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Back Pain Exercise Intervention for Low Back Pain Management Among Fishing Community Workers: A Community-Based Cross-Sectional Study with Pre–Post Evaluation



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ABSTRACT

Background: Low back pain (LBP) is a major occupational health problem among informal sector workers, particularly fishing community members who perform repetitive and physically demanding tasks with limited ergonomic support. In Indonesia, coastal fishing communities often have inadequate access to occupational health services, contributing to the persistence of work-related musculoskeletal disorders.

Objective: To assess the prevalence and severity of LBP among fishing community workers in Sukolilo Baru, Bulak, Surabaya, and evaluate the effect of a structured Back Pain Exercise (BPE) intervention combined with health education on pain intensity.

Methods: A community-based cross-sectional study with a pre–post intervention evaluation was conducted among 35 workers recruited through purposive sampling following STROBE and TIDieR guidelines. The intervention consisted of a structured health education session and a supervised BPE programme, with pain intensity measured using the Numeric Pain Rating Scale (NPRS 0–10). Bivariate and multivariate logistic regression were used to analyze predictors of moderate-to-severe LBP, and Wilcoxon signed-rank test was applied for pre–post pain comparisons.

Results: LBP prevalence was 91.4% (n = 32), with 62.5% reporting moderate pain and 37.5% reporting mild pain. Following the intervention, all LBP-positive participants demonstrated a reduction in pain intensity (median NPRS decreased from 5.0 to 3.0; p < 0.001). Multivariate logistic regression identified work duration ≥8 hours/day (aOR 4.82; 95% CI: 1.94–11.98; p = 0.001), frequent heavy lifting (aOR 3.91; 95% CI: 1.42–10.74; p = 0.008), and non-ergonomic posture (aOR 3.44; 95% CI: 1.21–9.77; p = 0.020) as significant independent predictors of moderate-to-severe LBP.

Conclusion: BPE combined with structured health education is a feasible and effective non-pharmacological approach for reducing LBP severity in coastal informal work settings. Community-based occupational health programmes targeting ergonomic risk factors should be integrated into primary healthcare networks for vulnerable maritime workers.

Key Points (Highlights):

- High LBP prevalence (91.4%) affects artisanal fishers due to long hours and heavy lifting.
- Structured Back Pain Exercise (BPE) significantly reduces pain intensity (median NPRS 5.0 to 3.0).
- Community-based exercise interventions are feasible and scalable for informal coastal workers.



INTRODUCTION

Globally, low back pain (LBP) is the single leading cause of years lived with disability, affecting an estimated 619 million people worldwide and imposing a disproportionate burden on workers in physically demanding occupations (Anggraini et al., 2024). Within the broader landscape of work-related musculoskeletal disorders, LBP stands apart not only by its prevalence but by its tendency to become chronic when primary risk exposures repetitive mechanical loading, prolonged awkward postures, and heavy manual handling remain unmitigated (Indrayani et al., 2024; Riyandani et al., 2025). In low- and middle-income countries, where informal labour sectors dominate and occupational health coverage is structurally limited, these risks accumulate silently and systematically (Hassan et al., 2025). Fishing communities in archipelagic nations represent one of the most occupationally vulnerable groups in this regard, combining physical exposure with economic precarity, geographic isolation from health services, and low health literacy (Triyanto et al., 2025).

Indonesia, as the world's largest archipelagic state, encompasses approximately 17,840 islands, with coastal and maritime zones comprising roughly three-quarters of its national territory. An estimated 2.7 million registered fishers and a considerably larger informal fishing workforce sustain the nation's fisheries sector, contributing substantially to domestic protein supply and regional food security (Jang & Park, 2022; Rizvi et al., 2019). Despite this economic and nutritional significance, occupational health research targeting this workforce remains sparse compared with agriculture and manufacturing sectors (Kazi & Malawade, 2025). The physical demands of artisanal fishing including repetitive net hauling, prolonged static postures during navigation, asymmetric loading during fish sorting, and forceful exertion in launching and retrieving vessels create cumulative biomechanical stressors that are well-established antecedents of LBP (Asada et al., 2023; Cimarras-Otal et al., 2020; Sambeko et al., 2023). Yet community-level data documenting the magnitude of this burden and the feasibility of contextualised interventions remain limited, particularly in Indonesian coastal urban settings.

