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Comparative study of subjective fatigue between automatic transmission bus drivers and manual transmission bus drivers.

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Abstract

The difference in the physiological condition of drivers of manual transmission buses (MTB) and automatic transmission buses (ATB) was examined from the viewpoint of occupational health. This study was based on a self-administered questionnaire which involved items concerning subjective fatigue complaints. No differences in the mental fatigue and stress between MTB drivers and ATB drivers were observed. Although ATB drivers tended to feel less physical fatigue than MTB drivers, the difference was not statistically significant. From these results, it was suggested that there was little difference in the subjective fatigue between ATB drivers and MTB drivers.

KEYWORDS: automatic transmission buses, manual transmission buses, subjective fatigue complaints

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Comparative Study of Subjective Fatigue between Automatic Transmission Bus Drivers and Manual Transmission Bus Drivers

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The difference in the physiological condition of drivers of manual transmission buses (MTB) and automatic transmission buses (ATB) was examined from the viewpoint of occupational health. This study was based on a self-administered questionnaire which involved items concerning subjective fatigue complaints. No differences in the mental fatigue and stress between MTB drivers and ATB drivers were observed. Although ATB drivers tended to feel less physical fatigue than MTB drivers, the difference was not statistically significant. From these results, it was suggested that there was little difference in the subjective fatigue between ATB drivers and MTB drivers.

Key words : automatic transmission buses, manual transmission buses, subjective fatigue complaints

One-man buses without a conductor have largely replaced two-man buses with a conductor over the last decade. One-man buses are usually manual transmission buses (MTB), but in recent years automatic transmission buses (ATB) have been introduced on some crowded routes. In spite of these changes, there have been relatively few studies concerned with the safety and health of bus drivers (1 — 3). This study compares the physiological conditions of ATB drivers with that of MTB drivers. The authors employed a self-administered questionnaire to evaluate the subjective fatigue of bus drivers.

Materials and Methods

The subjects of this study were 60 bus drivers employed by a private company who drove both ATB and MTB in Okayama area. Comparison was made between age-matched groups of drivers who drove ATB or MTB; total number was 50 in each group. The conditions other than driving ATB or MTB were designed to be identical between these two groups. There was no statistically significant difference in the mean length of employment, in the mean length of the bus driver's career, in the time driven per day and in the continuous driving hours between these two groups (Table 1).

The bus drivers filled out a questionnaire before and after work. The questionnaire contained a subjective fatigue inventory proposed by the Industrial Fatigue Committee of the Japan Association of Industrial Health (1970) (4, 5).

Buses used in the present study were 1979 model of Isuzu Motor Co., Ltd.(engine)

and Kawasaki Heavy Ind., Ltd.(body), both Tokyo, Japan. ATB had no clutch or gear-shift. Other devices of the ATB were the same as those of MTB. Both ATB and MTB had power steering.

Statistical evaluation was performed by Student's t-test or χ^2-test.

Table 1 Characteristics of each age-matched group

	ATB drivers	MTB drivers
Age (years)	40.60±8.21[a]	40.60±8.21[a]
Length of employment (years)	15.40±6.61	16.10±6.49
Length of career (years)	12.90±6.94	13.70±6.82
Bus driving hours per day	4.82±0.68	5.04±0.54
Continuous driving hours	1.02±0.48	0.94±0.43

a: Each value is the mean± S.D.

Results

Fatigue after work. Thirty-two percent of MTB drivers complained of fatigue after

