The back support belts with adjustable clavicle straps used (Brand: FST Magneto Back Support) in this study were off-the-shelves ready-made product procured available locally in Malaysia. The type of fabric used were polyester considering the sturdy, light weight, resistant to shrinking and stretching, and UV resistant features. The adjustable elastic straps were wrapped in a soft cotton fabric to minimize pinching and binding. Each subject in this study were aided by the researcher in wearing the back support vest to subject correct fitting for usage.

Experimental Protocol

The experiments were carried out during office hours where a pre-arranged schedule of appointments was made with all the subjects after obtaining written consent to participate in the experiments. During each session, each subject was briefed on the purpose of the study and shown a demonstration of the adapted Progressive Isoinertial Lifting Evaluation (PILE) techniques which protocol being described by Mayer et al. (10) as well as recommendations by McDaniel et al. (11) for design of a safe isoinertial weightlifting procedures. This was ensued by a question-and-answer session to ensure understanding of the experimental protocol.

Specifically, each subject was required to lift the box four times with different loads (5.9 kg, 10.4 kg, 14.9 kg and 19.4kg respectively) incrementally at each stage. For each lifting task, the subject was only required to lift the box with pre-set weight from the floor up to the 75 cm high table (using squat lifting) (Figure 1), a resemblance to the PILE described by Smeets et al. (12). Each subject was given at least 2 minutes of rest after each successive lift. The subject was given 20 minutes of resting before continuing with the post-test. The session is continued with subject performed lifting tasks without (control) and with the support vest (intervention).

The PILE functional testing in this study employed two possible criteria for termination: (i) psychophysical endpoint which was a voluntary termination due to fatigue, excessive discomfort, or inability to complete the specified lifting task; or (ii) aerobic endpoint where the heart rate of the subject exceeds 85% of the maximal heart rate (MHR). The MHR for each subject was calculated objectively (MHR = 180 – age) using the method described by Hшeg and Maffetone (13) for each subject. The third criteria of termination in the PILE protocol; safety endpoint, were not applicable as the "safe limit", being the maximum allowable load of 55%–60% of body weight was not achieved in this study based on the weight of subjects.

Figure 2: PILE method (left-to-right) – subjects were required to perform squat lifting on the box from the floor, standing straight up, take 2 steps forward then lowering down the load on the table

Following each successive lift; in both pre-test and post-test, all subjects were required to answer the LMD questionnaire providing rating to the discomfort they felt with emphasis on "discomfort, ache or pain" experienced of their body parts (instead of exertion) by the researcher who administer the experiment.

Data Analysis

All data acquired were analyzed using Statistical Package for Social Sciences (SPSS). Descriptive analysis with normality tests were performed. As the data distribution were not normally distributed, non-parametric analysis was carried out for all variables. The percentage of changes from pre-test to post-test for all LMD ratings were presented in the form of median and IQR calculated using group data. The bivariate analysis utilized Wilcoxon signed-rank test to compare the LMD ratings between pre-test and post-test outcomes within each group while Mann-Whitney U tests were used to compare the median differences across control and intervention group for each body parts. Statistical significance was set at $p<0.05$ for the bivariate analysis.

RESULTS

A total of 38 subjects were recruited for the study. All 38 subjects were retained to perform the experiment with equal number of subjects being randomly assigned into each of the control and intervention group. All the 38 subjects successfully completed the experiment without any voluntary withdrawal, dropout, or conditional termination (based on psychophysical, aerobic or safety endpoint).

Characteristics of Subjects

Table II presents the physical characteristics of the subjects as well as the typical duration of labor-intensive tasks and physical activities of the subjects in a week.