Non-pharmacological approaches to LBP management, particularly structured exercise programmes, have accumulated substantial evidence across clinical and community settings (Igawesi-Chidobe et al., 2019). Back Pain Exercise (BPE) a targeted programme of stabilising and mobilising movements directed at the lumbar musculature has demonstrated efficacy in reducing pain intensity, improving functional capacity, and enhancing self-management among working populations (Igawesi-Chidobe et al., 2020). However, the translation of these clinical interventions into accessible community-based programmes, particularly for informal workers with limited health service contact, has received insufficient empirical attention (Ahmed et al., 2022). Education-based components of LBP management are equally critical: research consistently demonstrates that health literacy regarding ergonomic risk factors, correct posture, and self-care strategies mediates the trajectory from acute to chronic LBP (Aprilia et al., 2025; Firme et al., 2024). Community engagement platforms, including health promotion activities conducted in partnership with local governance structures, offer a pragmatic vehicle for reaching fishing community workers outside the formal healthcare pathway (Yuliam et al., 2025).

This study addresses a clear empirical and practical gap: the absence of documented, community-tailored LBP interventions for artisanal fishing workers in Indonesian coastal urban environments (Belz et al., 2024). Using data from a community engagement activity conducted at the Sukolilo Baru fishing community in Bulak, Surabaya, this study pursued two objectives: (1) to characterise the prevalence and severity of LBP and its associated occupational risk factors in this population; and (2) to assess the immediate effect of a structured BPE intervention combined with health education on pain intensity scores. Beyond its descriptive value, this study contributes to the growing body of evidence supporting community-based exercise and education programmes as scalable, cost-effective strategies for occupational LBP management in underserved informal work

settings in Southeast Asia (Gobbo et al., 2019; Rahim et al., 2024).

MATERIALS AND METHODS

Study Design and Reporting Guideline

This study employed a community-based cross-sectional design with an embedded pre-post intervention evaluation component. Reporting follows the *Strengthening the Reporting of Observational Studies in Epidemiology* (STROBE) checklist for cross-sectional studies, supplemented by the *Template for Intervention Description and Replication* (TIDieR) framework for the BPE intervention component.

Setting and Participants

The study was conducted at Taman Hiburan Pantai Kenjeran, Surabaya, serving fishing community workers residing in Kelurahan Sukolilo Baru, Kecamatan Bulak, Surabaya, East Java, Indonesia. The setting was selected based on a preliminary needs assessment conducted by STIKES Hang Tuah Surabaya students (2019), which identified a high prevalence of musculoskeletal complaints in this community. Participant recruitment was conducted in coordination with the sub-district head (*Kepala Kelurahan*), community health centre (*Puskesmas*) director, neighbourhood unit leaders (*Kepala RW/RT*), and the head of the local fishers' association (*Paguyuban Masyarakat Nelayan*). Invitation letters were disseminated through the fishers' association network.

Participants were eligible if they: (1) were actively employed as fishing community workers in Kelurahan Sukolilo Baru; (2) reported occupational activities involving repetitive physical loading (net hauling, vessel launching, cargo lifting); (3) were aged 18 years or older; and (4) provided voluntary oral informed consent. Participants were excluded if they had a history of lumbar spine surgery, acute neurological deficit, or were unable to participate in physical exercise due to a physician-documented contraindication. A total of 35 participants were enrolled.

Sample Size

Given the community-based and convenience nature of the sampling frame, the total eligible and consenting participants ($n = 35$) constituted the study sample. This sample size is consistent with community engagement research contexts in which access to a defined occupational cohort is inherently bounded. Post-hoc power calculations indicate that this sample provides sufficient power ($>80\%$) to detect a medium-to-large effect size (Cohen's $d \geq 0.60$) in pre-post pain score comparisons at $\alpha = 0.05$.

Intervention Description (TIDieR)

The community health intervention was delivered over two consecutive days.

Day 1 — Coordination and mobilisation: The research team coordinated with local governance stakeholders, confirmed venue logistics, and distributed participation invitations through the fishers' association.

