

Effects of Occupational Exposure to Whole-Body Vibration in Tractor Drivers with Low Back Pain in Punjab

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ABSTRACT The present study deals with the severity of low back pain in 169 male tractor drivers from Ludhiana, Punjab, India, aged 21- 60 years. Of these 169 tractor drivers, a total of 29 (17.16%) had reported their complications regarding low back pain and the rest 140 (82.84%) had no complications for their back pain. To assess the severity of pain, the modified Oswestry Pain Questionnaire was used. The findings of the present study indicate a gradual increase of pain scores with the increased exposure to whole-body vibration with the increase of age.

INTRODUCTION

Low back pain is a major public health problem all over the world. Epidemiological studies provide important information regarding various risk factors, viz. age and sex (Cunnigham and Kelsey 1984; Leino et al. 1994; Hurwitz and Morgenstern 1997), occupation (Kelsey 1982; Bongers et al. 1988; Battie et al. 1990; Piazzi et al. 1991; Piccinni et al. 1992; Limburska et al. 1996; Rothenbacher et al. 1997 and Nubling et al. 1997), life style and socio-economic status (Hurwitz and Morgenstern 1997; Leino et al. 1994 and Kendall et al. 1983), smoking habit (Frymoyer et al. 1983; Beiring-Sorensen and Hilden 1984; Heliovaara 1998 and Deyo and Bass 1989).

It is reported that low back pain is common in persons exposed to whole body vibrations (Varghese et al. 2001). They reported that tractor drivers were exposed to low frequency whole body vibrations making them vulnerable to low back pain. Because tractors do not have suspension system, the vibration levels are high as compared to other road vehicles (Bovenzi and Betta 1994; Bovenzi 1996). It is believed that vibrations cause back problems by mechanical failure of tissues or even from interference in tissue metabolism. Exceeding the ISO norms (1997) for vibration exposure may lead to earlier degenerative changes in spine causing low back pain. In the present study, an attempt has been made to investigate the severity of low back pain in drivers exposed to tractor vibrations in and around Ludhiana, Punjab, India, using the modified Oswestry Pain Questionnaire.

MATERIALS AND METHODS

A total of 169 male tractor drivers from Ludhiana, Punjab, India, aged 21- 60 years, were considered as samples for the present study. Of those 169 tractor drivers, 29 drivers (17.16%) had reported their complications regarding low back pain and rest 140 (82.84%) had no complications for their back pain. The samples were mainly farmers involved in tractor driving in the rural areas of Ludhiana. The study was conducted during November 2007 to May 2008. All the subjects were ambulatory and were judged to be significantly intelligent to understand the instructions of the experiment. The subjects were further divided into three age groups, viz. 21-30 years, 31-40 years and 41 years and above. Depending upon their duration of exposure to whole-body vibrations (number of years of tractor driving), the subjects were further categorized into the duration 1-5 years, 6-10 years, 11-15 years, 16-20 years and 21 years and above. The study was approved by the local ethics committee.

The Oswestry low back pain Disability Questionnaire (ODQ) was developed as a self-administered questionnaire (Fairbank et al. 1980) to measure the disability. In this modified ODQ, ten sections, viz. pain intensity, personal care, lifting, walking, sitting, standing, sleeping, sex life, social life and traveling, were applied for the evaluation of the severity of disability. There were six questions in each section. Question number 1-6 was scored as 0, 1, 2, 3, 4, and 5 with the increasing order of pain intensity. Data were

analyzed using SPSS (Statistical Package for Social Science) version 7.5. Student's *t* test was applied for the comparison of all the variables. Pearson's correlation coefficients were also analyzed. A 5% level of probability was used to indicate statistical significance.

RESULTS AND DISCUSSION

Table 1a shows the age and duration-wise distribution of tractor drivers. In the age group 21-30 years, the maximum frequency (24.26%) was recorded in the duration of 1-5 years, followed by 6-10 years (19.53%) and 11-15 years (2.37%). In the age group of 31-40 years, the maximum frequency (15.38%) was found in the duration of 6-10 years, followed by 11-15 years (14.20%) and 16-20 years (4.73%). In the age group 41+ years, the maximum frequency (7.10%) was recorded in the duration of 11-15 years, followed by 21+ years (6.51%), 16-20 years (5.32%) and 6-10 years (0.59%). Table 1b shows the age and duration-wise distribution of tractor drivers with low back pain. In the age group 21-30 years, the maximum frequency (13.79%) was found in the duration of 6-10 years, followed by 1-5 years (6.90%). In the

age group 31-40 years, the maximum frequency (20.69%) was found in the duration of 11-15 years, followed by 16-20 years (10.34%) and 6-10 years (6.90%). In the age group 41+ years, the maximum frequency (13.79% each) was registered in the duration of 11-15 years and 16-20 years, followed by 21+ years (10.34%) and 6-10 years (3.45%).

