Original Article

Effect of Structured Exercise-Based Intervention on Upper Quadrant Dysfunction among Fish Processing Workers with Work-Related Musculoskeletal Disorders

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Abstract

Background: Musculoskeletal disorders (MSDs) are one of the major causes of morbidity, which affect particularly the upper quadrant in industrial settings and so upset the quality of life (QoL). The influence of the protocol of exercise-based programs at the workplace on the well-being of the worker is contradictory. The objective of the study was to find the effect of the structured exercise-based intervention on upper quadrant dysfunction among fish processing workers with work-related MSDs. **Methods:** The intervention group (n = 91) participated in an individually tailored structured exercise-based intervention (SEBI) program for three months, which consisted of stretching, strengthening, and active exercises. The control group (n = 93) was instructed to continue routine daily activities. The outcome measures of the cluster-randomized controlled trial were Neck Disability Index (NDI), Disabilities of Arm, Shoulder, and Hand (DASH), Visual Analog Scale (VAS), and Short Form-36, used to evaluate at baseline, eighth, and twelfth week. The data were analyzed by repeated analysis of variance and Student's t-tests. **Results:** The results for the overall perception of upper quadrant dysfunction showed statistically significant differences ($P < 0.0001$) for NDI, DASH, and VAS. Further, we obtained a significant difference in QoL between the intervention and control groups for physical and psychological health sub-domains. **Conclusion:** SEBI effectively enhanced the general health of fish processing workers by showing improvements in the measures of NDI, DASH, VAS, and QoL. Hence, SEBI can be recommended in the fish processing industries to achieve potential impact on upper quadrant dysfunction and improve the QoL.

Keywords: Exercise-based intervention, fish processing workers, musculoskeletal disorders, quality of life, upper quadrant dysfunction

Introduction

Work-related musculoskeletal disorders (WMSDs) have been a huge societal burden by means of morbidity[1] and disability in the working-age population.[2] influencing health and quality of life (QoL). The upper extremity is majorly affected, resulting in upper quadrant WMSDs (UQ-WMSDs).[3] Structured exercise-based intervention (SEBI) has been the key factor as an intervention parameter. The multimodal physiotherapy protocol[4] decreases the UQ-WMSDs, thereby improving the QoL. However, the evidence was lacking in the protocol. Therefore, this study was taken up to find the effect of SEBI on upper quadrant dysfunction among fish processing workers with WMSDs.

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Materials and Methods

The cluster-randomized controlled trial (C-RCT) was conducted in Udupi District, Karnataka state, India, between January 2019 and December 2021. The process included obtaining permission from the fish processing industries, written informed consent from the participants, screening, evaluation, and execution

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of the intervention program. The study was approved by the Institutional Ethical Committee (IEC: 126/2016) registered under CTRI (2017/09/009854) and conducted following the principles of the Declaration of Helsinki. The objectives and details of the program were explained to the participants at the beginning. The fish processing workers between 18 and 60 years who worked for a minimum of one year with upper quadrant complaints were included in the study, and those who refused to participate had a neurological disorder, and/or traumatic musculoskeletal injury were excluded. We screened 301 participants, out of which 32 were excluded due to ineligibility criteria. The participants included were 91 and 93 in the intervention group (IG) and control group (CG), respectively [Flowchart 1].

General characteristics

Sociodemographic information was collected using a questionnaire on physical and work-related factors such as gender, age, education, height, weight, marital status, working hours, experience, work section, and pain assessment. The questionnaire was translated into Kannada and Hindi and validated. Anthropometric Measures such as height, weight, blood pressure, heart rate, and range of motion were measured.

