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The impacts of rest breaks and stretching exercises on low back pain among commercial truck drivers in Iran

Running title: low back pain among commercial truck drivers

Mohammad Ghasemi [1], Amir Hossein khoshakhlagh *[2], Ali Ghanjal[3], Saeid Yazdanirad[2], Fereydoon Laal[4]

Affiliation

1- Health Research Center, Lifestyle institute, Baqiyatallah University of Medical Sciences, Tehran, Iran.
Email: mghmed@yahoo.com

2- Department of Occupational Health, School of public Health, Tehran University of Medical Sciences, Tehran, Iran & Students' Scientific Research Center, Tehran University of Medical Sciences, Tehran, Iran
Corresponding author: Email: ah.khoshakhlagh@gmail.com Tel: +00989194046948
Fax: 009888600062 ORCID: 0000-0002-2265-5054

3- Health Management Research Center, Baqiyatallah University of Medical Sciences, Tehran, Iran. Email: ghanjala@yahoo.com

4- Student Research Committee, School of public Health, Shahid Beheshti University of Medical Sciences, Tehran, Iran.
Email: fereydoonlaal@gmail.com

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*Purpose***.** The objective of this paper aimed to determine the impacts of rest breaks and stretching exercises on low back pain (LBP) in commercial truck drivers. *Methods*. This quasi-experiment was carried out on 92 truck drivers suffering from chronic LBP. Subjects were categorized into 3 groups (stretching exercises and rest breaks, rest breaks only, and reference). Pain severity and related disability were measured at the beginning of the survey and after 6 and 12 weeks. The latter was assessed using the Oswestry low back pain disability questionnaire (OLBPDQ) and the Roland Morris questionnaire (RMQ). *Results*. At the end of intervention, the mean pain scores in 3 groups were 2.72 ± 1.44, 4.11 ± 0.86 and 4.90 ± 1.31 respectively (p<0.001). The OLBPDQ scores in group 1 (stretches and resting time breaks) were significantly lower than group 2 (rest break) (p = 0.009). The RMQ scores showed a significant reduction in group 1 compared the other two groups (p = 0.001). Drivers in group 2 improved more significantly than group 3 regarding visual analogue scale (VAS) pain score (p = 0.049), OLBPDQ score (p = 0.024) and RMQ (p = 0.011). *Conclusion*. This study provided converging results that supplementary exercises during break periods consistently help to minimize LBP and disability.

Keywords: Commercial drivers; low back pain; resting time break; stretching exercises

1. Introduction

Low back pain (LBP) is an occupational health concern. There is a large body of evidence suggests that the contributors of work-related LBP are multifactorial, and include personal variables, as well as psychosocial factors and mechanical factors. Risk assessment of LBP shows that mechanical risks such as awkward postures, heavy lifting, and high physical demands are determinative factors [1]. There are many papers and literature reviews that have supported the association between static working postures and work-related musculoskeletal disorder risk [2,3]. It seems that the duration of maintaining an awkward posture is one of the main variables increasing the cumulative effects of mechanical stress [4]. It is noteworthy that estimating the interaction between this factor (duration of maintaining an awkward posture) and a number of other factors such as frequency of flexion and range of motion in the trunk area is difficult [5].

Some reports released in developing countries emphasize the high prevalent status of LBP among commercial drivers [6,7]. More than 27% of Iranian commercial drivers suffer from chronic LBP [8]. An Iranian investigation identified back pain as one of the most common musculoskeletal problems among truck drivers [9]. In another study, bus drivers working for an intercity travel agency from a western province and a central province were assessed regarding musculoskeletal disorders (WMSDs). Musculoskeletal problems were more common in the study group than office clerks. LBP was seen among 48.4% of bus drivers, and working hours per week and average continuous daily work were higher among pain sufferers [10]. In Finland, a European country, increased incidence of back pain was noted among professional drivers [11]. Furthermore, population-based studies in the USA [12] and Canada [13] have indicated that the frequency of LBP is 1.6 to 2 times the reference prevalence.