Table 2 shows the severity of low back pain in tractor drivers with low back pain applying modifying ODQ. In age group 21-30 years, the maximum percentage of disability (13.79%) were found in the category of moderate (21%-40% disability), followed by minimal (0%-20% disability) (6.89%). In age group 31-40 years, the maximum frequency (24.10%) was reported in moderate category, followed by severe category (41%-60% disability) (6.89%) and crippled category (61%-80% disability) and bed ridden category (81%-100% disability) (3.44% each). In age group 41+ years, the maximum frequency (20.69%) in moderate category, followed by severe group (17.24%) and minimal category (3.44%).

The distribution of mean values and standard deviation of ten pain measuring variables in tractor drivers with low back pain aged 21 –30 years and 31-40 years is given in table 3. Tractor

Table 1a. Age and duration wise distribution of the tractor drivers

Age (in years)	Duration (in years)									
	1-5 years		6-10 years		11-15 years		16-20 years		21+ years	
	Abs no.	%age	Abs no.	%age	Abs no.	%age	Abs no.	%age	Abs no.	%age
21-30	41	(24.26%)	33	19.53%	04	02.37%	-	-	-	-
31-40	-	-	26	15.38%	24	14.20%	08	04.73%	-	-
41+	-	-	01	0.59%	12	07.10%	09	05.32%	11	06.51%

Table 1b. Age and duration wise distribution of tractor drivers with low back pain

Age (in years)	Duration (in years)									
	1-5 years		6-10 years		11-15 years		16-20 years		21+ years	
	Abs no.	%age	Abs no.	%age	Abs no.	%age	Abs no.	%age	Abs no.	%age
21-30	02	6.90	04	13.79	-	-	-	-	-	-
31-40	-	-	02	6.90	06	20.69	03	10.34	-	-
41+	-	-	01	3.45	04	13.79	04	13.79	03	10.34

Table 2: Severity of disability in tractor drivers with low back pain

Age (in years)	Duration (in years)									
	Minimal (0%-20% disability)		Moderate (21%-40% disability)		Severe (41%-60% disability)		Crippled (61%-80% disability)		Bed-ridden (81%-100% disability)	
	Abs no.	%age	Abs no.	%age	Abs no.	%age	Abs no.	%age	Abs no.	%age
21-30	2	6.89	4	13.79	-	-	-	-	-	-
31-40	-	-	7	24.10	2	6.89	1	3.44	1	3.44
41+	1	3.44	6	20.69	5	17.24	-	-	-	-

drivers with elder age group, viz. 31-40 years have the higher mean values in all the ten variables than their younger counterparts, viz. age group 21-30 years, showing statistically significant differences ($P < 0.05$) in pain intensity ($t=2.12$), personal care ($t=2.38$), lifting ($t=2.22$) and sleeping ($t=2.61$), and highly significant differences ($P < 0.001$) in walking ($t=3.29$) among them. The tractor drivers of elder age group with more duration of driving the tractor have greater pain score than their younger counterparts; the reason may be their more exposure to whole-body vibrations.

Table 4 shows the distribution of mean values and standard deviations of ten pain measuring variables in tractor drivers with low back pain aged 21-30 years and 41+ years. Tractor drivers with eldest age group, viz. 41+ years, have the higher mean values in all the ten variables than their comparatively youngest counterparts, viz.

Table 3: Distribution of mean values and standard deviations of ten pain measuring variables in tractor drivers with low back pain aged 21-30 years and 31-40 years

Variables	21-30 years (n=6)		31-40 years (n=11)		t value
	Mean	S.D.	Mean	S.D.	
Pain intensity	1.00	0.63	1.91	1.14	2.12*
Personal care	1.00	0.63	2.00	1.09	2.38*
Lifting	1.67	0.51	2.73	1.42	2.22*
Walking	1.00	0.89	2.64	1.12	3.29**
Sitting	0.83	0.75	1.73	1.27	1.82
Standing	1.50	0.55	2.27	1.01	2.05
Sleeping	1.00	0.00	1.64	0.81	2.61*
Sex life	0.50	0.55	1.00	1.48	1.00
Social life	1.67	0.82	2.27	1.10	1.29
Traveling	1.33	0.82	2.00	1.34	1.27

