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Effectiveness of health education intervention on posture in ceramic industry workers

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Abstract
Background: One of the primary causes of work-related musculoskeletal diseases is poor posture. Ergonomic awareness in the industry is deemed to be low and that the increasing trend involving musculoskeletal disorders (MSDs) has been reported. To lower the risk of musculoskeletal disorders (MSDs) in the long run, it is critical to educate workers on proper postures and ergonomic training. Workers in the ceramic sector move heavy materials by hand, putting strain on their backs and shoulders. The purpose of this study was to give heath education intervention on posture in ceramic industry workers who handled the load manually to improve poor posture.
Methodology: This study was single group pre-test and post-test. The total number of subjects in the study was 62, with action category 4 on the OWAS scale at the start, after 7 days of monitoring. Subjects received a health education intervention on posture for 8 weeks, 20 minutes per session, 3 days per week. The OWAS scale was used to determine posture after 8 weeks of intervention.
Result: This study found significant for performing postural correction exercises to improve uncomfortable posture (category 4) and lowering the risk of musculoskeletal disorders.
Conclusion: This study concluded that health education intervention was effective on improving posture of manual material handling workers of ceramic industry.

Keywords: Posture, musculoskeletal disorder, OWAS scale, posture correction exercise

Introduction
According to the World Health Organization, health is a condition of complete physical, mental, and social well-being, not just the absence of sickness and disability [1]. Reassuring healthy behaviours, such as consistent physical activity, and reducing harmful activities or conditions, such as smoking, alcohol consumption, or excessive stress, can all help to improve health. India has been battling public health issues such as pandemics, infectious illnesses, non-communicable diseases, malnutrition, and insufficient medical treatment, all of which are fuelled by a rapidly rising population far apart from occupational health issues.
A prevalent occupational ailment is work-related musculoskeletal disorder (WMSD). It is defined by the World Health Organization as health issues involving the locomotor apparatus, which includes muscles, tendons, bone skeleton, cartilage, ligaments, and nerves. This encompasses any form of complaint, from pain with the slide translator to injuries that are reversible and incapacitating [1].
Work-related musculoskeletal disorders are common in many countries, resulting in significant costs and a negative impact on quality of life [16]. It has considerable influence on work time, absence, increasing work constraints, changing job and work disability which impose large number of economic effects on individual, work organization and society [3].
Awkward working posture is a physical trait associated with musculoskeletal ailments in the workplace [8]. According to the National Institute for Occupational Safety and Health, poor working posture is a strong link to the development of work-related musculoskeletal illnesses. Excessive reaching behind, twisting, working aloft, wrist bending, kneeling, stooping forward and backward bending, and squatting are all indications of uncomfortable posture [8, 9].

In many developing countries, workplace hygiene and posture analysis are frequently ignored, such as in India [11]. As a result, musculoskeletal disorders are linked to such high repetitive progressions, and working in an awkward posture does not improve workers' productivity, their posture should be checked, and educational steps taken to avoid musculoskeletal disorders [10, 11].

The ergonomic assessment tool OWAS was employed in this investigation. It was created in 1973 in Finland, specifically at the OVAKO OY Company, a renowned European steel bar and profile producer [13]. The technique for applying the OWAS code entailed making observations of the work task, validating the postures, assigning risk categories, and suggesting corrective actions.

Ergonomic interventions are one of numerous therapy and preventative options for work-related musculoskeletal problems. It entails comprehensive health education, workplace exercise design, and time management based on the work environment. Economic migrants regard difficult working circumstances as a given and, for the most part, work in poor postures. The main issues are repetitive processes and manual material handling [28].

In terms of the ceramic industry in India, it is one of the world's fastest-growing. Workers are directly involved in the manufacturing and loading operations in ceramic manufacturers. According to literature, manual material handling, particularly lifting, is one of the major health and safety hazards in industry. Lifting is considered the most stressful activity in manual material handling and can cause musculoskeletal disorders in exposed workers, making it a major concern in many industries.

