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Clinical characteristics of bus drivers and field officers infected with COVID-19: A cross-sectional study from Istanbul

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Abstract.
BACKGROUND: In metropolitans, where public transportation is used extensively, bus drivers are one of the occupational groups with a high risk of contracting COVID-19.
OBJECTIVE: This study aimed to assess the difference between the clinical status of a group of bus drivers and field officers with COVID-19 on public transportation lines in Istanbul.
METHODS: The study was conducted with 477 male volunteer participants. COVID-19 was confirmed through a positive nasopharyngeal culture sample using the real-time PCR test. Demographic information, biochemical parameters, clinical status, and the use of nutritional supplements were compared between those who recovered from COVID-19 at home or in the hospital.
RESULTS: The body mass indexes (BMI) of 83.9% of individuals was above normal and 75.4% were treated for the disease at home. There were significant differences in terms of age, BMI, weight loss, smoking, use of nutritional supplements, blood glucose levels and vitamin B_{12} values. However, there was no significant difference between the types of nutritional supplements used or other biochemical parameters.
CONCLUSION: It was determined that those who survived the disease at home were younger and had a lower BMI. It is important for both individuals and for general public health to create healthy working environments, especially for bus drivers, who have a high risk of COVID-19 contamination and transmission due to their long exposure time.

Keywords: Body mass index, occupational groups, obesity, pandemic

1. Introduction

In metropolitans, buses are private indoor environments and are often very busy during rush hour. If poorly ventilated, they are ideal environments for the airborne spread of infectious diseases, especially drivers at greatest risk due to the long exposure time to this environment [1]. According to Istanbul Electric Tramway and Tunnel (IETT) transportation statistics for 2020, a passenger spends an average of 24 minutes in a vehicle during a journey. However, in London, this contact time is 15 minutes on average, and a contact time of 15 minutes or less is not considered risky. A driver working in Istanbul, on the

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other hand, works on a route of 2–3 hours on average, this time may be longer depending on Istanbul traffic. For this reason, the driver makes two rings of the same route, and the total exposure time can reach 6–7 hours [2, 3]. Especially considering that drivers are subject to the longest exposure time, these factors also play an important role in public transport-borne contagion in a big metropolis like Istanbul. There are two possible routes of transmission of coronaviruses on a bus, by air and by surfaces. Most buses in Istanbul have a three-door system with one entrance and two exits. The necessity for passengers to pass by the driver while getting on the bus creates an important moment of contact [4].

For bus driver deaths in England and Wales, between March and May 2020, the Office for National Statistics (ONS) estimates the overall occupational death rate for bus drivers from 128 per 100,000 for all-cause and deaths involving COVID-19, which is greater than other occupations (78 per 100,000). This is almost twice what would be expected from bus and coach driver fatalities in the previous five years. England and Wales had 70 more bus and bus driver deaths than expected, 53 of whom had COVID-19 written on their death certificate [5]. According to the COVID-19 data of the General Directorate of IETT enterprises in Istanbul, five bus drivers were died in 2020 [3]. As stated in Kamga and Eickeyer's study, social distancing measures introduced to prevent the spread of COVID-19 are very important to protect not only passengers but also drivers and other employees working in this field, such as field operations officers and ticket attendants [6].

This situation forced the bus drivers and the officers working in the field with them to a high chain of contact during the intense periods of the pandemic. The effects of the working conditions of this occupational group, which has been in contact with passengers for a long period of travel and have continued to work with minimal interruptions even in an extraordinary situation such as a pandemic, on their cases of clinical characteristics on COVID-19 should be evaluated. Therefore, the aim of this study is to evaluate the clinical status of bus drivers and officers working with them in public transportation in Istanbul, a metropolitan city, and who had COVID-19. Although there are studies in the literature including on drivers who have had COVID-19, no study has been encountered that deals with the disease according to the state of hospitalization. For this reason, this study also aimed to compare the situations of those who are treated at home or in the hospital.

2. Methods

2.1. Study setting and population

This cross-sectional, single-center study was carried out with 477 volunteer patients, all-male, who worked as drivers and field officers on public transportation lines in the IETT, and were diagnosed with COVID-19 by polymerase chain reaction (PCR) tests between 30 March and 23 September 2020. Field officers are the people who follow the operation at the stations at the departure points of the bus drivers and use the same offices and lounges with them. For this reason, they are the people who have the highest contact with the drivers. Individuals working in this institution without randomization, who agreed participating in the study constitute the study sample. Written and verbal consent was obtained from the participants for the information they shared. The test used for the diagnosis of COVID-19 is a real-time reverse transcription-polymerase chain reaction (RT-PCR) with a nasopharyngeal swab. Legally, in parallel with the rules set by the government, it was mandatory for the drivers and officers on duty to use masks. For this reason, the individuals included in the study wore masks as personal protective equipment while on duty.