In commercial driving, an association between sustained sitting and LBP has been detected [14]. During sitting, the pelvis rotates backward and a reduction occurs in lumbar lordosis which, by itself, results in pathologic disk changes and LBP [15]. Unsupported sitting is more risky for LBP than sitting with the lumbar spine supported by an ergonomic back rest [16]. Sitting more than 4 h/day is a risk factor for LBP [17]. Surprisingly, Hartvigsen (2000) after reviewing 35 studies noted that except for one the surveys failed to find a positive relationship [18]. Also, one systematic review reported that a sedentary lifestyle by itself is not associated with LBP [19].

Road drivers as a target group for occupational LBP have distinct job conditions compared to their other colleagues (e.g., urban taxi drivers). First, they spend a lot of time ‘while driving’ with minimum movement. Second, they experience very long periods of exposure to whole body vibration (WBV), although the amount of vibration is less than that occurring with agricultural or industrial machines and vehicles; long periods of driving on the road make the accumulated exposure very high. Third, because of high costs (time loan, maintenance, insurance, etc.), Iranian drivers work many hours weekly which enhance the cumulative effects of physical and ergonomic hazards including WBV, sustained static position and awkward postures [20].

Several modalities have been used in attempts to prevent LBP [21]. The more popular evidence-based interventions include ergonomic ones (design of environment, tools or procedures) [22], physical activity [23], and education [24]. Education, design or improvements of physical health have a positive effect on absenteeism due to LBP [25,26].

In commercial driving, continuous work is only possible while sitting in a limited area. In addition, WBV is a strong hazard for developing LBP in drivers [27]. This paper aimed to determine the impacts of on-duty stretching exercises and rest break periods on LBP among commercial truck drivers.

2. Materials and Methods

2.1. Research subjects and inclusion criteria

In this quasi-experimental interventional study, the effect of on-duty rest breaks and exercise on reducing perceived LBP was assessed among Iranian commercial drivers during April to October 2016. The target population consisted of 92 male truck drivers who suffered from LBP. Preliminary analysis based on expected variability intergroup and within each group showed a minimum sample size of 56 persons in intervention and reference groups by a power of 80% and the α level of 0.05. Assuming 10% non-compliance or dropout we considered at least 30 subjects in each group.

The ethics committee of the University justified the methodology of the study.

The inclusion criteria were 1) age between 20 and 55 years, 2) suffering from chronic LBP lasting at least 12 months, 3) experience of commercial driving for at least 2 years and 4) signing informed consent. The subjects were excluded if they had a history of 1) degenerative or rheumatologic disorders, 2) present or history of lumbar discopathies, 3) massive trauma, 4) any systemic disorder, 5) psychological illnesses, or 6) long-term systemic corticosteroid administration. Since drivers in Iran have annual or bi-annual medical checkups to be permitted to drive, the exclusion criteria were easily extracted.

LBP was defined as pain lasting at least three months with or without radicular pain to lower extremities originating from a lumbar paraspinal area and resulting in sick leave or marked limitation of job productivity. LBP incidents were extracted from clinical assessments by a well- informed physician [20].

2.2. Dependent variable

All subjects rated their pain severity using a colored 10 cm (calibrated in millimeter) visual analogue scale (VAS). The drivers were asked to show the severity of pain by marking one point of this scale. So the severity ranged from 0.0 - 10.0. To rate disability due to LBP, the drivers also filled out the Iranian validated version of two questionnaires: the Oswestry low back pain disability questionnaire (OLBPDQ) and the Roland Morris questionnaire (RMQ) [28]. OLBPDQ is a 10-item questionnaire in which each item is scaled from 0 - 5. Total scores ranged from 0 - 50 with higher values representing more severe disability [29]. RMQ contains 24 sentences, and patients rated only those sentences which described them. More marked sentences meant more disability.

A total of 128 drivers were selected using blinding chart among which 92 subjects met the inclusion criteria. After signing the informed consent, the subjects were assigned to three groups. Group 1 received a rest break and exercise program, group 2 received a rest break only program, and group 3 was considered the reference. Blind randomization was done using slips of numbered papers in closed envelopes. The final selected subjects were requested to complete the questionnaires and pain scale.