Standard Form-36 (SF-36)

SF-36 is a multipurpose, short-form health survey with 36 questions. Physical health comprises physical function (PF), role limitation (RL), body pain (BP), and general health (GH); Psychological health comprises emotional problem (EP), emotional function (EF), emotional work (EW), and social function (SF). All items were rated on a 5-point scale, with five representing better health. The internal reliability, construct validity, and ability to detect changes in disease-related symptoms have been well-documented.[5]

Neck Disability Index (NDI)

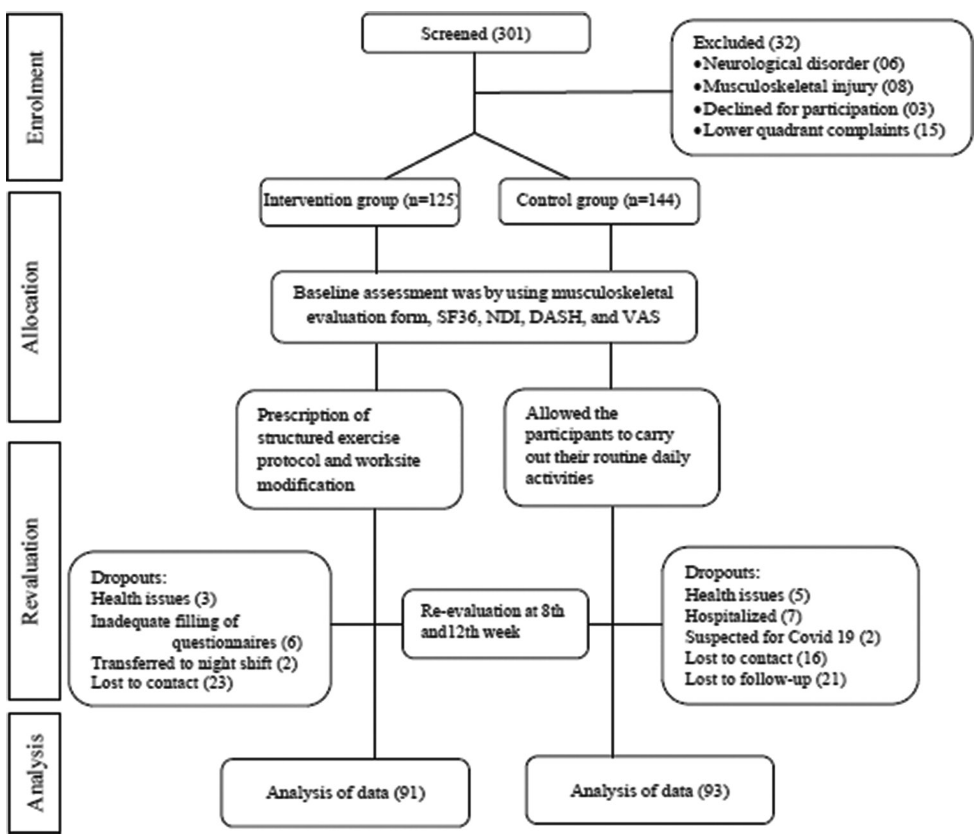
The NDI is used to measure neck-specific disability and contains 10 individual factors for pain and activities of daily living, including personal care, lifting, reading, headaches, concentration, work status, driving, sleeping, and recreation. Each item is scored from 0 to 5 on a 6-point Likert scale. Total scores vary from 0 to 50, where 0 is considered "no activity limitation" and 50 is considered "complete disability." Interpretation of total scores is as follows: 0 to 4, no disability; 5 to 14, mild disability; 15 to 24, moderate disability; 25 to 34, severe disability; and greater than 35, complete disability. The reliability and validity of the NDI are well-evidenced.[6]

Disabilities of the arm, shoulder, and hand (DASH)

DASH is used to measure the physical disability and symptoms of the upper extremity. The DASH consists of one 30-item module assessing upper limb function and two optional four-item modules evaluating symptoms and function related to work and recreational activities. A 5-point Likert scale is used to score each item.[7]

Visual Analog Scale (VAS)

The changes in pain intensity in the regions of neck, shoulder, elbow, hand/wrist, and upper back were measured with the



Flowchart 1: Participant recruitment

VAS. This was rated subjectively using a 0 to 10 scale, where 0 indicates "no pain at all," and 10 indicates "worst pain imaginable."[8]

Sample size

The total sample size of 63 participants was estimated for an expected effect size of 0.5 and power 0.80 at an alpha of 0.05, assuming an SD of 10. A 5-point minimum clinically important difference between the groups was considered. Bearing in mind a possible design effect of 1.4 we recruited 90 participants for each group.

$$n = \frac{2(Z_{1-\alpha 12} + Z_{1-\beta}1)^2\ \sigma^2}{d^2} \times \text{Design effect}$$

$$n = \frac{2\ (1.96 + 0.84)^2 \times 10^2}{5^2} \times 1.4\, n = 89$$

n = Sample size σ = Standard Deviation

d = Minimum clinically important difference

Accounting for 30% attrition rate, the sample size required is 125.