The current investigation is focused on the ceramic industry in Maharashtra. Workers in this industry lift loads ranging from 10 to 27 kg, resulting in biomechanical risk factors, cardiovascular hazards, musculoskeletal symptoms, jobsite injuries, and psychological symptoms such as depression, mental stress, and absenteeism, among others. These dangers arise mostly as a result of poor posture. As a result, for worker safety and to eliminate dangers associated with uncomfortable posture, thorough health education is essential. This research focuses on posture correction exercises with lifting and carrying techniques that are simple to incorporate into their regular routines and do not require them to take time away from work.

Methods and Materials

Design Overview

In the ceramic sector, a single group pre and post-test study was conducted. Ethical approval received from the institutional ethical committee. Inclusion and exclusion criteria were used to choose subjects for the study. The intervention program's procedure was explained to the subjects, and only then were they requested to sign the consent form. The posture of the workers during their usual manual material handling was examined using the OWAS method during the first week, i.e. 7 days. The assessment was carried out when the workers were unloading from the truck; a video was captured as they were unloading, and then each worker was given a postural code after 10 seconds of snapping. The postural risk category was calculated for each subject after each day's examination. For a period of seven days, the mean value of each postural risk was computed. The mean posture of workers resulted in action category 4 of postural risk, health education intervention was offered to them.

Study Population and Sample Size

62 subjects were recruited in study. Inclusion criteria were age between 20-40 years,

Workers who handle ceramic material manually to unload it, workers with the results of Action Category 4 in OWAS scale. (Who needs immediate intervention), workers who works for more than 2 hours to handles material manually but less than 5 hours, workers who has work experience 2-5years, subjects who are willing to take part in study. Exclusion Criteria were psychological compromised subjects who are not able to follow the instructions, subjects who works on computer, subjects who are not willing to take part in study.

Intervention

Health education intervention started from 2nd week, it included following intervention.

1. Appropriate lifting/ loading techniques

This technique was explained to workers along with exercise program.

- **Stance:** Wide foot base, symmetrical base, stance close to the object.
- **Posture:** Shoulders should be symmetrically aligned above pelvis.
- **Back:** Maintain proper lordosis, back should be stabilized, lift is performed smoothly, there should be no jerky movements.
- **Object:** Grip the object firmly, add forearm support if the object is too bulky.
- **Turning with load:** Never twist the body leaving the feet still, always keep the body in straight alignment, move the feet around.
- **Rest Pauses:** Take frequent rest pauses, rest before sensation of fatigue, and avoid working to the point of fatigue.

Lowering the Load

Reverse of lifting, keep the back braced, bend the knees to required position, lower carefully, and do not drop the weight suddenly.

Table: Week-2 (20 minutes per session for 3 days per week)

Exercise	Instructions
Deep breathing exercise	Workers instructed that lift both arms while inhaling through the nose, lower arms forward while exhaling.
Straightening shoulders and flanks	While seated, straighten your right hand and put your left hand on your waist. Incline your body toward the left side while counting “one, two, three, four.” Return to the original position while counting “five, six, seven, eight.” Perform the same action on the opposite side.
Calf stretching	1. Sit on the middle of the chair and stretch your left leg forward. 2. Cross both hands while bending your upper body toward the big toe of your right foot. 3. Perform the same action on the opposite side.

Squat while seated	1. Perform a squat while seated on the chair. 2. Shake both hands and both arms by moving them as much as possible.
Pelvic tilt exercise	Pull your jaw downward and droop your head toward your breast. Inhale and then exhale through your mouth while looking down and bending your back, while stretching both elbows toward the pelvic joint. Maintain the posture for over 10 seconds and then return to the original posture.
Spine flexibility exercise	In the cat pose, straighten your right leg slowly while maintaining a neutral posture (linear) of the spine (do not lift or detach the right pelvis). At the same time, lift your left arm. Relax muscle strain after maintaining the pose for 10 seconds and lower your left arm and right leg

Table: Week 3-8 (20 minutes per session for 3 days per week)