Individuals in all groups were instructed in face-to-face visits and were given instructions by an occupational medicine specialist about the importance of rest breaks in preventing LBP and how to perform the breaks. Each subject also received a typed-pictorial relevant guide containing the definition of LBP, its clinical presentation, and preventive actions such as proper load carriage, proper sleeping, ergonomic sitting and proper driving.

2.3. Intervention

Exercises selected for subjects in group 1 consisted of stretching movements. Subjects were requested to conduct the stretches during their rest breaks. The stretches emphasized abdominal and back muscles. They consisted of two parts, slow lumbar flexion, and slow lumbar extension, lasting at least 30 seconds in each repetition [30]. Five repetitions for each part were defined as a set.

Drivers performed the first exercise session under observation by a physical therapist and all sessions thereafter during their commercial travels.

Subjects in groups 1 and 2 were required to spend a total of at least 0.5 - 0.75 h on rest break (the driver was required to simply relax, get out of the cab, take a walk, and use the toilet) during each 10 h driving interval divided by 2 - 3 break intervals [31]. Compliance with the intervention was monitored using a self-designed checklist (e.g., the frequency of stretching and breaks by group). Each subject who discontinued conducting the interventions was excluded from the study.

2.4. General and occupational data collection (or measurement)

We developed a 2-page self-administrated questionnaire composed of 42 items regarding personal (demographic, smoking, exercise, psychological profile, and average frequency of physical activity) and occupational (type of vehicle, number of working hours per week, average number of occupationally active days per month, and years of work-related activities as a commercial driver) that was completed by subjects. This was administered to assess for potential confounding between intervention groups. The survey required less than 10 min to complete.

All outcomes and variables were measured at the first visit (initial assessment), after 6 weeks (middle assessment), and after 12 weeks (final assessment) using VAS, OLBPDQ, and RMQ; the whole trend of the intervention procedure is illustrated in figure 1.

2.5. Data analysis

For categorical data, the χ^2 and Fisher exact test were applied. For continuous variables, including age, body mass index (BMI), years in commercial driving, hours of daily driving, pain severity, and OLBPDQ as well as RMQ scores, one-way analysis of variance (ANOVA´s) post hoc test was considered and, the Kruskal–Wallis test was performed for non-parametric data. The mean values were compared within groups for consecutive assessments and between groups in each separate assessment.

An Analysis was based on intent-to-treat and loss-to-follow-up subjects; missing data were carried forward from initial data. A level of 0.05 was the criterion for significance.

The group and time factors were indeed between subjects and within subjects, respectively, which was used a 2-way mixed effects ANOVA.

3. Results

Figure 1 provides a schematic of the design of the study and losses to follow-up. From the 128 initial volunteers, 25 individuals did not meet the inclusion criteria and 92 recruits with a mean ± SD age of 36.70 ± 9.16 years participated. Of them, seven pain sufferers refused to continue during the intervention.

The range of commercial driving activity duration was 2 - 35 years. The mean age and working duration figures for each group are presented in table 1. Groups were similar in age, education level, years of commercial driving, BMI, smoking habits, type of truck, daily time of driving, and regular exercise ($p>0.05$) (table 1). Comparing the three outcomes of measurements at the first assessment revealed no initial differences in disability scores or pain severity among the 3 groups (table 2).

Drivers in group 1 (rest break and exercise) and group 2 (rest break only) showed significant improvement in their OLBPDQ and RMQ scores as well as in the VAS scale in the middle measurement ($p<0.001$, table 2). Post hoc analysis of differences between groups in the middle assessment revealed significant lower OLBPDQ, RMQ, and VAS scores in group 1 compared with group 2. These differences were seen only in RMQ scores when group 2 was compared with group 3. Drivers assigned to group 1 showed significant improvement in disability and pain scores.

Results of the nonparametric post hoc analysis for data obtained in the final assessment (after 12 weeks) represented a significant improvement in group 1 compared with the other two groups in pain severity and related disability. Drivers in group 2 also improved significantly more than those in group 3 (table 3).