Table I: Overall and Within Group Physical Characteristics, Duration of Labor-Intensive Tasks and Physical Activities of Subjects

Variable	Mean (±SD)	Median (IQR)			U^{α}	p-value
		All (N = 38)	Control (n = 19)	Experimental (n = 19)		
Age (years)	31.5 (±3.05)	33.0 (3.0)	33.0 (3.0)	29.0 (6.0)	83.5	0.004*
Weight (kg)	75.0 (±16.82)	72.5 (20.0)	70.0 (25.0)	75.0 (16.0)	175.5	0.884
Height (cm)	169.4 (±5.19)	170.0 (6.0)	170.0 (8)	170.0 (6.0)	141.5	0.251
BMI (kg/m^2)	26.1 (±5.44)	24.6 (6.9)	23.5 (9.2)	25.4 (6.3)	162.0	0.589
Duration of labour-intensive tasks in a week (hours)	15.7 (±10.15)	15.0 (14.0)	14.0 (14.0)	15.0 (13.0)	150.0	0.370

Table I: Overall and Within Group Physical Characteristics, Duration of Labor-Intensive Tasks and Physical Activities of Subjects (CONT.)

Variable	Mean (±SD)	Median (IQR)			U$^{\alpha}$	p-value
		All (N = 38)	Control (n = 19)	Experimental (n = 19)		
Duration of physical activities (sports) in a week (hours)	3.7 (±4.58)	2.0 (5.0)	2.0 (4.0)	2.0 (3.0)	158.0	0.500

$^{\alpha}$ Mann-Whitney U test

* Significant at p <0.05

A comparison between the group revealed significant difference (p<0.05) for age but not for any other variable.

Overall LMD Ratings of Neck, Upper Back, Middle Back and Lower Back for Both Control and Experimental Group

Table III showed the overall results of LMD ratings for each of the respective body parts among the control and intervention groups alongside the percentage of score changes (differences) from pre-test to post-test using median calculated from grouped data. The median of LMD ratings were relatively low (below 1 which indicates very little discomfort) for all body parts investigated in this study except for lower back. Generally, the median score (grouped data) of LMD ratings increases with weight load increment which was also indicated by the percentage of changes across all body parts.

Table II: Results of LMD's rating for each body parts among control and intervention group during pre-test and post-test with percentage of changes.

Body parts	Loads	CONTROL GROUP (n=19)			INTERVENTION GROUP (n=19)		
		^{a}Median (IQR)		^{b}Percentage of changes	^{a}Median (IQR)		^{b}Percentage of changes
		Pre-test	Post-test		Pre-test	Post-test	
Neck	5.9 kg	0.079 (0.329)	0.132 (0.382)	67.09%	0.053 (0.303)	0.053 (0.303)	0.00%
	10.4 kg	0.158 (0.408)	0.211 (0.461)	33.54%	0.118 (0.397)	0.111 (0.375)	-5.93%
	14.9 kg	0.235 (0.536)	0.321 (0.781)	36.60%	0.265 (0.969)	0.111 (0.375)	-58.11%
	19.4 kg	0.778 (1.536)	0.625 (1.375)	-19.67%	0.375 (0.672)	0.367 (0.725)	-2.13%
Upper Back	5.9 kg	0.026 (0.276)	0.079 (0.329)	203.85%	0.000 (0.000)	0.000 (0.000)	0.00%
	10.4 kg	0.079 (0.329)	0.139 (0.403)	75.95%	0.111 (0.375)	0.083 (0.347)	-25.23%
	14.9 kg	0.167 (0.431)	0.219 (0.542)	31.14%	0.219 (0.542)	0.167 (0.431)	-23.74%
	19.4 kg	0.321 (0.95)	0.286 (0.850)	-10.90%	0.423 (0.859)	0.300 (0.719)	-29.08%

Table II: Results of LMD's rating for each body parts among control and intervention group during pre-test and post-test with percentage of changes.(CONT.)