Exercise	Instructions
Adductor muscle strengthening exercise	Pull your jaw downward while lying down on the floor and bend both knees. Move both knees to your breast, and wrap the knees with your hands. Then pull them toward your breast. Return to the original posture after maintaining the pose for over 7 seconds.
Body stretching	Kneel down and straighten both your arms forward. Straighten your shoulders and touch the floor.
Lower muscle static strengthening exercise	While seated, bend both your knees and cross both ankles. Push your ankles in opposite directions to create contact. Maintain the posture for 10 seconds, and then relax.
Abdominal muscle strengthening exercise	Lie down on the floor, looking at the ceiling and raising both your knees. Lift your upper body slowly and wrap both arms around your knees. Maintain the posture for 5 seconds while looking at your belly button. Return to the original posture and repeat the whole procedure thrice.
Head and neck stretching	Straighten your neck and lower back while pushing down your vertex with both hands crossed. Maintain the posture for 3 seconds, and then stretch your shoulders and elbows, relaxing the strained neck and shoulder muscles.

Outcome Measure

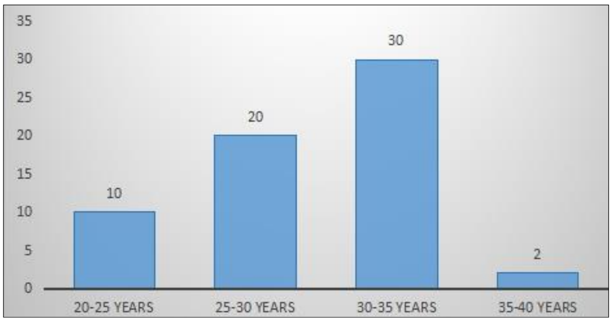
OVAKO Posture Analysis System (OWAS)-

After the eighth week of intervention, the workers were evaluated. The sessions were continued until the eighth week; after which they were reviewed for post-test assessment in the ninth week (7 days) by OWAS scale which gives action category for posture.

Result

Table 1: Distribution of patients according to age group

Age Group	Frequency	Percentage
20-25 Years	10	16.13
25-30 Years	20	32.26
30-35 Years	30	48.39
35-40 Years	2	3.23
Total	62	100.00



Graph 1: Distribution of patients according to age group

In the group 10 males (16.13%) were between 20-25years, 20(32.26%) males were between 25-30 years, and 30 males (48.39%) were between age group of 30-35 years and 2 males (3.23%) between age group of 35-40 years.

Table 2: Comparison of Mean of Relative Frequency for Back Component between Pre and Post Test

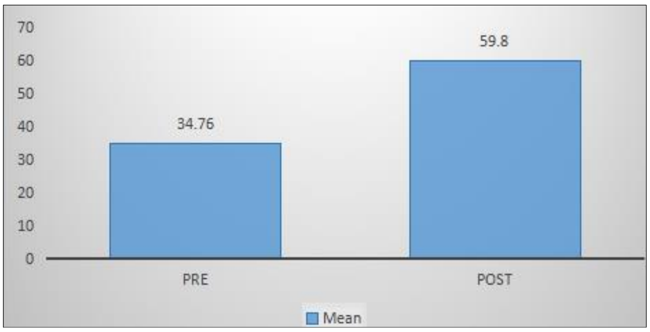
Back	Mean	N	SD	SE	t-Value	P-Value	% Change	Result
Pre	54.87	62	10.23	1.31	16.338	<0.001	39.00	Significant
Post	76.27	62	9.67	1.24				

Graph 2: Comparison of Mean of Relative Frequency for Back Component between Pre and Post Test

Paired t-test was carried out to test significance in mean of relative frequency between pre and post-test for back component in 62 samples. At pre- test mean was 54.87% and 76.27% at post-test, with SD 10.23 and 9.67 there was 39% change occurred and P-Value is less than 0.05. Hence there is significant change observed in pre and post-test.