Evaluating each group separately over the period of the study and the final assessment showed that all three variables were improved in groups 1 and 2 compared to the initial tests, but no significant changes were seen in the scores of group 3 (table 1). Table 4 shows the mean improvement values between the first and last measurements.

4. Discussion

The findings of the current study indicated that rest breaks plus stretching exercises, especially if performed for longer times, is more effective in improving LBP and its related disability for commercial truck drivers than rest breaks alone. In other words, rest breaks improve LBP and are more effective when combined with stretching exercises.

The initial pain score (VAS scale) was significantly affected by the implementation of a 12-week rest break plus exercise program. Subjects performing this intervention showed significant improvement (approximately 2.9 points) compared to those in the rest break only intervention group (approximately 1.4 points). Also in the latter group, there was a slight decrease in VAS scores compared to the reference group. To the best of the authors' knowledge, the impacts of rest break plus exercise on VAS scores have not been previously investigated in drivers; therefore a comparison with the present survey is not possible. A study of individuals with prolonged standing found that the exercise program intervention is effective in decreasing LBP [32].

At the 6- and 12-week follow-up assessments, disability scores in group 1 were significantly improved. In group 2, although the decrease in scores was still significant at the final assessment, there was no less improvement compared to group 1. After 6 weeks, no significant changes were observed; this represents the slow response of LBP-related disability to rest breaks. Hence, this finding is a somewhat supervenient event and what should be highlighted is that improvement in LBP and the relevant disability is quite possible using the rest break strategy during driving time.

Post hoc analysis revealed significant differences in the outcomes of the final assessments of the 3 groups ($p < 0.001$), but group 2 compared to group 1 and the group 3 exhibited less differences ($p < 0.05$). As noted, although several studies have addressed various interventions for relief of work-related LBP such as manipulation [33], herbal medicine [34], and exercise therapy [35] in various jobs, the current findings may provide some additional insight for improving LBP among truck drivers.

According to reports of the national health survey, the prevalence of musculoskeletal problems is higher among commercial drivers than in the Iranian male population [36]. On the other hand, musculoskeletal problems are related to some occupational risk factors for drivers, so attention to reducing job hazards is very important in this job group [10]. Road drivers usually spend their working time in a restricted driving cabin with no space for body movement, and this leads to a sustained, static position. This static situation promotes the accumulation of strain/spasm and subsequent musculoskeletal complaints [37].

Sitting by itself is a probable cause for increased intradiscal pressure, structural weakening, diminished metabolic exchange in the vertebral column, and exacerbation of tissue attrition [38]. Additionally, prolonged sitting in bad postures, which is frequently seen in truck drivers, has been noted as an important cause of degenerative changes, discopathy, and subsequent LBP [1]. Prolonged sitting due to road driving along with repetitive body movements negatively affect blood circulation, coordination, and control of movements [1].

One apparent fact in the case of occupational LBP is the great attribution of WBV, mainly in driving. The results of many investigations demonstrate that exposure to WBV is an important cause of LBP [39]. The demonstrated theories include increased matrix degrading and proteolytic enzymes and subsequent changes in extracellular metabolism in discal tissue [39]. Another effect of WBV is muscle fatigue which creates pain. A static sitting position, especially without a convenient back support, predisposes the vertebral column to the damaging effects of WBV [39]. A single role for WBV could not be quantified. Meanwhile, there are limited findings of the dose-response relationship between WBV as well as other driving health hazards and the occurrence of LBP. Many personal factors also contribute to LBP in drivers [40]. Rest breaks and stretching exercises can be useful options against LBP as a multifactorial occupational health problem for which the quantitation of risk factors is difficult.

Attention to exercise and rest breaks are seen as aspects of total wellness and a healthy lifestyle essential for all commercial drivers [41]. While on duty, drivers benefit from stretching exercises and rest breaks, because they decrease the risk of vehicle crashes [31]. It is not obvious whether adding more rest breaks to driving times has an additive effect or not [41]; therefore, a good equilibrant time of rest breaks was recommended to the subjects of this study.