Table 2 Rates of subjective fatigue before and after work

Category	Item	ATB[a] drivers		MTB[b] drivers	
		Before work	After work	Before work	After work
1 Dull-drowsy component	Feeling heavy in the head	10.0%	14.0%	6.0%	6.0%
	Feeling tired over the whole body	8.0	14.0	8.0	10.0
	Having tired legs	8.0	16.0	2.0	12.0
	Yawning	14.0	14.0	6.0	16.0
	Feeling hot headed or muddled	4.0	8.0	4.0	4.0
	Becoming drowsy	34.0	18.0	28.0	12.0
	Feeling eye strain	18.0	24.0	16.0	16.0
	Becoming rigid or clumsy in movements	8.0	6.0	2.0	4.0
	Feeling unsteady while standing	2.0	6.0	2.0	4.0
	Desire to lie down	6.0	16.0	4.0	8.0
2 Component of difficulty in concentration	Having difficulty in thinking	2.0%	4.0%	2.0%	2.0%
	Becoming weary of talking	4.0	4.0	0	2.0
	Becoming nervous	4.0	4.0	0	2.0
	Inability to concentrate	0	4.0	4.0	0
	Inability to show interest in things	4.0	2.0	2.0	4.0
	Becoming forgetful	6.0	6.0	4.0	6.0
	Lacking self-confidence	2.0	0	0	2.0
	Anxiety about things	8.0	4.0	4.0	6.0
	Inability to straighten up	4.0	0	6.0	4.0
	Lacking patience	4.0	6.0	2.0	6.0
3 Component of physical disorder	Having a headache	4.0%	8.0%	2.0%	4.0%
	Feeling stiff in the shoulders	26.0	24.0	16.0	22.0
	Feeling pain in the lower back	16.0	10.0	8.0	10.0
	Feeling constrained in breathing	0	2.0	0	0
	Feeling thirsty	12.0	12.0	8.0	6.0
	Having a husky voice	8.0	8.0	8.0	4.0
	Experiencing dizziness	2.0	2.0	2.0	4.0
	Having eyelid spasms	0	0	0	0
	Have tremors in the limbs	2.0	4.0	4.0	2.0
	Feeling ill	4.0	6.0	2.0	4.0

a: ATB, automatic transmission bus.
b: MTB, manual transmission bus.

work, which was 1.7 times as often as ATB drivers. However, the difference in the rates between ATB drivers and MTB drivers was not statistically significant(χ^2-test).

Symptoms of subjective fatigue. The responses to the subjective fatigue questionnaire were different between before and after work as shown in Table 2. Concerning MTB drivers, the items "Having tired legs" and "Desire to lie down" were higher after work, and the item of "Becoming drowsy" was lower after work. The same situation was seen among ATB drivers. The item of "Yawning" was higher after work. However, none of the differences were statistically significant(χ^2-test).

Three components in subjective fatigue. Fig. 1 shows the rates of three components in subjective fatigue complaints which increased after work. Each component consists of 10 items. The rates were calculated by summing up the samples which increased the complaints of each component after work. None of component 1 (dull-drowsy component) or component 2 (component of difficulty in concentration) in subjective fatigue complaints after work were statistically different between the two groups. Component 3 (component of physical disorder) in subjective fatigue complaints showed a tendency to have lower rates after ATB driving than after MTB driving ($P=0.054$, χ^2-test).

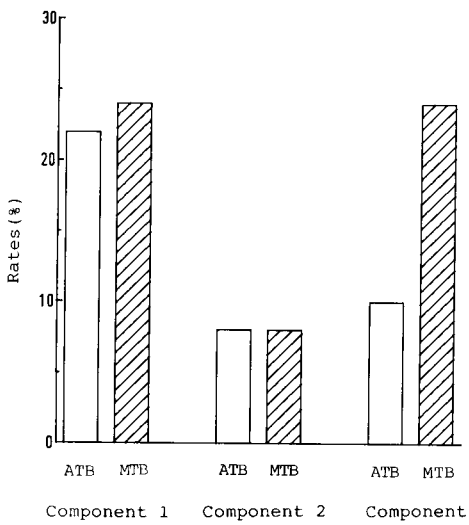

Fig. 1 Rates of three components in subjective fatigue complaints which increased after work. ATB: automatic transmission buses. MTB: manual transmission buses. Component 1: Dull-drowsy component. Component 2: Component of difficulty in concentration. Component 3: Component of physical disorder.

Discussion

The authors hypothesized that drivers of ATB would have lower rates of subjective fatigue complaints after work than drivers of MTB, but this hypothesis was not substantiated from the results in spite of the decreased frequency of foot and hand motions during ATB driving.

From these results, it was concluded that the introduction of ATB would not effectively decrease the work load of one-man bus drivers. In order to decrease the work load of one-man bus drivers, it was thought that the traffic circumstances and working conditions, such as driving time, rest time and worker's participation in occupational health, would have to be changed.

Differences in mental fatigue and stress between ATB drivers and MTB drivers were not observed. Only the physical fatigue of ATB drivers tended to be less than that of MTB drivers, although the differences were not statistically significant. From these results, it was suggested that there was little difference in subjective fatigue between ATB and MTB drivers.

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