Body parts	Loads	CONTROL GROUP (n=19)			INTERVENTION GROUP (n=19)		
		^{a}Median (IQR)		^{b}Percentage of changes	^{a}Median (IQR)		^{b}Percentage of changes
		Pre-test	Post-test		Pre-test	Post-test	
Middle Back	5.9 kg	0.026 (0.275)	0.105 (0.355)	303.85%	0.000 (0.000)	0.000 (0.000)	0.00%
	10.4 kg	0.111 (0.375)	0.139 (0.403)	25.23%	0.219 (0.550)	0.139 (0.403)	-36.53%
	14.9 kg	0.235 (0.536)	0.235 (0.594)	0.00%	0.423 (0.911)	0.250 (0.583)	-40.90%
	19.4 kg	0.455 (1.334)	0.281 (0.679)	-38.24%	0.778 (1.469)	0.556 (1.100)	-28.53%
Lower Back	5.9 kg	0.088 (0.368)	0.200 (0.550)	127.27%	0.139 (0.403)	0.105 (0.355)	-24.46%
	10.4 kg	0.088 (0.368)	0.267 (0.750)	203.41%	0.300 (0.792)	0.281 (0.656)	-6.33%
	14.9 kg	0.313 (1.140)	0.625 (1.640)	99.68%	0.600 (1.091)	0.400 (0.688)	-33.33%
	19.4 kg	1.429 (2.192)	1.167 (2.115)	-18.33%	0.900 (1.545)	0.679 (0.830)	-24.56%

^{a} Median: Calculated from grouped data.

^{b} Percentage of changes: based on ^{a} Median; positive indicating increment of LMD rating, negative indicating reduction of LMD rating

Comparison of LMD Ratings Within Group and Between Group

In establishing statistical significance for the comparison of LMD ratings within each of the groups (pre-test to post-test), Table IV showed that within the control group, there were no significant differences for all the pair across all body parts studied except for one; lower back at weight load of 10.4kg where there was a significant increase of LMD rating post-test.

On the other hand, the results within the intervention group showed significant differences for several pairs across different body parts at different weight load; neck at 14.9kg, middle back at 14.9kg and 19.4kg respectively as well as lower back at 14.9kg where there was an overall decrease of LMD rating post-test except for middle back at 14.9kg.

Comparing across both the control and intervention group, the post-test results showed that there were no significant differences across all pairs except for middle back at 5.9kg where the median value of the LMD rating were higher among control group compared to intervention group post-test.

In the form of graphical presentation, Figure 2 showed the trend of LMD ratings for each body parts comparing the post-test median value (calculated from group data) in both control and intervention group. Generally, the LMD ratings (based on median value calculated from grouped data) increased with increment in weight load handled for both group across all body parts investigated.

A notable overall trend showed that the post-test median (grouped data) among control group were higher than intervention group for neck, upper back, and lower back but not middle back.

Table III: Differences of LMD ratings (median score) from pre-test to post-test within each group for each of the body parts investigated according to respective weight load