There are two miscellaneous reasons which may confound the interpretation of the findings of this study. First, there is an unacknowledged competition among commercial drivers. Drivers like to have more work travels so as to earn much more freight. This may impose more overtime work on them. Consequently, the effect of the rest breaks and stretches may not be prominent. Secondly, it should be mentioned that Iranian drivers, as noted among drivers in Malaysia [1], experience a usual fear of medical disqualification in each periodic health assessment; therefore, many musculoskeletal pains are not reported, and the real prevalence of LBP among commercial drivers is unclear.

In conclusion, this study provided practical results that stretching exercises during rest breaks consistently help to minimize LBP and disability, and it is better when combined with training for drivers on general information regarding LBP and its consequences. More comprehensive studies are suggested to complete our findings.

4.1. Strengths and weaknesses of the survey

The main strength of this survey was that it chose an interventional design and investigated concurrent impacts of rest breaks and exercise. Applying the OLBPDQ questionnaire and the RMQ questionnaire together also resulted in more comprehensive outcome measurements regarding disabilities. Furthermore, since interventions were conducted in the work environment, the procedure may be straightforwardly practical in real settings. Simple randomization was used to allocate subjects to intervention and reference groups, and the base-line variables in the three groups were successfully balanced. One weakness of this study is that there was no direct supervision to ensure the proper and regular performance of exercise and rest break programs. A second weakness could be that the effect of vibration was not considered in this study. In addition, we didn't use objective measures such as muscle strength and lumbar range of motion.

Compliance with ethical standards

Subjects received oral information on the study before signing consent forms.

Disclosure statement

The authors report no potential conflicts of interest.

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Figure 1. The trend of intervention procedure in the study.

Table 1. Personal, demographic and occupational variables among three groups of drivers.

Personal, demographic and occupational variable	Total (N = 92)	Rest breaks and stretching (n = 31)	Rest breaks (n = 30)	Reference (n = 31)	*p*
Age (year)	36.70 ± 9.16	36.97 ± 9.68	36.77 ± 8.51	36.35 ± 9.52	0.965
Body mass index	27.07 ± 2.06	27.23 ± 2.44	27.15 ± 1.76	26.84 ± 1.97	0.743
Years in professional driving (year)	15.48 ± 9.41	16.97 ± 9.68	15.37 ± 8.97	14.10 ± 9.58	0.489
Time of daily driving (h)	7.95 ± 1.50	8.10 ± 1.55	8.00 ± 1.64	7.74 ± 1.34	0.637
Education level					
Diploma and less	88 (95.65%)	30 (32.61%)	28 (30.43%)	30 (32.61%)	0.750
Academic	4 (4.35%)	1 (1.09%)	2 (2.17%)	1 (1.09%)	
Regular exercise					
Yes	29 (31.52%)	8 (8.69%)	10 (10.87%)	11 (11.96%)	0.691
No	63 (68.48%)	23 (25.00%)	20 (21.74%)	20 (21.74%)	
Type of truck					
log	47 (51.09%)	16 (17.39%)	19 (20.65%)	12 (7.09%)	0.766
Dump	17 (18.48%)	6 (6.52%)	5 (5.43%)	6 (6.52%)	
Refrigerator	13 (14.13%)	5 (5.43%)	2 (2.17%)	6 (6.52%)	
tank	11 (11.96%)	3 (3.26%)	3 (3.26%)	5 (5.43%)	
Concrete transport	4 (4.35%)	1 (1.09%)	1 (1.09%)	2 (2.17%)	
Smoking habit					
Yes	24 (26.09%)	10 (10.87%)	7 (7.61%)	7 (7.61%)	0.629
No	68 (73.91%)	21 (22.83)	23 (25%)	24 (26.09%)	

Table 2. Comparing outcome measures (VAS, OLBPDQ, and RMQ) in three groups using (Kruskal–Wallis) test.