The inclusion criteria were a positive RT-PCR test performed at an authorized hospital in Istanbul, Turkey, not being prevented from working as a bus driver or field officer on the date of data collection, wearing a mask on duty as required by legal pandemic measures. The positive diagnosis of COVID-19 was confirmed through a positive nasopharyngeal culture sample for COVID-19 using a RT-PCR test [7]. Persons who were on leave or on a report at the time of data collection were excluded in the study.

2.2. Data collection and evaluation

Data were recorded through interviews with patients via an online form or via telephone. Biochemical parameters were obtained retroactively from the central laboratory of IETT, on the condition of covering the last one year of the patients.

In the study, data were collected in four parts. In the first part, the demographic information (age, occupational status, having chronic disease, weight, height, body mass index (BMI), smoking) of the patients was included, while in the second part, medical history, comorbidities, biochemical parameters as fasting blood glucose, serum insulin, low density lipoprotein (LDL), high density lipoprotein (HDL), triglyceride, total cholesterol, alkaline phosphatase (ALP), creatinine, lactate dehydrogenase (LDH), alanine transaminase (ALT), aspartate aminotransferase (AST), gamma-glutamyl transferase (GGT), serum iron, hemoglobin (HGB), hematocrit (HCT), Vitamin D, Vitamin B_{12}, thyroid stimulating hormone (TSH) and free thyroxine (FT4) levels are included. In the third part, the date of diagnosis, the treatment process (at home/hospital/intensive care unit) the symptoms observed during the time of the disease are included. The fourth part includes the use of nutritional support during the illness. Data on chronic diseases and smoking was obtained based on individuals' self-reporting.

Chronic disease assessment was evaluated with the medical records of the patients. Body mass index (BMI) was calculated by dividing participants' weight (kg) to the square of height (m^2), and in accordance with the WHO's criteria those over 25 kg/m^2 were considered overweight and those over 30 kg/m^2 were obese. In the case of patients using nutritional supplements, they were asked to use the product regularly as of the beginning of the pandemic, and those who declared that they used one or more nutritional supplements on a daily basis were included in the study.

In the study, participants were divided into two groups, Home and Hospitalized. Critically ill patients, defined as a combination of hospitalized and intensive care units with the use of mechanical ventilation, and mild symptomatic in the hospital are defined as the Hospitalized group. Mild symptomatic or asymptomatic patients who had the disease as an outpatient at home are defined as the Home group. In other words, both home and hospitalized variables were evaluated.

The medical records of the individuals were used about the laboratory findings, the complications of the disease and the treatment method. The required information was collected from the medical records of IETT Health Clinics Laboratory from January to December 2019. If there was any suspense in the assessment of the medical records, the work health doctors were asked to find the necessary information. Patients with missing medical information were excluded from the study.

2.3. *Statistical analysis*

Categorical parameters are presented as numbers or percentages. Continuous parameters are expressed as mean ± standard deviation (SD). The conformity of the data to the normal distribution was tested with the Kolmogorov-Smirnov test. Differences of the studied parameters between groups were evaluated by the Wilcoxon Rank for non-parametric data, and the independent sample *t*-test for parametric data. All data were analyzed using SPSS 22.0 (IBM Corp., NY, USA), and considered significant when p-value<0.05.

3. Results

This study was conducted with 477 individuals who were all males, and most of whom were bus drivers (79.04%). The mean age, weight and height were found 43.39 ± 6.66 years, 88.85 ± 15.17 kg, and 175 ± 6.47 cm, respectively. Also, the mean BMI of participants was found 29.96 ± 4.36 kg/m^2. The majority of individuals are between the ages of 40–49 (57.02%) and had normal BMI (49.48%), but a high obesity rate is also recorded (34.59%). In all individuals, 29.35% are regular smokers and 89.67% of those with chronic diseases have diabetes (Table 1).

Most of these individuals (75%) were not hospitalized, and the majority (70.44%) had moderate or mild symptoms (Table 2). The rate of those showing more than one symptom is 86.16%. The most common symptoms are muscle and joint pain (77.57%), fever (58.07%) and anosmia (55.97%). When the treatments received by these individuals were examined, it was determined that 36.48% received antivirals, 36.68% were administered antibiotics and 24.53% underwent oxygen therapy.