Body parts	Loads	CONTROL GROUP (n=19)				EXPERIMENTAL GROUP (n=19)			
		Median (IQR)		Z-score $^{\beta}$	p-value	Median (IQR)		Z-score $^{\beta}$	p-value
		Pre-test	Post-test			Pre-test	Post-test		
Neck	5.9 kg	0.0 (0.0)	0.0 (0.5)	-1.414	0.157	0.0 (0.0)	0.0 (0.0)	0.000	1.000
	10.4 kg	0.0 (0.5)	0.0 (0.5)	-1.000	0.317	0.0 (0.0)	0.0 (0.0)	-1.069	0.285
	14.9 kg	0.0 (0.5)	0.0 (1.0)	-1.265	0.206	0.0 (0.5)	0.0 (0.0)	-2.264	**0.024***
	19.4 kg	1.0 (2.0)	0.5 (1.0)	-1.382	0.167	0.5 (0.5)	0.5 (0.5)	-0.137	0.891
Upper Back	5.9 kg	0.0 (0.0)	0.0 (0.0)	-1.414	0.157	0.0 (0.0)	0.0 (0.0)	0.000	1.000
	10.4 kg	0.0 (0.0)	0.0 (0.5)	-1.633	0.102	0.0 (0.0)	0.0 (0.5)	-1.342	0.180
	14.9 kg	0.0 (0.5)	0.0 (0.5)	-0.966	0.334	0.0 (0.5)	0.0 (0.5)	-1.518	0.129
	19.4 kg	0.0 (1.0)	0.0 (1.0)	-0.425	0.671	0.5 (1.0)	0.0 (0.5)	-1.725	0.084
Middle Back	5.9 kg	0.0 (0.0)	0.0 (0.0)	-1.732	0.083	0.0 (0.5)	0.0 (0.5)	0.000	1.000
	10.4 kg	0.0 (0.0)	0.0 (0.5)	-0.276	0.783	0.0 (0.5)	0.0 (0.5)	-1.725	0.084
	14.9 kg	0.0 (0.5)	0.0 (0.5)	-0.365	0.715	0.5 (1.0)	0.5 (1.0)	-2.140	**0.032***
	19.4 kg	0.5 (1.0)	0.0 (0.5)	-1.581	0.114	1.0 (1.0)	0.0 (0.0)	-2.339	**0.019***
Lower Back	5.9 kg	0.0 (0.0)	0.0 (0.5)	-1.633	0.102	0.0 (0.5)	0.0 (0.0)	-0.707	0.480
	10.4 kg	0.0 (0.0)	0.0 (0.5)	-2.264	**0.024***	0.0 (0.5)	0.0 (0.5)	-1.020	0.308
	14.9 kg	0.5 (0.5)	0.5 (2.0)	-1.860	0.063	0.5 (1.0)	0.5 ±0.5)	-2.069	**0.039***
	19.4 kg	1.0 (2.5)	1.0 (2.5)	-0.422	0.673	1.0 (1.5)	0.5 (0.5)	-1.846	0.065

$^{\beta}$ Wilcoxon signed-rank test
* Significant difference at p<0.05

Table IV: Comparison of median score of LMD ratings between control group and intervention group for post-test

Body parts	Loads	Post-test Median ± IQR		U□	p-value
		Control (n=19)	Intervention (n=19)		
Neck	5.9 kg	0.0 ± 0.5	0.0 ± 0.0	152.0	0.215
	10.4 kg	0.0 ± 0.5	0.0 ± 0.0	146.5	0.220
	14.9 kg	0.0 ± 1.0	0.0 ± 0.0	127.0	0.063
	19.4 kg	0.5 ± 1.0	0.5 ± 0.5	141.0	0.227
Upper Back	5.9 kg	0.0 ± 0.0	0.0 ± 0.0	152.0	0.075
	10.4 kg	0.0 ± 0.5	0.0 ± 0.5	162.0	0.447
	14.9 kg	0.0 ± 0.5	0.0 ± 0.5	166.5	0.626
	19.4 kg	0.0 ± 1.0	0.0 ± 0.5	179.5	0.974
Middle Back	5.9 kg	0.0 ± 0.0	0.0 ± 0.5	142.5	**0.037***
	10.4 kg	0.0 ± 0.5	0.0 ± 0.5	180.5	1.000
	14.9 kg	0.0 ± 0.5	0.5 ± 1.0	176.0	0.882
	19.4 kg	0.0 ± 0.5	0.0 ± 0.0	138.0	0.188
Lower Back	5.9 kg	0.0 ± 0.5	0.0 ± 0.0	153.5	0.307
	10.4 kg	0.0 ± 0.5	0.0 ± 0.5	180.0	0.987
	14.9 kg	0.5 ± 2.0	0.5 ±0.5	141.5	0.228
	19.4 kg	1.0 ± 2.5	0.5 ± 0.5	122.5	0.078