Measuring tool		Baseline assessment				Middle assessment				Final assessment			
		Group1 (n = 31)	Group2 (n = 30)	Group3 (n = 31)	*p*	Group1 (n = 31)	Group 2 (n = 30)	Group 3 (n = 31)	*p*	Group 1 (n = 31)	Group 2 (n = 30)	Group 3 (n = 31)	*p*
VAS	M ± SD	5.62 ± 1.46	5.55 ± 0.90	5.53 ± 1.44	0.918	3.62 ± 1.46	4.50 ± 0.91	5.09 ± 1.31	0<0.001	2.72 ± 1.44	4.11 ± 0.86	4.90 ± 1.31	0<0.001
	95% CI	[5.09, 6.16]	[5.22, 5.89]	[5.00, 6.06]		[3.09, 4.16]	[4.16, 4.84]	[4.61, 5.58]		[2.19, 3.25]	[3.79, 4.44]	[4.42, 5.38]	
	5% trim med *M*	5.618	5.58	5.50		3.61	4.51	5.12		2.72	4.12	4.93	
OLBPDQ	M ± SD	34.35 ± 9.10	32.83 ± 5.33	33.13 ± 8.55	0.812	22.52 ± 7.22	27.47 ± 4.66	31.13 ± 8.33	0<0.001	19.52 ± 5.94	24.97 ± 5.58	29.81 ± 8.38	0<0.001
	95% CI	[31.02, 37.69]	[30.84, 34.83]	[29.99, 36.27]		[19.87, 25.16]	[25.7, 29.21]	[28.07, 34.18]		[17.33, 21.70]	[22.88, 27.05]	[26.73, 32.88]	
	5% trim med *M*	34.32	33.06	33.02		22.67	27.57	31.06		19.54	24.74	2971	
RMQ	M ± SD	16.10 ± 4.62	15.60 ± 3.69	15.90 ± 5.04	0.970	9.13 ± 3.40	11.77 ± 3.55	14.52 ± 4.34	0<0.001	5.26 ± 2.92	9.80 ± 3.52	12.71 ± 4.42	0<0.001
	95% CI	[14.40, 17.79]	[14.22, 16.98]	[14.05, 17.75]		[7.88, 10.38]	[10.4, 13.10]	[12.92, 16.11]		[4.19, 6.33]	[8.48, 11.12]	[11.09, 14.33]	
	5% trim med *M*	16.11	15.46	15.84		8.96	11.52	14.37		5.23	9.59	12.53	

VAS =visual analogue scale
OLBPDQ= Oswestry low back pain disability questionnaire
RMQ= Roland Morris questionnaire
p from non-parametric (Kruskal–Wallis) test.

Table 3. Comparing groups after intervention using post-hoc analysis (Scheffe test).