As shown in Table 3, significant differences were found between age, BMI, smoking and use of nutritional supplements values between those who were not hospitalized and those who were hospitalized ($p < 0.05$). No statistically significant difference was found between any chronic disease status ($p > 0.05$). There was a significant difference between the groups in terms of nutritional supplements ($p = 0.045$), but not with the type of product. Individuals in both groups use vitamin C supplements the most (28.21% in Hospitalized, 38.89% in Home). While vitamin D is preferred in the second, the preference of other nutritional supplement types is low.

Significant differences were found between pre-disease glucose and vitamin B_{12} values between hospitalized and home ($p < 0.05$). There was no significant difference in the other biochemical parameters ($p > 0.05$) (Table 4).

Table 1
Demographical characteristics of participants

Characteristics	*n*	%
Age (year)		
≤ 39	117	24.53
40–49	272	57.02
Over 50	88	18.45
Occupational status		
Driver	377	79.04
Officer	100	20.96
Chronic disease		
Yes	184	38.57
No	293	61.43
One or more diseases		
Diabetes	29	15.76
Obesity	165	89.67
Hypertension	33	17.93
Cardiovascular disease	18	9.78
Respiratory system disease (COPD/Asthma)	32	17.39
Other		
(Chronic kidney disease, Hematologic system disease Autoimmune system disease, Obstructive Sleep Apnea, Guatr)	32	17.39
Smoking		
Former	191	40.04
Never	143	30.61
Current	143	29.35
BMI (kg/m^2)		
19–24.99	76	15.93
25–29.99	236	49.48
30–34.99	128	26.83
35–39.99	32	6.71
Over 40	5	1.05

Table 2
COVID-19 related clinical data of the individuals

Clinical data	*n*	%
COVID-19 treatment status		
Home	360	75.47
Hospitalized	117	24.53
COVID-19 disease severity		
Mild or asymptomatic	19	3.98
Moderate or mild with symptoms	336	70.44
Severe	111	23.27
Intensive care	11	2.31
Signs and symptoms upon admission		
Fever	277	58.07
Muscle and joint pain	370	77.57
Caugh	251	52.62
Sore throad	232	48.64
Anosmia	267	55.97
Headache	74	15.51
Nausea and vomiting	103	21.59
Diarrhea	164	34.38
Shortness of breath and whezing	181	37.95
Reluctance to eat	14	2.94
Lassitude or weakness	29	6.08
More than one sign or symptom	411	86.16
Treatment		
Antiviral treatment	174	36.48
Antibiotic treatment	175	36.68
Oxygen therapy	117	24.53
Mechanical ventilation	11	2.31

4. Discussion

In this study, the clinical characteristics and results of 477 COVID-19 survivors working as bus drivers and field officers were examined. It was determined that those who survived the disease at home were younger and had a lower BMI. It was also observed that those who survived in the hospital lost more weight.

Advanced age and chronic diseases such as cardiovascular disease, hypertension, diabetes mellitus, chronic lung disease, chronic renal failure, and obesity are considered risk factors for any serious conditions. When the distribution of patients who died in Italy and China are examined, it is seen that the mortality rate is less than 1% for those under the age of 60, 3.5% for those over the age of 60 and up to 20% for those over the age of 80. Mortality rates are also higher in males [8, 9]. In the data coming from Italy, which is the first country to be affected by the pandemic after China, the death rate in the elderly population is 20.2%, a significantly higher mortality rate (0.4–3.5%) than that of the younger population [10]. In our study, it was observed that the age of individuals who are in Hospitalized group was higher than that of those who received home treatment. This situation shows a parallel with other tables that have emerged. Advanced age is also an important risk factor for COVID-19 treatment in drivers and field officers. Especially for drivers who are in direct contact with passengers, health status should be monitored and additional measurements should be planned.

The most common symptoms of COVID-19 are fever, cough, shortness of breath and fatigue. Some patients may have myalgia, nasal congestion, sore throat, headache, arthralgia, and diarrhea. In a study by Fu et al. [11] conducted on 3600 patients, fever was observed in 83% of the patients, cough in 60%, fatigue in 38%, myalgia in 28%, shortness of breath in 24.9%, headache in 14%, diarrhea in 8%. 5.6% of patients were asymptomatic. On the other hand, in the study of Tian et al. [12] in which 262 patients were evaluated, fever was seen in 82.1%, cough in 45.8%, fatigue in 26.3%, dyspnea in 6.9%, and headache in 6.5%.5% of patients were asymptomatic. In our study, the most common symptom was found to be muscle-joint pain (77.57%), fever in 58.07%, inabil-