$^{\alpha}$ Mann-Whitney U test
* Significant difference at p<0.05

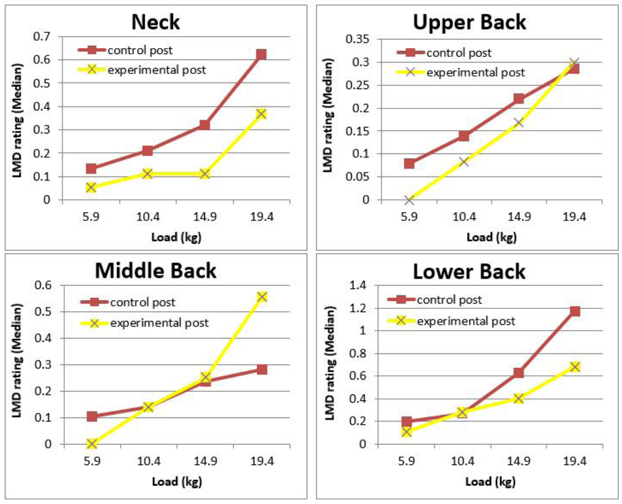


Figure 3: Trend of LMD ratings (median score of grouped data) for each body parts (neck, upper back, middle back, and lower back) comparing post-test results between control and intervention group

DISCUSSION

Manual handling of loads impose upon the body musculature system a significant amount of force which has been supported in various biomechanical models and epidemiologically linked to a broad range of musculoskeletal disorders particularly of the back. It is one of the most intensively studied area within the domain of physical ergonomics to which various health and safety authorities as well as standards has been prescribed in limiting the manual handling of loads based on the consideration of various factors.

In the interest of this study, only the back (upper, middle and lower region) including the neck were investigated considering the effects the back support belt is expected to provide. While a significant difference was observed for age between control and intervention group in this study, the effect may be negligible considering that relatively small gaps (median of 4 years) although previous studies have showed that ageing diminishes strength and muscle mass (14, 15). Despite the fact, statistics has also showed that back injuries among those aged 45 years old are lower than those within 20-45 years of age which suggest that decreased in physical capacity may be counterbalanced by experiences (16).

It was fortunate that the potential effect of experiences due to ageing has been controlled in this study where all subjects were required to perform squat lifting as demonstrated. Based on the percentage of change from the median calculated using grouped data within control group, it was interesting to note a peculiar trend where there were slight reduction of discomfort from pre-test to post-test albeit small for the highest weight load (19.4kg) in each of the body part investigated.

The results of the comparison within control group for all pairs from pre-test to post-test were mostly within expectation (no statistical differences for all pairs except for one) as the weight load handled (experimented) had no changes from pre-test in the post-test. For the pair (lower back at 10.4kg) which indicated significant difference, there were no plausible explanation although we suspect that some of the subjects may not have taken enough rest break in between lift/stages or that they may have felt strain in the lower back but did not or refuse to terminate. The explanation can also apply to significant difference at post-median between control and intervention group (middle back at 5.9kg).

On the other hand, although four (4) pairs of comparison within intervention group showed significant differences from pre-test from post-test, there does not appear to be any particular trend or pattern with most of the median score calculated from grouped data showed only slight reduction of discomfort ratings (based on the percentage of changes). Further comparison focusing only on post-test results between intervention and control group also did not indicated effectiveness of the back support belt with only one (1) pair yield significant differences without any obvious trend or pattern.

While it is possible that the reduction of discomfort among the intervention group were not significantly experienced due to similar explanation in the control group (inadequate muscle recovery in between lift), the sample size as well as design of the lifting tasks in the experiment (including preparation of subject) may not be sufficiently robust to elicit the necessary response. Besides small sample size, this preliminary study employed only 4 weight loads (with a pre-defined increment of weight load following each successive lift) in a simple pre-test post-test comparison which lack randomization and blinding of the weight lifting protocol due to safety concern.

It should be further acknowledged that the experiment conducted potentially lead to tiredness at the end of post-test as a result of cumulative handling of load which may explain the higher ratings of discomfort for the highest load of 19.4kg. In addition, it should not be discounted that the subjects may have also engaged in strenous activities days leading to the experiment hence being exposed to other confounding factors that may affect muscle performance. However, all subjects were screened prior to the experiment to ensure that they are not experiencing any musculoskeletal disorders.