Randomization and blinding

Each industry was strategized as a cluster to prevent contamination, and each one was assigned to either the IG or the CG depending on their locality in the taluk, as the IG falls in Udupi Taluk and CG in Kundapura Taluk. We selected the clusters by considering the presence of maximum compulsory sections, types of tasks, and the average size of the industry to make equal comparability in both groups. An equal number of clusters (04) was allocated from a taluk for each group to minimize any bias. Out of 125 participants in the IG, 91 (72.8%) participated until the end, whereas 93 (64.5%) out of 144 in the CG did so. The participants and physiotherapists could not be blinded to group allocation because of the type of design, but the data analysts were blinded.

Intervention

Various types of exercise, such as stretching,[9,10] strengthening,[11] and flexibility exercises,[12] were included in SEBI in agreement with previous studies to promote the overall health of the workers. However, the results were varied for comparisons with methodological concerns, the size of industry, type of data collection, type of task, work condition, the environment, and mode of intervention. SEBI includes a combination or separate set of exercise programs that includes three sets of stretching (5 repetitions: 15 seconds hold), strengthening (10 repetitions), and range of movement exercises (15 repetitions) with a 5-second rest once a day for 3 to 5 days a week for cervical and upper limb muscles (72 sessions for a single exercise). The protocol administered to the IG also includes an awareness program that provides educational advice on pain, individual and job risk factors, and workplace modification. The individualized self-mode exercise program was tailored to indicate the worker's disorders in a slow, controlled manner. The frequency, sets, repetitions, type, and number of exercises may vary in the progression during follow-ups depending on the symptomatic complaints. During acute pain, electric modalities such as ultrasound and transcutaneous nerve stimulation were administered based on need, and later, active mobilization was initiated as a replacement. At the beginning, approximately 30 workers were gathered and trialed for group therapy near their workstations for 30 minutes. The total intervention period was 12 weeks, with the baseline evaluation and re-evaluation at weeks 8 and 12 for review by the same physiotherapist. A good adherence (81%) was maintained by the participants by logging their practice in a logbook and through telephone calls. The exercise time was made flexible depending on their leisure to avoid dropouts and increase compliance with the intervention. Each participant was encouraged to communicate with the instructor on the telephone for any clarification during monthly visits. The CG was allowed to carry out their routine activities without any specific treatment, but they were withheld from starting any new physical activity, including sports.

Out of 125 participants in the IG, 34 were dropped out. Six could not be included because of inadequate filling of questionnaires, two were transferred to the night shift, three were dismissed because of health issues, and 23 were lost to contact from the particular industry. Among the 144 participants allocated to the CG, 51 dropped out. Five were excluded because of health problems, 16 were dropped out because they were lost to contact, two were suspected of COVID-19, seven were hospitalized, and 21 were dismissed because they were lost to follow-up.

Data analysis

Data were analyzed with the Statistical Package for the Social Sciences (SPSS) software version 15.0. Descriptive statistics included means and standard deviations or frequency tables for all outcome measurements. The Chi-square test was used for the association between sociodemographic factors and the outcome variable. Repeated measured analysis of variances (R-ANOVA) was used to analyze the QoL between the groups. The Student's *t*-test was used to determine any significant differences between the pre- and post-treatment measurements. The differences were expressed as mean differences with 95% confidence intervals (CIs) between the groups. In all analyses, $P < 0.0001$ was considered statistically significant.

Results

Table 1 shows the demographics and work-related factors of the participants. The age of the participants ranged from 20 to 60 years, and the male and female ratio was 45.1%:54.9%. The two groups were balanced according to the mean ± (SD) age, body mass index (BMI), the percentage of marital status, and educational status. BMI was subdivided into three groups: less than 24, from 24 to 29.99, and more than 30 kg/m^2. The average of the workers' processing hours per day was 8.60.