Table 3: Comparison between Mean of Relative Frequency- Pre and Post-Test for Arm Component

Arm	Mean	N	SD	SE	t-Value	P-Value	% Change	Result
Pre	34.76	62	13.56	1.74	14.422	<0.001	72.04	Significant
Post	59.8	62	10.98	1.41				

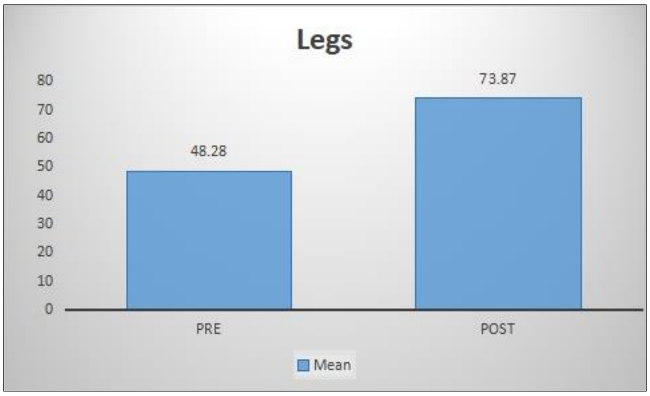


Graph 3: Comparison between Mean of Relative Frequency -Pre and Post-Test of Arm Component

Paired t-test was carried to test significance of mean of relative frequency for arm component between pre and post -test. At pre-test it was 34.76% and at post- test it was 59.8% with SD 13.56 and 10.98 respectively, there were 72.04% change observed. P-Value is less than 0.05. There is significant change observed in pre and post- test.

Table 4: Comparison between Mean of Relative Frequency -Pre and Post-Test for Leg Component.

Legs	Mean	N	SD	SE	t-Value	P-Value	% Change	Result
Pre	48.28	62	12.87	1.65	15.529	<0.001	53.00	Significant
Post	73.87	62	9.78	1.25				



Graph 4: Comparison between Mean of Relative Frequency -Pre and Post-Test for Leg Component

Paired t-test was carried out to test significance in mean of relative frequency between pre and post-test of leg component. At pre-test it was 48.28 and post-test it was 73.87 with SD 12.87 and 9.78 respectively. 53% change observed. P-Value is less than 0.05. Hence, there was significant change observed in pre and post-test.

Table 5: Comparison between Mean of Relative Frequency -Pre and Post-Test for Load Component

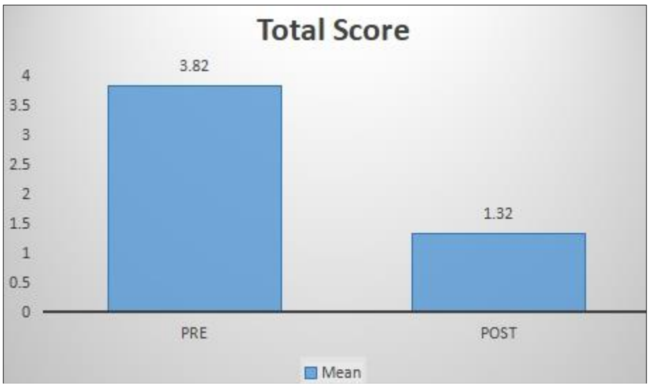
Load	Mean	N	SD	SE	t-Value	P-Value	% Change	Result
Pre	52.39	62	14.29	1.83	10.702	<0.001	37.37	Significant
Post	71.97	62	9.49	1.22				

Graph 5: Comparison between Mean of Relative Frequency -Pre and Post-Test for Load Component

Paired t-test was carried to test significance in mean of relative frequency between pre and post- test for load component. At pre-test it was 52.39 and at post- test it was 71.97 with SD 14.29 and 9.49 respectively. 37.37% change observed. P-Value is less than 0.05. Hence we can conclude that, there is significant change observed in pre and post-test.

Table 6: Comparison between mean difference of pre and post postural risk level

Total Score	Mean	Median	SD	SE	Wilcoxon W	P-Value	% Change	Result
Pre	3.82	4	1.04	0.13	18.928	<0.001	65.45	Significant
Post	1.32	1	0.98	0.12				



Graph 6: Comparison between mean difference of pre and post postural risk level

Wilcoxon signed Rank test was carried to test significance in risk level pre and post-test. Mean and SD of Pre-test and post-test was 3.82±1.04 and 1.32±0.98 respectively. There were 65.45% change occurred. As p value<0.001, hence result is significant for risk level.