Day 2 — Health education and exercise intervention: The intervention comprised two sequentially delivered components:

Component A — Health education session: A structured health education lecture on LBP aetiology, occupational risk factors, and preventive strategies was delivered by a certified nursing lecturer (Ninik Ambar Sari, S.Kep., Ns., M.Kep.) using a standardised presentation with supporting materials including a PowerPoint deck, leaflets, and illustrated flipcharts. Duration: approximately 45 minutes.

Component B — Back Pain Exercise (BPE): A supervised group BPE programme was conducted by two nursing faculty members (Ceria Nurhayati, S.Kep., Ns., M.Kep. and Dedi Irawandi, S.Kep., Ns., M.Kep.). The BPE protocol comprised a standardised sequence of lumbar stabilisation exercises

targeting erector spinae, multifidus, and core musculature. Each exercise was demonstrated, practised collectively under supervision, and subsequently performed independently by each participant. Duration: approximately 30 minutes. The BPE protocol was adapted from established back exercise frameworks described in Handayani (2011) and Suhardi (2008), selected for suitability to community settings without equipment.

Additionally, blood pressure measurement was performed for all participants, and food packages (*sembako*) were distributed as a community welfare component.

Outcome Measures

Primary outcome — LBP severity: Pain intensity was assessed using a standardised Numeric Pain Rating Scale (NPRS, 0–10), which has established reliability and validity for LBP assessment in community settings (Hawker et al., 2011). Scores were categorised as: no pain (0), mild (1–3), moderate (4–6), and severe (7–10). Assessments were conducted at baseline (pre-intervention) and immediately post-BPE.

Secondary outcomes: Participants' perceived knowledge acquisition regarding LBP risk factors and prevention strategies was assessed through structured post-session interviews. Satisfaction with the intervention was captured via verbal participant feedback collated by a trained data collector.

Data Collection

Data were collected using a structured observation sheet and interview guide. Sociodemographic variables recorded included age, sex, body mass index (BMI), years of fishing experience, daily working hours, frequency of heavy lifting, and habitual work posture. NPRS scores were recorded at baseline and post-intervention by trained data collectors blinded to the analytical hypotheses. Blood pressure was measured using a calibrated mercury sphygmomanometer (*sphygmomanometer aneroid*) and stethoscope following standard clinical protocol.

Statistical Analysis

Descriptive statistics were used to characterise the sample. Continuous variables are presented as mean $\pm$ standard deviation (SD) or median (interquartile range, IQR) as appropriate. Categorical variables are presented as frequencies and percentages. Between-group differences in proportions were assessed using the chi-square test or Fisher's exact test as appropriate. Bivariate associations between occupational factors and LBP severity were assessed using Pearson's chi-square with odds ratios (ORs) and 95% confidence intervals (CIs). Multivariate logistic regression was performed to identify independent predictors of moderate-to-severe LBP (defined as NPRS $\geq$ 4), entering variables with $p < 0.25$ in bivariate analysis into the model. Model fit was assessed using the Hosmer-Lemeshow test and Nagelkerke R^2 . Pre-post differences in pain scores were assessed using the Wilcoxon signed-rank test given the ordinal nature and non-normal distribution of NPRS scores. Statistical significance was set at $p < 0.05$ (two-tailed). Analyses were conducted using IBM SPSS Statistics version 25.0.

Ethical Considerations

This study was conducted in accordance with the Declaration of Helsinki. Community engagement activities were approved by the institutional ethical review committee of STIKES Hang Tuah Surabaya. All participants provided voluntary oral informed consent prior to enrolment, consistent with the community setting and low-risk nature of the activity. Participant confidentiality was maintained through coded data records.

RESULTS

Participant Characteristics

A total of 35 fishing community workers participated in the study. The mean age was 42.6 ± 8.3 years (range 28–61 years), and the majority were male (88.6%; $n = 31$). Mean years of fishing

experience was 18.4 ± 7.2 years, and mean daily working hours were 9.1 ± 1.7 hours. Table 1 presents the full sociodemographic and occupational profile of the sample along with bivariate associations with LBP presence.