Table 1: Demographic and work-related characteristics

Variables, *n* (%)	Intervention Group (*n*=91)	Control Group (*n*=93)
Age (years)*	39.65+/(10.29%)	42.31+/-(10.24%)
18-29	15+/-(16.5%)	13+/-(14.0%)
30-39	28+/-(30.8%)	20+/-(21.5%)
40-49	32+/-(35.2%)	33+/-(35.5%)
50-60	16+/-(17.6%)	27+/-(29.0%)
Gender		
Male	41 (45.1%)	19 (20.4%)
Female	50 (54.9%)	74 (79.6%)
BMI (kg/m²)*	24.70+/-(2.06%)	25.04+/-(2.16%)
Lesser than 24	22+/-(24.1%)	21+/-(22.6%)
From 24 to 29.99	67+/-(73.7%)	67+/-(72.0%)
More than 30	2+/-(2.2%)	5+/-(5.4%)
Marital status		
Married	72 (79.1%)	76 (81.7%)
Unmarried	19 (20.9%)	17 (18.3%)
Educational status		
Primary	20 (22.0%)	21 (22.6%)
High school	34 (37.4%)	36 (38.7%)
Pre university	36 (39.6%)	29 (31.2%)
Graduate	1 (1.1%)	6 (6.5%)
Working Time (hours)*	8.60+/-(0.82%)	8.43+/-(0.83%)
8	56+/-(61.5%)	65+/-(69.9%)
8 to 12	32+/-(35.2%)	27+/-(29.0%)
More than 12	3+/-(3.3%)	1+/-(1.1%)
Experience (years)*	7.88+/-(4.93%)	9.15+/-(4.80%)
Lesser than 5	42+/-(46.2%)	35+/-(37.6%)
From 5 to10	28+/-(30.8%)	29+/-(31.2%)
From10 to 20	17+/-(18.7%)	25+/-(26.9%)
More than 20	4+/-(4.4%)	4+/-(4.3%)
Comorbidities		
Nil	59 (64.8%)	59 (63.4%)
Diabetes	10 (11.0%)	12 (12.0%)
Blood Pressure	7 (7.7%)	6 (6.5%)
Cardiac problems	1 (1.1%)	2 (2.2%)
Bronchial asthma	4 (4.4%)	2 (2.2%)
Accidental injury	6 (6.6%)	8 (8.6%)
Others	4 (4.4%)	4 (4.2%)
Parts of body		
Neck	28 (30.8%)	13 (14%)
Shoulder	33 (36.3%)	36 (38.7%)
Elbow	15 (16.5%)	18 (19.4%)
Wrist	9 (9.9%)	17 (18.3%)
Upper back	7 (7.7%)	10 (10.8%)
Severity of pain		
Mild	40 (44.0%)	38 (40.9%)
Moderate	34 (37.4%)	44 (47.3%)
Severe	17 (18.7%)	11 (11.8%)
Lesser than 3	29 (31.9%)	28 (30.1%)
From 3 to 6	29 (31.9%)	33 (35.5%)
More than 6	33 (36.3%)	32 (34.4%)
Personal history		
Smoke	10 (11.0%)	4 (4.3%)
Alcohol	23 (25.3%)	19 (20.4%)
Physical exercise	39 (42.9%)	28 (30.1%)

Contd...

Table 1: Contd...

Variables, *n* (%)	Intervention Group (*n*=91)	Control Group (*n*=93)
Section		
loading	6 (6.6%)	5 (5.4%)
Boiler	8 (8.8%)	5 (5.4%)
Mixing	6 (6.6%)	0 (0.0%)
Production	9 (9.9%)	6 (6.5%)
ETP	1 (1.1%)	2 (2.2%)
Cutting	23 (25.3%)	36 (38.7%)
Grading	3 (3.3%)	3 (3.2%)
Packing	6 (6.6%)	4 (4.3%)
Maintenance	17 (18.7%)	17 (18.3%)
General duty	12 (13.2%)	15 (16.1%)
Others	0 (0.0%)	0 (0.0%)

*Mean +/- (standard deviation)

Most (58.1%) of the participants worked longer than 5 years, studied until high school (38%) and pre-university (35.3%), and were married (80.4%). The cutting section had the highest number of participants (32.1%); regarding the severity of pain, 42.4% of participants considered theirs mild and moderate. The parts affected more severely were the shoulder joints (27.5%) and neck (22.3%), which had reached the chronic stage (69%).

