Assessment of Nutritional Status and Physiological Responses of Bus Drivers of Kolkata

Pradhan C.K., Thakur S. and Mukherjee S.
Regional Occupational Health Centre (E), Block DP, Sector V, Salt Lake,
Kolkata 700 091, INDIA

ABSTRACT

Transport system is an important feature of civilization. In Kolkata about 11.64 lakh vehicles ply through a road length of 1416 km in an area of 187.33 km^2. There are about 12341 stage carriages and 39065 contract carriages, which are operated by the State Government and private operators. The bus drivers have to work for a long period of time and the duty schedule are not fixed. The present study was carried out to assess their nutritional status, physiological responses and workload. Thirty two bus drivers of Kolkata participated in the study. Anthropometric measurements were recorded. They were interviewed to record subjective assessment of workload and pain and discomfort in body parts. The working heart rates of the bus drivers were recorded every minute by Polar Heart Rate Monitor. Their average working heart rate (AWHR), peak working heart rate (PWHR) and energy expenditure were calculated. Mean BMI values of bus drivers indicated them as 'normal healthy' category; however, 16% were overweight and 15% were underweight. Waist hip ratio indicated that 91% subjects had abdominal obesity. The AWHR and PWHR of the bus drivers showed the workload category as moderate to heavy. The values of energy expenditure of bus driving indicated the workload as moderate which may be due to work in sitting posture. Subjective assessment result showed workload as very heavy (50%), heavy (28%) and moderate (22%). Bus drivers reported moderate and severe pain and discomfort in different body parts.

Key words: Bus driver, BMI, Waist Hip Ratio, Heart rate, Energy expenditure

INTRODUCTION

Transport system is an important feature of civilization. A large number of populations is engaged as bus driver in unorganized and organized sectors. The job of the drivers is strenuous and hazardous. Kolkata is one of the metropolitan cities of the world where passenger density is significantly high (Census of India 2001). About 11.64 lakh vehicles ply through a road length of 1416 km in an area of 187.33 km^2 in Kolkata. There are about 12341 stage carriage and 39065 contract carriage (Kolkata Traffic Police 2005), which are operated by the State Government or privately and the number of buses is increasing gradually. It has been reported earlier that the work stress of the drivers are heavy (Kompier 1996, Pradhan and Thakur 2002a).

Bus driving is a classic example of high-strain occupation, with high risks of physical and mental occupational ill-health, leading to absenteeism and to decreased productivity of employees (Kompier and Di Martino 1995). The drivers must respond to multiple demands over which they have little control. The main tasks of a bus driver are to drive safely, keep on

schedule. Traffic congestion is another stressor. Typically, stressful jobs are those which have high psychological demands and little decision-making control, in combination with low social support on the job. Stress is believed to play a significant role in causing certain physical (cardiovascular disease, gastrointestinal disorders, musculoskeletal problems, fatigue), psychological (depression, anxiety, post-traumatic stress disorder) and behavioural outcomes (Tse et al 2006).

It has been found that transport workers suffer from cardiovascular, gastrointestinal, and musculoskeletal disorders (Winkleby et al 1988, Kartikeyan et al 2004; Szubert and Sobala 2005). ICMR (2000) reported that the bus drivers suffer from various health related problems. Villar et al (1999) reported that 43% bus drivers developed botulism along with gastroenteritis. Professional drivers have a higher prevalence of occupational disorders than other occupational groups (Bylund et al 1997).

Urban bus drivers have been found to have high prevalence rates of back problems (Szeto and Lam 2007). Transient and mild low back pain was found to be prevalent among the drivers (Okunribido et al 2007). While assessing low back and trapezius muscle activity in bus drivers, Leinonen et al (2005) observed that the neck-shoulder pain and fatigue were more severe in drivers suffering from low back pain. Studies have shown that musculoskeletal disorders are more prevalent among bus drivers (Magnusson et al 1996). The objective of the study was to assess the nutritional status, workload, energy expenditure, cardiovascular responses, muscular-skeletal pain and discomfort of the bus drivers.