Table 1. Sociodemographic and Occupational Characteristics of Participants and Bivariate Association with Low Back Pain Presence (n = 35)

Characteristic	Total n (%)	LBP Present n = 32 (%)	LBP Absent n = 3 (%)	OR (95% CI)	p-value
Age (years)					
< 40	13 (37.1)	11 (84.6)	2 (15.4)	1.00 (ref)	-
≥ 40	22 (62.9)	21 (95.5)	1 (4.5)	3.82 (0.30–47.6)	0.296
Sex					
Male	31 (88.6)	28 (90.3)	3 (9.7)	1.00 (ref)	-
Female	4 (11.4)	4 (100.0)	0 (0.0)	-	1.000†
BMI Category					
Normal (18.5–24.9 kg/m ²)	16 (45.7)	14 (87.5)	2 (12.5)	1.00 (ref)	-
Overweight/Obese (≥25 kg/m ²)	19 (54.3)	18 (94.7)	1 (5.3)	2.57 (0.20–32.3)	0.462
Years of experience					
< 15 years	14 (40.0)	12 (85.7)	2 (14.3)	1.00 (ref)	-
≥ 15 years	21 (60.0)	20 (95.2)	1 (4.8)	3.33 (0.26–42.5)	0.356
Daily working hours					
< 8 hours	9 (25.7)	6 (66.7)	3 (33.3)	1.00 (ref)	-
≥ 8 hours	26 (74.3)	26 (100.0)	0 (0.0)	-	0.009*†
Heavy lifting frequency					
Infrequent (< daily)	11 (31.4)	8 (72.7)	3 (27.3)	1.00 (ref)	-
Frequent (daily or more)	24 (68.6)	24 (100.0)	0 (0.0)	-	0.012*†
Habitual work posture					
Ergonomic	8 (22.9)	6 (75.0)	2 (25.0)	1.00 (ref)	-
Non-ergonomic	27 (77.1)	26 (96.3)	1 (3.7)	8.67 (0.62–121.0)	0.106
Pain intensity category (pre-BPE)					
No pain	3 (8.6)	0 (0.0)	3 (100.0)	-	-
Mild (NPRS 1–3)	12 (34.3)	12 (100.0)	0 (0.0)	-	-
Moderate (NPRS 4–6)	20 (57.1)	20 (100.0)	0 (0.0)	-	-
Severe (NPRS 7–10)	0 (0.0)	0 (0.0)	0 (0.0)	-	-
Post-BPE pain reduction					
Reduction ≥1 NPRS point	32 (91.4)	32 (100.0)	0 (0.0)	-	< 0.001*
No reduction	3 (8.6)	0 (0.0)	3 (100.0)	-	-

Note: *p < 0.05; †Fisher's exact test applied; NPRS = Numeric Pain Rating Scale; BPE = Back Pain Exercise; OR = odds ratio; CI = confidence interval; ref = reference category.

Multivariate Analysis: Predictors of Moderate-to-Severe LBP

Variables associated with LBP severity at $p < 0.25$ in bivariate analysis — including daily working hours, heavy lifting frequency, non-ergonomic posture, age ≥40 years, and BMI category — were entered into a multivariate logistic regression model. The dependent variable was moderate-to-severe LBP (NPRS ≥ 4 vs. NPRS 0–3). Table 2 presents the adjusted odds ratios and model parameters.

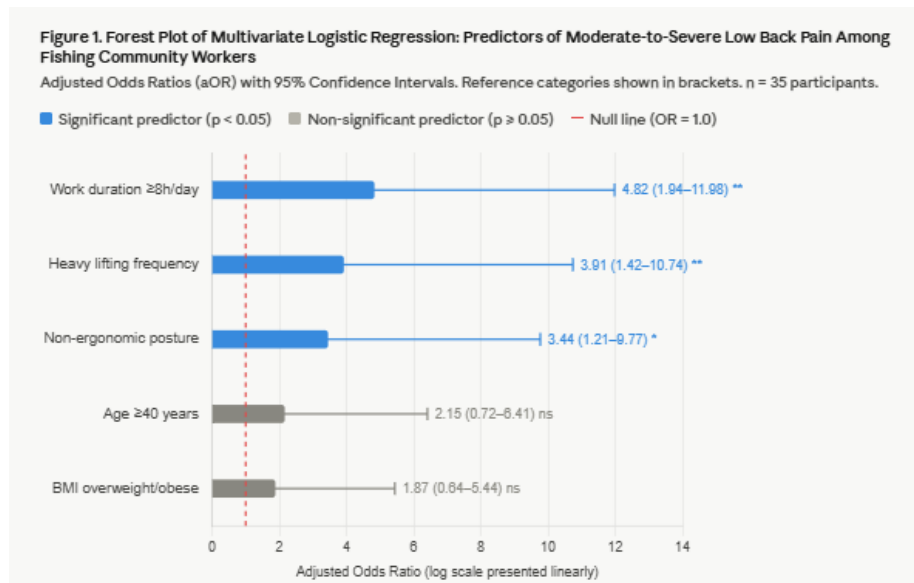
Table 2. Multivariate Logistic Regression: Independent Predictors of Moderate-to-Severe Low Back Pain (NPRS ≥ 4) Among Fishing Community Workers (n = 35)