Table 2 presents within- and between-group comparisons of means of the NDI, DASH, and VAS. Within-group comparisons are presented as change from baseline (CFB) in mean at weeks 8 and 12. There was a statistically significant difference in CFB in the NDI [$F_{(2, 60)} = 40.86$, $P < 0.0001$], DASH [$F_{(2, 122)} = 122.94$, $P < 0.0001$], and VAS [$F_{(2, 180)} = 104.85$, $P < 0.0001$] in the IG. However, we observed statistically significant differences in the CG in NDI [$F_{(2, 22)} = 13.43$, $P < 0.0001$] and DASH [$F_{(2, 160)} = 41.19$, $P < 0.0001$] only. The corresponding CFB with 95% CI is presented in Table 2. The CFB for NDI, DASH, and VAS was significantly decreased in the IG, whereas there was minimal or no change in CFB values in the CG. On comparing the difference in mean CFB between the IG and CG, statistically significant differences in NDI [$F_{(2, 82)} = 22.33$, $P < 0.0001$], DASH [$F_{(2, 282)} = 191.02$, $P < 0.0001$], and VAS [$F_{(2, 364)} = 99.61$, $P < 0.0001$] were observed. The average value of the VAS for pain before and after the intervention was found to be reduced significantly [Figure 1].

Tables 3 and 4 present within and between-group comparison of means of each domain in physical and psychological health measures of SF-36, respectively. Statistically significant differences in CFB in PF [$F_{(2, 178)} = 6.50$], RL [$F_{(2, 178)} = 50.93$], BP [$F_{(2, 178)} = 115$], and GH [$F_{(2, 178)} = 101.1$] were detected in the IG at $P < 0.0001$, except in physical function ($P = 0.02$). However, we observed a statistically significant difference only in RL [$F_{(2, 187)} = 3.46$, $P < 0.0001$] in the CG. The corresponding CFB with 95% CI is presented in the same Tables 3 and 4. The CFB for all the domains significantly increased at week 12 in the IG. In the CG, there was a minimal change in CFB values. On comparing the difference in mean CFB between the IG and CG, a statistically significant difference was observed in

Table 2: Summary of comparison of means of domains in psychological health measure of NDI, DASH, and VAS

Domain	Time	Intervention Group		Control Group		CFB (95% CI)
		Mean+SD*	CFB† (95% CI)	Mean+SD	CFB (95% CI)	
Neck Disability Index	Baseline	26.29 (8.99)	-	23.83 (7.24)	-	-
	Week 8	23.65 (6.94)	-2.64 (-4.89, -0.39)	24.83 (7.15)	1.00 (0.13, 1.86)	3.64 (-0.18, 7.3)
	Week 12	16.45 (6.53)	-9.83 (-12.09, -7.58)	26.00 (8.05)	2.17 (1.29, 3.03)	12.01 (8.34, 5.66)
Disabilities of Arm Shoulder and Hand	Baseline	59.02 (16.97)	-	54.26 (14.82)	-	-
	Week 8	53.65 (15.09)	-5.37 (-6.97, -0.96)	55.84 (15.59)	1.58 (0.92, 2.23)	6.95 (5.37, 8.52)
	Week 12	46.36 (13.94)	-12.65 (-14.25,-1.04)	57.25 (15.40)	2.97 (2.33, 3.63)	15.63 (14.06,7.21)
Visual Analog Scale	Baseline	5.21 (2.07)	-	5.05 (2.27)	-	-
	Week 8	4.53 (1.83)	-0.68 (-0.99,-0.37)	4.99 (2.2)	-0.06 (-0.19, 0.06)	0.62 (0.28, 0.94)
	Week 12	2.99 (1.66)	-2.21 (-2.52,-1.90)	5.13 (2.23)	0.08 (-0.05, 0.20)	2.29 (1.96, 2.62)