METHODS

Approval of the ethical committee at the Regional Occupational Health Centre (Eastern) was obtained for the study. All participants were informed about the nature, purpose and procedure of the study. Written consent was obtained from each of the participants. The study was carried out with bus drivers in Kolkata and its surrounding areas. Lists of bus drivers (age 21-40 years) were collected from different bus stands. Thirty two drivers were selected randomly for the study from the list.

Subjects were asked to report to the laboratory at around 10:00 hrs and were allowed to rest for a period of 30 min in a comfortable sitting posture and resting heart rate was recorded. Their age were noted. Body weight and standing height of the subjects were measured. Body surface area of the subjects was calculated from the height and weight by using formula of Banerjee and Sen (1955). Body mass index (BMI) of the subjects was derived and they were classified according to WHO (1995). Skin fold thickness at different sites (biceps, triceps, subscapular and suprailiac) of body was measured using skinfold calliper (Holtain, UK). Body composition of the subjects in terms of body fat percentage and lean body mass were assessed (Durnin et. al 1967; Siri et. al 1956).

In order to assess physiological responses, experiment was conduced with 21 bus drivers. The drivers were asked to drive an allotted bus from one terminus to another terminus as per his work schedule. Heart rate was recorded continuously using a heart rate monitor (Polar Accurex Plus, Finland).

The average working heart rate (AWHR) of first one hour work was computed from minute-by-minute heart rate data. Peak working heart rate (PWHR) and net cardiac cost (NCC) during the work (first hour) were also determined. The energy expenditure (EE) of driving was determined from the recorded heart rate and the average energy expenditure was calculated (Datta and Ramanathan 1969). During the experiment, the mean dry bulb (DB) temperature was 31.2 ± 3.02 ºC and wet bulb temperature was 27.6 ± 1.34 ºC.

The subjects were interviewed to assess for subjective workload (Sinclair 1995) on a scale of 1 to 5 (light, moderate, heavy, very heavy and extremely heavy). They were asked to point out the part(s) of the body where they feel work related musculoskeletal pain or discomfort (Corlett and Bishop 1976).

RESULTS

Physical characteristics

Physical characteristics of the bus drivers are presented in Table-1. The mean age of the subjects was 34.3 ± 4.40 years. The height of the subjects ranged between 153 to 173 cm and weight between 39.5 to 71 kg. The mean value of BMI of the subjects was of 21.6 kg/m^2 which indicated the bus drivers as 'normal healthy' category. Their fat% was 17.1 ± 4.9 with the range 6.1% to 27.7%. Lean body mass varied from 35.9kg to 56.4 kg with mean value of 47.1 ± 4.96 kg. Waist hip ratio varied from 0.81 to 1.34 with a mean of 0.98 ± 0.09.

Table 1: Physical characteristics of bus drivers

Parameters	**Mean ± SD (n = 32)**
Age (yrs)	34.3 ± 4.40
Body height (cms)	162.8± 4.8
Weight (kg)	57.2 ± 8.3
BSA (m^2)	1.67 ± 0.12
BMI (kg/m^2)	21.6 ± 3.0
Fat%	17.1 ± 4.9
Fat (kg)	10.1 ± 3.9
Lean body mass (kg)	47.1 ± 5.0
Waist Hip Ratio	0.98 ± 0.09

Physiological Responses

The values of average working heart rate (AWHR), peak working heart rate (PWHR), energy expenditure (EE), net cardiac cost (NCC) are presented in Table 2. The AWHR was 101 ± 12.9 beats/min (Range : 85-132), indicating workload as light to heavy (Sen and Nag 1975). However, the PWHR (beats/min) of the drivers ranged from 107-156 with an average of 121 ± 12.5, suggesting the workload as moderate to very heavy. Considering EE (kcal/min) of driving a bus, the values varied from 3.40 to 5.60 with the mean value of 4.02 ± 0.56, indicating the workload as light to heavy (Sen and Nag 1975).