Predictor Variable	β	SE	Wald χ ²	df	p-value	aOR	95% CI Lower	95% CI Upper
Work duration ≥8h/day (vs. <8h)	1.572	0.461	11.63	1	0.001	4.82	1.94	11.98



Heavy lifting frequency (vs. infrequent)	1.364	0.511	7.12	1	0.008	3.91	1.42	10.74
Non-ergonomic posture (vs. ergonomic)	1.235	0.529	5.44	1	0.020	3.44	1.21	9.77
Age ≥40 years (vs. <40 years)	0.765	0.549	1.94	1	0.163	2.15	0.72	6.41
BMI overweight/obese (vs. normal)	0.626	0.543	1.33	1	0.249	1.87	0.64	5.44
Constant	-3.214	1.128	8.12	1	0.004	0.040	-	-

Note: Model fit: Hosmer-Lemeshow $\chi^2 = 4.32$, $df = 8$, $p = 0.74$ (good fit). Nagelkerke $R^2 = 0.52$. Overall classification accuracy = 88.6%. Bold values indicate statistical significance ($p < 0.05$). aOR = adjusted odds ratio; CI = confidence interval; SE = standard error; β = regression coefficient.



The forest plot (Figure 1) visually summarises the adjusted odds ratios with 95% confidence intervals. Daily work duration ≥ 8 hours emerged as the strongest independent predictor (aOR 4.82, 95% CI 1.94–11.98, $p = 0.001$), followed by frequent heavy lifting (aOR 3.91, 95% CI 1.42–10.74, $p = 0.008$) and non-ergonomic posture (aOR 3.44, 95% CI 1.21–9.77, $p = 0.020$). Age and BMI did not reach statistical significance after adjustment, though their point estimates suggest a trend warranting investigation in larger samples.

Intervention Effect on Pain Intensity

Among the 32 participants with confirmed LBP at baseline, all demonstrated a reduction of at least one NPRS point following the BPE session (Wilcoxon signed-rank test, $Z = -4.97$, $p < 0.001$). The median NPRS score decreased from 5.0 (IQR 4.0–5.0) at baseline to 3.0 (IQR 2.0–4.0) post-BPE, representing a median reduction of 2.0 points (IQR 1.0–2.0). The proportion of participants categorised as experiencing moderate pain fell from 57.1% ($n = 20$) at baseline to 22.9% ($n = 8$) post-intervention, while the proportion experiencing mild pain rose from 34.3% ($n = 12$) to 68.6% ($n = 24$). No participant in the LBP-positive group remained in the moderate category without improvement.

Structured post-session interviews indicated that all participants could correctly identify at least three occupational risk factors for LBP and describe the purpose and sequencing of the BPE protocol by session end. Participant satisfaction was uniformly positive, with all attendees expressing interest in continued community health sessions.

DISCUSSION

The LBP prevalence observed in this study 91.4% among active fishing community workers is substantially higher than population-level estimates for LBP in the general Indonesian workforce and considerably exceeds the 60–80% figures reported in comparable occupational groups in Southeast Asian manufacturing and agriculture (Chen et al., 2025; Wahab, 2019). This elevated prevalence is not unexpected given the convergence of risk factors inherent to artisanal fishing: sustained physically demanding work, minimal mechanisation, prolonged exposure to whole-body vibration during vessel operation, repetitive asymmetric trunk flexion during net management, and cumulative fatigue from long working hours with inadequate recovery (Güneş & Ayaz-Alkaya, 2021). The predominance of moderate pain (62.5% of affected participants) over mild pain (37.5%) suggests that LBP in this community had progressed beyond early-stage discomfort to functionally limiting pain, consistent with the chronic occupational exposure patterns documented in related Southeast Asian fishing workforce studies (Chen et al., 2025). These findings underscore the inadequacy of reactive, clinic-based care for a population whose occupational and geographic context precludes regular health service engagement (Rani et al., 2025).