*SD: standard deviation †CFB: change from baseline

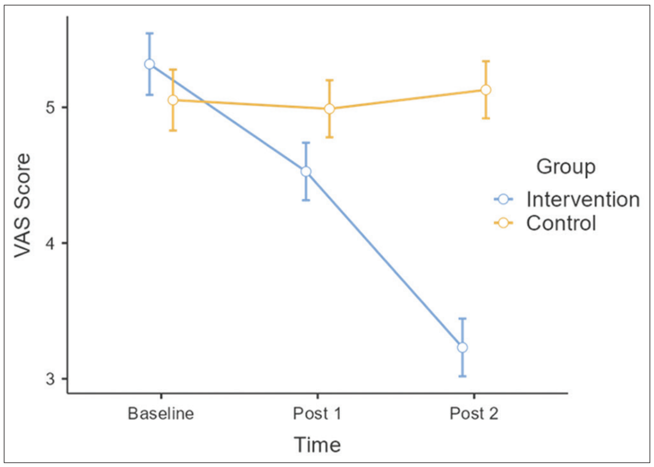


Figure 1: Error bar chart for mean Visual Analog Scale

the domain of PF [$F_{(2, 363.98)}$ = 4.90], RL [$F_{(2, 364.84)}$ = 25.56,], BP [$F_{(2, 364.07)}$ = 117.45,] and GH [$F_{(2, 362.97)}$ = 92.61,], with $P < 0.0001$.

On comparison of within-group means in the domains of psychological health measurements from the SF-36, we observed statistically significant differences in CFB in EP [$F_{(2, 178)}$ = 33.74, $P < 0.0001$], EF [$F_{(2, 178)}$ = 111.85, $P < 0.0001$], EW [$F_{(2,178)}$ = 67.88, $P < 0.0001$], and SF [$F_{(2, 178)}$ = 49.6, $P < 0.0001$] in the IG. However, we observed statistically significant differences in EP [$F_{(2, 187)}$ = 3.26, $P = 0.0001$], EF [$F_{(2, 187)}$ = 9.28, $P < 0.0001$, and SF [$F_{(2, 187)}$ = 13.52, $P < 0.0001$] in the CG. On comparing the difference in mean CFB between the IG and CG, a statistically significant difference was observed in the domain of EP [$F_{(2, 364.96)}$ = 17.87, $P < 0.0001$], EF [$F_{(2, 364.97)}$ = 112.26, $P < 0.0001$], EW [$F_{(2, 364.97)}$ = 59.19, $P < 0.0001$], and SF [$F_{(2, 365.04)}$ = 63.77, $P < 0.0001$].

Discussion

The results of the present study showed significant differences ($P < 0.0001$) between scores in NDI, DASH, VAS, and SF-36 at baseline and after the 12-week intervention, within and between the groups. SEBI decreased upper quadrant dysfunction and improved QoL among fish processing workers with WMSDs in the IG compared to the CG. There was a consistent reduction in the mean ± (SD) NDI, DASH, and VAS scores in the IG [Table 2]. These values increased gradually in the CG, except for the VAS, which remained at 5 (2.2). Similarly, there was a significant increase in the CFB scores in both the physical and psychological components of SF-36 (such as GH, BP, EF, EW, and SF) in the IG at the end of 12 weeks. On reviewing the CG, all the domains showed decreased values except EP, which negligibly increased. In the IG, RL was the most changed, and PF was the least changed; RL was the least changed in the CG.