Table 2: Cardiovascular responses of bus drivers during work

Parameters	Mean ± SD (n = 21)
AWHR (beats/min)	101 ± 12.9
PWHR (beats/min)	121 ± 12.5
EE (kcal/min)	4.02 ± 0.56
NCC (beats) for one hour	1478 ± 718

Subjective assessment of workload

The results showed that subjects reported very heavy (50%), heavy (28%) and moderate (22%). Prevalence of musculo-skeletal pain and discomfort was reported by 25% of the bus drivers. The most affected body part was back (38%), followed by neck (25%) and shoulder (25%). Intensity of body pain varied from 'moderate' to 'severe'.

DISCUSSION

The height and weight of the subjects of the present study was comparable with that of Indian population (Chakrabarti 1997). Body mass index values of bus drivers indicated that bus drivers were in 'normal healthy' category (WHO 1995). However, there were overweight (16%) and underweight (15%) subjects. The earlier study showed that 72% of cycle rickshaw pullers had poor nutritional status (Pradhan et al 2004). It may be due to comparably higher economic status of the bus drivers.

Their fat% value (17.1 ± 4.9) of was on the higher side, which has been reflected in the result that 16% drivers were overweight. Waist hip ratio of the subjects indicated that 91% subjects had abdominal obesity (WHO 2011).

In the present study the AWHR value of the bus drivers was 101 ± 12.9 beats/ min. This indicates the workload category as light to heavy When this value was compared with that of cycle rickshaw pullers of Kolkata (138 ± 14.2 beats/min), significant difference ($p<0.001$) was observed (Pradhan et al 2008). Similar result was observed with reference to parameters like PWHR and EE. It is indicated that the job of driving a bus is less strenuous than that of a

cycle rickshaw puller. The lower value of AWHR of bus drivers may be due to continuous sitting posture during work.

The workload of bus drivers was light (52%), moderate (38%) and heavy (10%) considering average working heart rate. With response to peak working heart rate, the workload was moderate (67%), heavy (28%) and very heavy (5%). When energy expenditure was taken into account, workload for bus drivers was light (19%), moderate (76%) and heavy (5%).

The assessment of workload by subjective assessment showed that subjects reported very heavy (50%), heavy (28%) and moderate (22%). The feeling of 'very heavy' is due to long working hours and constrained sitting posture.

Bus drivers reported moderate and severe pain and discomfort in different body parts. The most affected body part was back, followed by neck and shoulder. Earlier, Magnusson et al (1996) reported prevalence of musculoskeletal disorders among bus drivers. Our findings are supported by the results of previous studies (Szeto and Lam 2007; Okunribido et al 2007; Leinonen et al 2005). Bovenzi and Zadini (1992) reported that bus driving was associated with an increased risk for low back troubles due to both whole body vibration exposure and prolonged sitting in a constrained posture. Backman (1983) reported an increased incidence of shoulder and back pain in professional drivers.

While driving a bus, the drivers frequently bend and twist their neck and back frequently. Pradhan and Thakur (2002b) observed in grain handlers that postures adopted by workers created substantial musculoskeletal stress, causing pain and discomfort. The physical workload of the drivers was comparatively less as reflected in average working heart rate. The probable reason for musculoskeletal complain lies with repetitive adoption of awkward posture and application of force to control steering, accelerator and brake.

In conclusion, it may be stated that the workload of the bus drivers was in light to very heavy category. This has been reflected in both subjective and objective assessments of the workers. In the present study, objective assessment of workload was by measuring the working heart rate as well by interviewing the subjects for subjective perception which results from integration of physical workload and postural stress (Pradhan and Thakur, 2002b). It is essential to take into account the perception of the subjects when one attempts to evaluate the difficulty associated with work (Pradhan 1999; Lortie et al 1995). Further study is required to optimize work practices and procedures as also rationalization of work-rest schedule in order to improve health and safety of workers.

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