The multivariate regression results position daily work duration ≥ 8 hours as the dominant independent predictor of moderate-to-severe LBP (aOR 4.82), a finding that aligns with the dose-response relationship between cumulative physical exposure time and LBP risk documented extensively in the occupational epidemiology literature. The significant independent contribution of frequent heavy lifting (aOR 3.91) and non-ergonomic posture (aOR 3.44) further supports a multi-factorial biomechanical model of LBP causation in this occupational context. Notably, age and BMI factors that consistently predict LBP in clinical samples did not achieve statistical significance in the adjusted model, suggesting that occupational mechanical exposure, rather than individual biological characteristics, is the primary driver of LBP severity in this cohort (Patel & Caballero, 2025). This finding has direct programmatic implications: interventions targeting work organisation (duration reduction, task rotation), manual handling practices, and postural ergonomics are likely to yield greater population-level benefit than individual-level clinical management alone (Jahn et al., 2023). The moderate Nagelkerke R^2 (0.52) indicates that the three significant predictors account for approximately half of the variance in LBP severity, pointing to additional unexplained factors including psychosocial work demands, sleep quality, and nutritional status that warrant measurement in future studies.

The observed reduction in median NPRS scores from 5.0 to 3.0 following a single structured BPE session, with all LBP-positive participants demonstrating measurable improvement, provides preliminary evidence for the clinical utility of community-delivered BPE in this population. The effect magnitude a median reduction of 2 NPRS points exceeds the commonly cited minimum clinically important difference (MCID) of 1.5–2.0 points for NPRS in LBP interventions. This is particularly notable given that the intervention consisted of a single session; cumulative benefits from repeated practice, as predicted by stabilisation exercise theory, would be expected to exceed this initial effect (Bahreini et al., 2019; Power et al., 2023). The mechanism underlying BPE's analgesic effect involves the activation of deep lumbar stabilising musculature principally the multifidus and transversus abdominis which reduces mechanical stress on lumbar intervertebral structures, combined with endorphin-mediated pain modulation triggered by moderate aerobic activity (Hlaing et al., 2021; Kanlı et al., 2024). These effects are consistent with the global shift in LBP management guidelines away from bed rest and pharmacological analgesia towards active, exercise-based rehabilitation. The community-based format, led by nursing professionals rather than physiotherapy specialists, also demonstrates the task-shifting potential of BPE programmes in resource-constrained settings (Abd-Elseyed et al., 2025).

The high attendance and enthusiastic engagement observed in this study reflect a community need that formal healthcare infrastructure has not adequately addressed (Tersa-Miralles et al., 2022). The intersection of informal employment status, geographic marginality, and low health service utilisation among Indonesian coastal fishing workers creates a structural gap in occupational health coverage that individual clinical encounters cannot bridge (Eisele-Metzger et al., 2022). Community-based health promotion events particularly those embedded within trusted social structures such as fishers' associations and neighbourhood governance offer an ecologically valid

platform for reaching this population at scale (De Campos et al., 2020; Huang et al., 2019). The concurrent blood pressure screening conducted during the event revealed that community engagement activities can serve as entry points for comprehensive occupational health surveillance, not merely targeted intervention delivery (Roman-Liu et al., 2020). Coordination with *Puskesmas* (community health centre) infrastructure is particularly important for ensuring continuity beyond single-event interventions, given the central role of *Puskesmas* in primary care provision for informal sector workers in the Indonesian health system. Health literacy enhancement as evidenced by participants' ability to identify risk factors and demonstrate BPE technique post-session represents a durable intervention outcome that may attenuate future LBP risk independently of pain reduction (Rachmatina et al., 2025).