So *et al*.[13] demonstrated in their RCT that the reduction in symptoms of MSD was due to the combination of exercise and ergonomic intervention. The program consisted of ergonomics knowledge transfer, consultation, biofeedback, motor control facilitation, and tailor-made neck and shoulder conditioning exercises for 12 weeks. The worker could exert force effectively post-intervention, which positively affected the speed and resistance,[14] expiratory forces by strength training,[15] and pain, strength, function, and QoL through progressive resistance training conducted in a patient population.[16] Various therapeutic activity studies have been conducted to show the changes in upper-quadrant outcome measures in the industrial sector. One tailored exercise program produced minimum disability scores in neck, shoulders, arms, and hands in comparison with the CG.[7] It involved a series of three stages: a warm-up session with five low-intensity mobilization exercises with a 30-second rest in between, strengthening exercises using dumbbells and elastic bands for 15 minutes, and a cool down of stretching exercises maintained for 60 to 90 seconds. In a C-RCT of industrial laboratory technicians, performing supervised strength training for 20 minutes three times per week for 20 weeks at the workplace showed a significant long-term reduction in spinal and upper extremity pain and DASH.[17] An intervention conducted in women in the clothing manufacturing industry[18] showed similar results in the VAS at the spine and hips, NDI, and all the domains of the SF-36. In comparison with our study, differences in gender, protocol, and methodology were found; however, the decrease

Table 3: Summary of comparison of means of domains in physical health measure of Standard Form-36

Domain	Time	Intervention Group		Control Group		CFB (95% CI)
		Mean+SD*	CFB† (95% CI)	Mean+SD	CFB (95% CI)	
Physical Function (PF)	Baseline	46 (6.49)	0	47.39 (5.66)	0	0
	Week 8	47.34 (5.71)	1.34 (0.07, 2.61)	47.12 (6.93)	-0.26 (-1.17,0.64)	1.61 (0.07,3.15)
	Week 12	48.37 (7.78)	2.31 (1.04, 3.58)	47.28 (6.86)	-0.10 (-1.01,0.80)	2.41 (0.87,3.96)
Role Limitation (RL)	Baseline	49.46 (35.71)	0	55.58 (37.59)	0	0
	Week 8	71.12 (37.45)	21.66 (14.19, 29.11)	61.17 (37.85)	5.59 (0.62, 10.54)	16.07 (7.22,24.92)
	Week 12	87.50 (30.50)	38.04 (30.57, 45.48)	61.43 (38.56)	5.85 (0.89, 10.80)	32.17 (23.32,41.03)
Body Pain (BP)	Baseline	54.85 (21.83)	0	61.06 (21.56)	0	0
	Week 8	61.63 (20.80)	6.81 (2.96, 10.19)	60.29 (21.50)	-0.77 (-2.09, 0.55)	7.31 (3.55,11.07)
	Week 12	81.72 (15.68)	26.87 (23.05, 30.27)	59.49 (20.79)	-1.57 (-2.89, -0.24)	28.19 (24.44,31.95)
General Health (GH)	Baseline	68.40 (15.14)	0	70.24 (15.72)	0	0
	Week 8	70.69 (16.09)	2.29 (-0.44, 5.02)	70.13 (15.32)	-0.11 (-1.13, 0.92)	2.39 (-0.47,5.27)
	Week 12	86.48 (12.69)	18.08 (15.34, 20.81)	70.03 (15.82)	-0.21 (-1.23, 0.82)	18.28 (15.41,21.15)

*SD: standard deviation. †CFB: change from baseline

Table 4: Summary of comparison of means of domains in psychological health measure of Standard Form – 36