Table 3
Variables according to hospitalization

Characteristic	Home (*n*:360)		Hospitalized (*n*:117)		*p**
	Mean	SD	Mean	SD	
Age	42.67	6.80	45.87	5.53	0.004
BMI	28.64	4.31	30.05	4.40	**0.005**
Duration of illness (day)	18.75	7.15	30.61	18.84	0.187
Weight loss (kg)	–1.55	3.78	–7.49	4.65	**0.013**
Number of symptoms	3.82	2.27	4.96	2.25	0.388
	n	%	*n*	%	
Weight loss	147	40.83	109	93.16	**0.013**
Smoking					
Never	106	29.44	37	31.63	**0.005**
Former	137	38.06	54	46.15	**0.006**
Current	117	32.50	26	22.22	**0.004**
BMI (kg/m^2)					
19–24.99	60	16.67	16	13.68	**0.004**
25–29.99	188	52.22	48	41.03	**0.005**
30–34.99	87	24.17	41	35.04	**0.001**
35–39.99	21	5.83	11	9.40	**0.001**
40 and above	4	1.11	1	0.85	**0.001**
Having chronic disease	243	76.94	50	13.68	
Diabetes	9	7.69	20	29.85	0.015
Hypertension	14	11.97	19	28.36	0.087
Obesity	112	95.75	53	79.10	0.001
Other (Autoimmune system disease, Obstructive Sleep Apnea, Guatr)	19	16.24	31	46.27	0.147
Use of nutritional supplements during illness	211	58.61	59	50.43	**0.045**
Vitamin C	140	38.89	33	28.21	0.082
Vitamin D	62	17.22	19	16.24	0.491
Multivitamin	21	5.83	6	5.13	0.799
Other products (minerals, omega 3, probiotics, propolis, etc)	118	32.78	28	35.05	0.701

*Independent sample *t*-test.

ity to smell in 55.97%, cough in 52.62%, sore throat in 48.64%, weakness in 6.08%, and headache in 15.51%. In four of the first 43 cases that emerged in Thailand at the beginning of the epidemic, transmission from tour buses was determined, and these cases presented with fever and pneumonia. In this observational study, the researchers speculated that tourist bus drivers may be responsible for transmitting the virus to their co-workers or local habitats, possibly during coffee breaks [13]. The relationship of contamination and increased risk can be predicted for our cases as well.

The clinical condition in COVID-19 may vary according to the underlying diseases. Huang et al. [14] reported that 32% of 41 patients had an underlying disease; diabetes mellitus was observed in 20%, hypertension in 15% and cardiovascular disease in 15% of these patients. In another study, Lai et al. [15] reported that the most common underlying diseases in adult patients were cardiovascular disease, diabetes mellitus and hypertension. In our study, hypertension and diabetes mellitus were the most common underlying conditions. The probability of comorbidity was higher in hospitalized patients. More comprehensive data on the severity and duration of each comorbidity with detailed information are needed to examine the relationship between COVID-19 and underlying chronic diseases.

Another remarkable clinical condition is weight loss in the hospitalized group (-7.49 ± 4.65, $p = 0.013$). Holdoway [16] also drew attention to unwanted weight loss in recommendations for the management of diets during or after the illness of COVID-19 survivors. Accordingly, individuals should be screened in terms of malnutrition and the reason for weight loss should be tried to be understood. While hospital malnutrition may be a possibility, it should not be overlooked that COVID-19 may cause loss of taste and smell or psychological factors such as anxiety may reduce food intake.

The relationship between hospitalization and obesity, as a comorbidity, for COVID-19 has been investigated previously, but no direct relationship has been found in general, obesity may predispose young patients with COVID-19 to more serious illnesses that require hospitalization and intensive care unit