Discussion

The goal of this study, titled "Effectiveness of Health Education Intervention on Posture in Ceramic Industry Workers" was to determine the effectiveness of health education as an intervention on awkward back, arm, leg, and load posture in ceramic industry manual material handling workers. A total of 62 people were selected in a single group, based on inclusion criteria, and they received intervention three times a week for 20 minutes each session for a total of eight weeks. Workers who uses computer were not included in this study. It was hypothesized that workers may or may not have an effect on awkward posture as a result of health education intervention. There are numerous tools like RULA, REBA, manual risk assessment tool (manTRA), liberty manual material handling tables (SNOOK tables) and equation like NIOSH to evaluate work posture at work sites, as noted in literature reviews.[7,17] Nonetheless the research question in this study was to determine the influence of health education intervention on uncomfortable posture by assessing ceramic industry workers

The statistical examination of the pre- and post-test of each body component, as well as the postural risk level in the OWAS scale, revealed a significant result using the paired t-test and Wilcoxon test, with p values of 0.001 for both. The current study used the OWAS approach to analyse working posture while handling manual materials, including a 7-day pre-assessment. The OWAS approach is an analytical method that allows you to enhance your ergonomic condition by measuring working posture. According to Nilgun Figlal *et al*. (2014), OWAS is one of the methodologies for analysing working postures and may be successfully applied to a wide range of industries, including construction, shipping, ceramics, manufacturing, and liquid petroleum gas employees. Widyanti A (2020) has been awarded with a kappa value of 0.21-0.41, OWAS has a good validity. It takes into account varied back, arm, and leg positions. It also includes the weight that a worker has lifted. Each body posture is coded and grouped into one of four postural risk groups [21].

In 2015, DeokJu Kim investigated the effects of an exercise programme on posture and musculoskeletal pain. The findings of this study sated that conducting exercise programs on a regular basis may help individuals exercise regularly and maintain correct posture. It is useful to reduce musculoskeletal pain and to reduce musculoskeletal disorders at working site [49].

This research backs up the current study for the workers' intervention. Musculoskeletal problems caused by work are complex in nature. Heavy load lifting, awkward posture, violent activity, repetitions, and full body vibration have all been linked to WMSDs in epidemiological research. Manual material handling (MMH) and significant physical loads are common causes of WMSDs. Injury risks associated with MMH activities include frequent uncomfortable postures and violent exertion (lifting and carrying large weights).

In this study, workers were engaged in a postural correction exercise programme that focused on antigravity musculature such as the erector spinae, iliopsoas, gluteus medius, soleus, abdominal muscles, and internal obliques, tibialis anterior as workers were engaged continuously for 2-5 hours and they worked in unloading material between 2-5 years, which helped to maintain upright and correct posture while lifting and carrying material. Chowdhury SS (2015) proposed lifting and carrying techniques for category 3, which were used in the current investigation [45].

After an 8-week intervention, the OWAS approach was used to conduct a 7-day post-intervention assessment. Wilcoxon signed rank test revealed a significant result for the post-assessment risk level score. According to the findings of the current study, if corrective activities for uncomfortable posture are not taken, it can decrease work productivity and worsen WMSDs, which can lead to disability.

Conclusion

With the annual economic impact, it is clear that WMSD are a significant health concern today. Ergonomic intervention is still a relatively new field of study. After statistical analysis, the current study revealed that health education is helpful among manual material handling workers in the ceramic industry, which supports the alternative hypothesis.

Limitations and Future Scope

Limitations of this study were it did not measure pain and had only one outcome measure. Control group was not included in study. Future studies can be conducted with more sample size, among the workers with more age group. Manual material handling workers with having pain with more than five years of work experience can be included in future study. It can be conducted in many other industrial sectors where the labourers handle the load manually.

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Conflict of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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