Domain	Time	Intervention Group		Control Group		CFB (95% CI)
		Mean+SD*	CFB† (95% CI)	Mean+SD	CFB (95% CI)	
Emotional Problem (EP)	Baseline	74.44 (30.82)	0	78.72 (31.62)	0	0
	Week 8	87.77 (26.18)	13.33 (8.59, 18.07)	79.81 (32.11)	1.09 (-1.71, 3.89)	12.24 (6.81, 17.67)
	Week 12	93.70 (23.38)	19.26 (14.52, 23.99)	82.26 (31.18)	3.54 (0.73, 6.35)	15.71 (10.28, 21.14)
Emotional Function (EF)	Baseline	69.94 (15.01)	0	57.87 (28.26)	0	0
	Week 8	72.16 (14.35)	2.22 (-0.06, 4.50)	55.85 (27.53)	-2.02 (-3.14, -0.89)	4.24 (1.73, 6.74)
	Week 12	85.94 (13.15)	16 (13.71, 18.28)	55.63 (26.96)	-2.24 (-3.35, -1.11)	18.23 (15.72, 20.73)
Emotional work (EW)	Baseline	77.73 (15.29)	0	58.63 (28.22)	0	0
	Week 8	79.46 (15.02)	1.73 (-0.44, 3.91)	57.65 (27.77)	-0.98 (-2.15, 0 0.19)	2.71 (0.27, 5.15)
	Week 12	89.64 (11.64)	11.91 (9.73, 14.09)	57.74 (26.82)	-0.89 (-2.07, 0.28)	12.80 (10.36, 15.24)
Social Function (SF)	Baseline	59.58 (21.28)	0	63.56 (25.11)	0	0
	Week 8	62.08 (20.30)	2.5 (-1.12, 6.12)	61.43 (24.43)	-2.13 (-4.00, -0.25)	4.62 (0.61, 8.64)
	Week 12	76.52 (18.53)	16.84 (13.31, 20.56)	58.64 (25.53)	-4.92 (-6.79, -3.04)	21.86 (17.85, 25.87)

*SD: standard deviation. †CFB: change from baseline

in pain was the chief factor that influenced QoL. According to a review study, resistance exercises carried out three times a week for 20 minutes at the workplace decreased pain intensity at the upper extremity and the spine.[19]

Our study was supported by a multimodal physical therapy program combining therapeutic exercise and health education that moderately limited the pain intensity for an improved health-related QoL among patients with chronic MSDs. The land- and aquatic-based tailored exercises were prescribed for 30 minutes each two times per week and conducted for 8 weeks.[20] Workplace exercise practice and education together changed the QoL components with occupational environment scores for administrative department employees,[21] whereas an education program alone benefited QoL among production workers in a steel trading company.[22]

The present study addressed each participant personally with a tailored exercise model and an educational pamphlet, which proved beneficial. Thus, the role of movements from exercise and education on posture for optimizing body mechanics was verified in the effect of the intervention. Moreover, the identification of the risk factors was easier in the program while treating MSDs when incorporating a user-friendly intervention design.

Although the fish processing industries were selected from one region of India, the population sample was huge and represented the homogeneity of the industry. Hence, the clinical results of economic, non-pharmacological, and cost-effective training sessions can be applied to other areas of the country. The results of many RCTs were diverse and inconsistent with respect to the method of intervention and exercise modality, but the present C-RCT provides evidence-based clinical information. There was perfect randomization of participants geographically to avoid contamination and minimal loss to follow-up. The interventions at the workplace, especially the combination of treatments with rich specificity between the exercises performed, were a big enhancement for the workers. Because we included medium- and large-scale industries from the entire district in the coastal region, the external validity of the findings remained high. The factors that made the intervention successful: (1) Evidence-based exercises were performed on the advice of specialists in the field; (2) Therapeutic exercise training was tailored as per indication and risk factors raised in the section of the industry with clear instructions; and (3) Good monitoring of exercise program compliance.

The impracticality of complete blinding may be listed as a limitation of the study. Also, any changes in the lifestyle and severity of the participant's comorbidities were not reported during the follow-up sessions. Finally, the schedule restraints and distance over the geographical area restricted daily supervision during the intervention. Future research into the intervention's long-term effects to be compared with those of other types of interventions is recommended. Furthermore, possible preventive and interventional measures through a supervised and/or home program may be evaluated for feasibility and adherence.

Conclusion

The individually tailored SEBI integrated with ergonomic education decreased upper quadrant dysfunction and, hence, demonstrated a potential impact on all the aspects of QoL in a sample of fish processing workers with UQ-WMSDs. The trial had a good participation rate and was well tolerated by the participants, obtaining results beyond the required. The significance of the SEBI program should be explained collectively to the workers to increase awareness of short-term exercise programs for chronic conditions. Given that the company decides on the flexibility of workers' timetables, we should change workers' behavior to integrate life-long programs to enhance the GH state. They should be considered with higher priority to improve pain, function, disability, and QoL; however, implementation of a mechanism for a prevention strategy is always crucial.

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Conflicts of interest

There are no conflicts of interest.

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