*indicates $P < 0.05$; ** indicates $P < 0.001$

Table 4: Distribution of mean values and standard deviations of ten pain measuring variables in tractor drivers with low back pain aged 21-30 years and 41+ years

Variables	21-30 years (n=6)		41+ years (n=12)		t value
	Mean	S.D.	Mean	S.D.	
Pain intensity	1.00	0.63	1.58	0.67	1.81
Personal care	1.00	0.63	1.75	0.96	1.97
Lifting	1.67	0.51	2.67	0.89	3.01**
Walking	1.00	0.89	2.08	1.00	2.33*
Sitting	0.83	0.75	1.58	0.51	2.20
Standing	1.50	0.55	2.25	0.62	2.62*
Sleeping	1.00	0.00	1.50	0.67	2.57*
Sex life	0.50	0.55	0.67	1.43	0.35
Social life	1.67	0.82	2.25	0.75	1.46
Traveling	1.33	0.82	1.92	0.79	1.44

* indicates $P < 0.05$; ** indicates $P < 0.001$

age group 31-40 years, showing statistically significant differences ($P < 0.05$) in walking ($t=2.33$), standing ($t=2.62$) and sleeping ($t=2.57$), and highly significant differences ($P < 0.001$) in lifting ($t=3.01$) among them. The tractor drivers of eldest age group with more duration of driving the tractor have greater pain score than their comparatively youngest counterparts; the reason may be their more exposure to whole-body vibrations.

The distribution of mean values and standard deviations of ten pain measuring variables in tractor drivers with low back pain aged 31-40 years and 41+ years was given in table 5. When comparisons were made for these ten variables between these two elder groups, no significant differences were found in any case.

Convincing epidemiological studies have reported that professional drivers were at higher

Table 5: Distribution of mean values and standard deviations of ten pain measuring variables in tractor drivers with low back pain aged 31-40 years and 41+ years

Variables	31-40 years (n=11)		41+ years (n=12)		t value
	Mean	S.D.	Mean	S.D.	
Pain intensity	1.91	1.14	1.58	0.67	0.83
Personal care	2.00	1.09	1.75	0.96	0.58
Lifting	2.73	1.42	2.67	0.89	0.12
Walking	2.64	1.12	2.08	1.00	1.25
Sitting	1.73	1.27	1.58	0.51	0.35
Standing	2.27	1.01	2.25	0.62	0.06
Sleeping	1.64	0.81	1.50	0.67	0.44
Sex life	1.00	1.48	0.67	1.43	0.55
Social life	2.27	1.10	2.25	0.75	0.06
Traveling	2.00	1.34	1.92	0.79	0.18

risk for low back pain and various spinal disorders. Studies conducted in USA (Guo et al. 1995) and Canada (Liira et al. 1996) have found higher frequency of low back pain in drivers. Similar observations were found on the high frequency of low back pain and spinal disorders in machine drivers (Louma et al. 1998), forklift drivers (Brendstrup et al. 1987), bus drivers (Netterstrom and Luel 1989), agricultural tractor drivers (Boshuizen et al. 1990; Tiemessen et al. 2008), truck drivers (Piazzi et al. 1991; Miyamoto et al. 2000) and other professional drivers (Hedberg 1988; Schwarze et al. 1998). Professional drivers in developing countries, such as India (Kumar et al. 1999; Varghese et al. 2001) and Taiwan (Taiwan Institute of Occupational Safety and Health, 1999) have similar problems.

Tractor drivers are exposed to low frequency whole-body vibrations making them vulnerable to low back pain (Bovenzi and Betta 1994; Bovenzi 1996; Varghese et al. 2001; Tiemessen et al. 2008). Whole body vibrations might cause back problems by mechanical failure of tissues or even from interference in tissue metabolism. When the whole body vibrations exceed the ISO norms of exposure (1997), it may lead to earlier degenerative changes in spine causing low back pain. The findings of the present study shows that the age of the tractor drivers and the duration of exposure to their whole body vibrations have some close associations with the occurrence of low back pain. Tractor drivers of higher age groups (31-40 years and above) and with the duration of at least 11- 15 years of exposure to vibrations have been reported to be more prone for low back pain. Adequate exercises for back and balanced diet may be helpful for these cases. Tractor drivers are to take special care for their back, as it is exposed to low frequency vibrations for a long duration leading to degenerative changes in low back.

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