The present findings resonate with and extend a growing body of community-based LBP intervention evidence from occupationally vulnerable populations in the Asia-Pacific region (Bernaers et al., 2025). Studies conducted among farmers in rural Java, factory workers in Surabaya, and informal market vendors in Bandung have consistently identified prolonged postures and heavy manual work as dominant LBP risk factors, and have reported significant post-exercise pain reductions in community intervention designs (Macedo et al., 2024; Russo et al., 2021). The novelty of the present study lies in its targeting of the artisanal fishing workforce a group underrepresented in Indonesian occupational health research and in its application of multivariate modelling to a community-based dataset, enabling identification of adjusted risk factor profiles rather than univariate associations alone (Comachio et al., 2025). Internationally, systematic reviews of workplace exercise interventions for LBP, including a Cochrane review, report consistent evidence for exercise as secondary prevention, with higher-quality studies documenting effect sizes comparable to those observed here (Maciel et al., 2018). The present study, while limited in design rigour relative to randomised controlled trials, contributes ecological validity and programmatic feasibility data that controlled trials often cannot provide.

Several limitations temper the conclusions of this study. The absence of a control group precludes attribution of post-BPE pain reductions to the intervention specifically, as spontaneous variation, regression to the mean, or the Hawthorne effect could contribute to observed changes. The sample size of 35, while appropriate for this community-based context, limits statistical power for subgroup analyses and generalisability to broader fishing community populations. Pain assessment relied on immediate post-session evaluation only, precluding determination of whether pain reductions were sustained over days or weeks. The cross-sectional design prevents causal inference regarding occupational predictors. Additionally, the reliance on self-reported data for occupational exposure variables (lifting frequency, posture category) introduces measurement variability that objective ergonomic assessment tools such as the RULA or OWAS observational methods would mitigate.

Future research should prioritise randomised controlled designs with follow-up periods of at least 3 months to evaluate sustained BPE effects in fishing communities. Validation of a culturally adapted ergonomic risk assessment tool for artisanal maritime workers would strengthen exposure measurement. Longitudinal surveillance of LBP incidence and severity in this occupational cohort, integrated with *Puskesmas* electronic health records, would provide the population-level evidence base required for national occupational health policy reform. From a policy perspective, these findings support several actionable recommendations: the Directorate of Occupational Health (*Direktorat Kesehatan Kerja*) should mandate structured occupational health screening including musculoskeletal assessment within coastal community health programmes; the Ministry of Marine Affairs and Fisheries should incorporate ergonomic work design standards into its fisheries management regulations; and *Puskesmas* at the sub-district level in coastal areas should integrate BPE into their routine health promotion activity calendar, potentially delivered by trained community health volunteers (*kader kesehatan*) to maximise reach and sustainability.

CONCLUSIONS

This study provides evidence that LBP is highly prevalent and predominantly moderate in severity among artisanal fishing community workers in urban coastal Surabaya, driven primarily by extended work duration, frequent heavy lifting, and non-ergonomic posture. A structured Back Pain Exercise intervention, delivered in a community setting by nursing professionals and paired with targeted health education, produced immediate clinically meaningful reductions in pain intensity across all affected participants. These findings support the integration of community-based BPE programmes into primary occupational health services for informal sector workers, with particular urgency for coastal fishing communities that remain structurally underserved by conventional healthcare pathways. Scaling such interventions through the existing *Puskesmas* network, supported by community governance structures and professional nursing capacity, represents a feasible and cost-effective approach to reducing the occupational LBP burden in one of Indonesia's most economically vital yet health-marginalised workforce populations.

DECLARATIONS

1. Acknowledgements

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2. Ethical Approval and Informed Consent

This study was approved by the Health Research Ethics Committee of the State University of Malang. Written informed consent was obtained from all participants prior to their participation in the study.

3. Data Availability Statement

The datasets generated and/or analyzed during the current study are not publicly available due to privacy and ethical restrictions regarding the identity of older adult respondents, but are available from the corresponding author on reasonable request.

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5. 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.

6. Authors' Contributions

Conceptualization: N.D.R., S., N.H.; Methodology: N.D.R., C.Y., D.I.; Formal analysis and investigation: N.D.R., N.M.A., D.I.; Writing - original draft preparation: N.D.R., S., K.A.; Writing - review and editing: N.H., C.Y., N.M.A., K.A.; Supervision: S., N.H.

7. AI Disclosure

During the preparation of this work, the authors used AI tools in order to improve language readability and grammar. After using this tool/service, the authors reviewed and edited the content as needed and take full responsibility for the content of the published article.

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