Another key fact to note was that the experiments in this study were conducted during office hours, after which they were expected to resume their job tasks at the request of the workplace management. As such, the subjects were not pre-conditioned, a protocol described by previous studies. In our defense, the job description of the subjects were primarily manual handling of load which reflect the day-to-day routine which would otherwise takes place with or without our study and thus reflect to a certain extent the true nature of occupational setting.

In a nutshell, it can be observed that this study is in support of the notion that the back support belt may not be sufficiently effective in reducing the risk of low back pain or injuries resulting from manual handling tasks in occupational setting despite the limitations described which may potentially confound the outcome of this study. This was similarly echoed not only by past research which includes a review with theoretical discussion by Bridger (17), a systematic review by Ammendolia, Kerr and Bombardier (18) as well as Margaret and Konz (19) but also by many prominent Occupational Safety and Health authorities and agencies in such as Canadian Centre for Occupational Health and Safety (CCOHS), United State National Institute for Occupational Safety and Health (US NIOSH), European Agency for Safety and Heath at Work (EU-OSHA), Health and Safety Executive United Kingdom (HSE UK) (20).

Originally developed as a therapeutic device in healthcare setting for back injuries or spinal deformities, the back support belt (sometimes referred to as orthoses, spinal braces or corsets) has been widely used in attempt to prevent back injuries due to manual handling in occupational setting. Researches in the past has raised concerns on the rampant promotion and implementation in the industries based on unfounded claims by manufacturers, unmonitored usage or prescription by non-health personnel, the lack of understanding on the mechanism and evidences of back support belt in attenuating back injuries via increased intra-abdominal pressure via reduction in spinal compression (21).

Primarily, the back support belt served to immobilize and support on the lumbar spine of the wearer (22) where the mechanical stiffness provide a direct biomechanical benefits that decreases lumbar range of motion (ROM) (23), reduced stresses in the passive tissues of the posterior lumbar spine (24) and possibly reduced compressive loading of the lumbar spine (25). However, it should be noted that these features described may or may not be applicable on users who perform manual handling which nature of work are dynamic and requires activation of various muscles groups in their tasks.

According to Van et al. (23), wearing a back support belt can prevent stooped shoulders and serve as a reminder to workers in maintaining appropriate posture while limiting the lumbar range of motion (ROM). Due to the restraining properties of the back support belt, workers must squat to lift loads on the floor rather than bending the lower back forward (26). However, without proper information, education or supervision on the wearer, these benefits may fall short and misconstrued such that they provide false sense of security against low back injuries causing the wearer to lift heavier load or at higher frequencies.

It was however interesting to note a large retrospective cohort study by Merdith, Oosthuizen and Nedved (27). In their article, the authors highlighted the shortcoming of clinical trials in the past literatures particularly the high dropout rate in some and poor compliance in others to which the evidence of back support belt effectiveness were often regarded as inconclusive based on their review. The authors go on to investigate effectiveness of the mandatory usage of back support belt among 21 metropolitan stores which was followed up from year 1995 to year 1999.

While the study was unable to find statistically significant decrease of low back pain incidents due to manual handling injury, the days lost and direct costs due to low back pain both showed significant reduction (half the duration of lost time injuries and a quarter of direct costs post-intervention) which was associated with the intervention (usage of back support belts). Perhaps, replicating such study at large scale with proper experimental methodology and protocol including follow up may better provide a centerpiece information to the effectiveness of back support belt for manual handling in the near future.

CONCLUSION

Corresponding to the previous research on the effectiveness in back support belt usage in reducing low back injuries, the immediate outcomes in this study showed no significant reduction on the discomfort of the back including the neck among the intervention group (except for 5.9kg at middle back region). While it cannot be denied that this study may suffers from a number of limitations, there is a need for a much more robust design of experiments, utilizing the newer and better technological advantage as well as the advanced understanding of pathomechanics, neuromuscular control system to support or refute the epidemiological evidence.

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