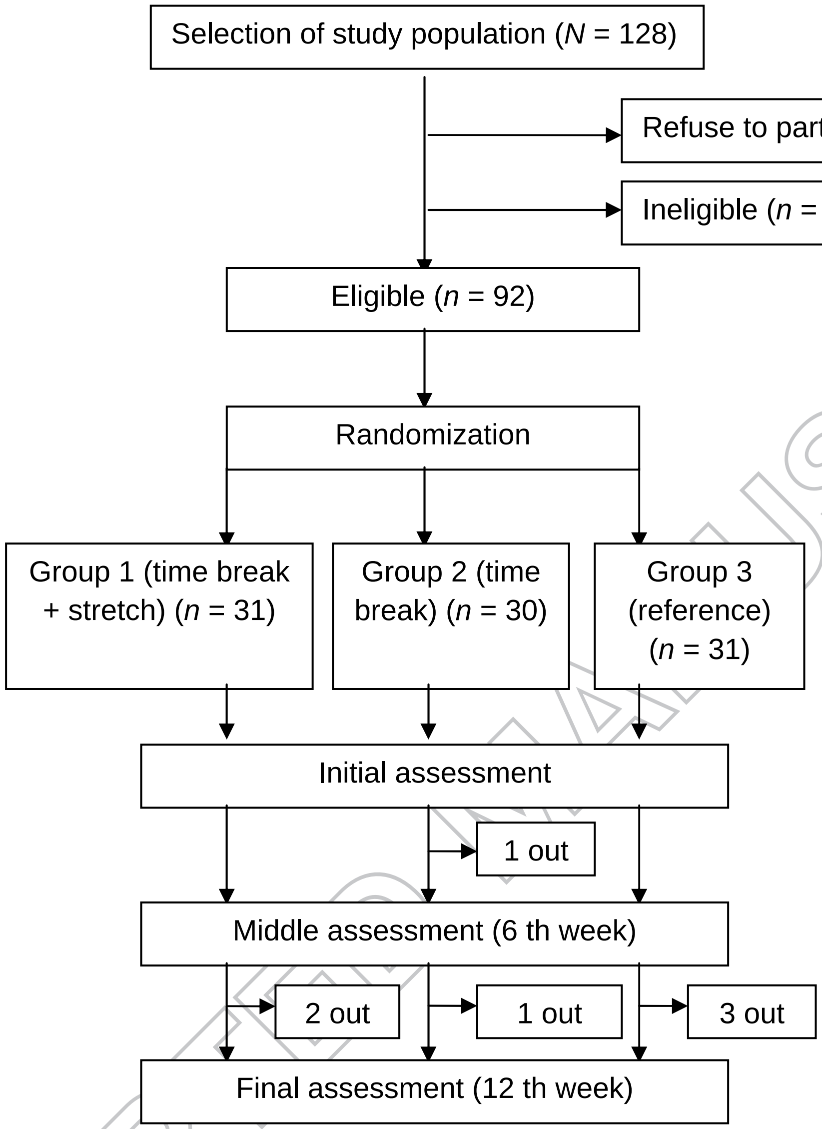
Measuring tool		*SE*	*p*
Mean VAS (middle assessment)	group 1 vs. 2	0.321	0.029
	group 1 vs. 3	0.319	<0.001
	group 2 vs. 3	0.321	0.186
Mean VAS (final assessment)	group 1 vs. 2	0.316	<0.001
	group 1 vs. 3	0.314	<0.001
	group 2 vs. 3	0.316	0.049
Mean RMQ (middle assessment)	group 1 vs. 2	0.971	0.029
	group 1 vs. 3	0.963	<0.001
	group 2 vs. 3	0.971	0.022
Mean RMQ (final assessment)	group 1 vs. 2	0.942	<0.001
	group 1 vs. 3	0.935	<0.001
	group 2 vs. 3	0.942	0.011
Mean OLBPDQ (middle assessment)	group 1 vs. 2	1.775	0.024
	group 1 vs. 3	1.761	<0.001
	group 2 vs. 3	1.775	0.125
Mean OLBPDQ (final assessment)	group 1 vs. 2	1.732	0.009
	group 1 vs. 3	1.718	<0.001
	group 2 vs. 3	1.732	0.024

VAS =visual analogue scale
OLBPDQ= Oswestry low back pain disability questionnaire
RMQ= Roland Morris questionnaire
Data extracted from the post-hoc analysis (Scheffe test)

Table 4. Mean improvement in pain and disability scores.

Measuring tool	Rest breaks and stretching	Rest breaks	Reference	*p*
	M ± SD	M ± SD	M ± SD	
VAS	2.9022 ± 0.6507	1.4422 ± 0.6402	0.6269 ± 0.6052	0.001
OLBPDQ	14.839 ± 9.173	7.867 ± 7.601	3.323 ± 1.815	0.001
RMQ	10.839 ± 4.091	5.800 ± 2.592	3.194 ± 2.428	0.001

VAS =visual analogue scale
OLBPDQ= Oswestry low back pain disability questionnaire
RMQ= Roland Morris questionnaire


Selection of study population (N = 128)
Refuse to participation (n = 11)
Ineligible (n = 25)
Eligible (n = 92)
Randomization
Group 1 (time break + stretch) (n = 31)
Group 2 (time break) (n = 30)
Group 3 (reference) (n = 31)
Initial assessment
1 out
Middle assessment (6 th week)
2 out
1 out
3 out
Final assessment (12 th week)