Table 4
Biochemical parameters of participants

Characteristic	Home (*n*:360)		Hospitalized (*n*:117)		*p**
Biochemical parameters	Mean	SD	Mean	SD	
Vitamin D (mg/dl)	17.47	2.49	15.14	1.71	0.070
Fasting Glucose (mg/dl)	107.07	17.78	116.57	19.68	**0.002**
Vitamin B12 (pg/ml)	250.25	93.27	213.42	90.15	**0.008**
Triglyceride (mg/dl)	223.42	74.93	225.32	81.18	0.671
HDL (mg/dl)	44.60	6.82	42.03	6.80	0.639
LDL (mg/dl)	145.09	27.26	153.26	29.99	0.132
VLDL (mg/dl)	44.70	14.99	45.02	16.24	0.669
Total cholesterol (mg/dl)	235.25	33.91	242.54	33.77	0.162
ALT (U/L)	48.27	27.47	51.71	24.91	0.131
AST (U/L)	29.52	11.74	30.20	8.32	0.456
GGT (U/L)	38.49	25.38	42.03	36.63	0.411
LDH (U/L)	340.25	39.62	351.93	40.70	0.280
HGB (g/dl)	15.30	0.69	15.40	0.66	0.082
ALP (U/L)	118.77	53.75	117.43	52.29	0.414
Serum Fe (ug/dl)	112.67	32.42	113.48	37.66	0.694
FT4 (ng/dl)	0.93	0.08	0.92	0.08	0.191
TSH (uIU/ml)	2.48	1.04	2.81	2.11	0.525
HCT (%)	44.45	2.67	44.54	2.28	0.644
Insulin (U/L)	12.40	5.22	13.08	6.86	0.644
Creatinine (mg/dl)	0.92	0.23	0.95	0.14	0.141

*Independent sample *t*-test, Abbreviations: HDL = high-density lipoprotein; LDL = low-density lipoprotein; VLDL = very low-density lipoprotein; ALT = alanine transaminase; AST = aspartate aminotransferase; GGT = gamma-glutamyl transferase; LDH = lactate dehydrogenase; HGB = hemoglobin; ALP = alkaline phosphatase; FT4 = free thyroxine; TSH = thyroid stimulating hormone; HCT = hematocrit.

admission. It has been shown that obese individuals are more likely to need mechanical ventilation in the event of contracting COVID-19 and have higher mortality rates. Therefore, it should not be forgotten that obesity may be closely related to the risk of contracting COVID-19 [17]. Lighter et al. [18] found that COVID-19 patients who younger than 60 years of age are more likely to be received to the hospital or intensive care unit when they are obese. Simonnet et al. [19] and Caussy et al. [20] found a high proportion of COVID-19 patients requiring mechanical ventilation with an increased BMI. In our study, 89.67% of the patients also had a high rate of obesity. The BMI of those who survived the disease in the hospital is 30.05 kg/m^2 and there is a significant relationship between BMI and the state of recovering from the disease at home or in the hospital. Here, it is necessary to consider that risk factors relevance with COVID-19 are also under the influence of factors such as genetics, nutritional status, immunological predisposition.

In this study, the smoking rate of Home was 32.5% which is 22.2% higher than Hospitalized. Low prevalence of smoking in hospitalized COVID-19 patients has been previously reported by other researchers from China, and Spain. In these studies, there is the opinion that nicotine can provide protection against coronavirus infection due to its immunomodulatory effects. Nevertheless, more detailed epidemiological studies are needed to examine the relationship of smoking with the course of COVID-19 [21, 22].

According to a study supported by the PLife COVID-19 Online Studies, the curiosity in immune-related supplements and foods like vitamins C and D, zinc, omega-3, garlic, ginger, together with their consumption increased during the COVID-19 outbreak in March 2020. The main reason to increase nutritional support is to improve immune strength and health [23, 24]. In our study, 56.6% of the participants used nutritional supplements. It was determined that 58.1% of those who used supplements recovered from the disease at home. The most preferred supplement in our study was vitamin C, but no statistically significant effect was shown between the types of nutritional supplements and the severity of the disease. This may be due to various reasons such as duration of use, dose, and continuity.

There are some limitations of the study. Although the usage of masks is mandatory at the time of the study, it is not known exactly how well individuals comply with personal protective equipment and precautions. In addition, purposive sampling is also a limitation. One of the other limitations is the inability to access the medical records of some patients due to the work-from-home system during the pandemic period, and some data are missing. In order to reduce the impact of this limitation, individuals with incomplete medical information were excluded from the study.

5. Conclusion

COVID-19 affects bus drivers and field operations officers working in close contact with each other, with hitherto known effects. Especially, advanced age and high BMI are important risk factors affecting treatment at home or in the hospital in the cases in this study. It should not be forgotten that these people, who are exposed to crowded groups for a long time due to their occupational status, are not only potential patients but also potential carriers and are contagious. For this reason, taking special precautions for this occupational group will also be protective for public health in general. It is recommended to isolate the driver's seat of buses with a cabin, to provide personal protective equipment free of charge and uninterruptedly by employers, to control the use of equipment by admins, to provide regular trainings to these individuals on the importance of equipment and hygiene rules for both personal and public health. At the same time, it is thought that regular weight loss and weight monitoring of individuals with high BMI under the control of a dietitian will have positive reflections on the course of both COVID-19 and other diseases and general health burden.

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Author contributions

Conceptualization and methodology: H.H.G., M.K.S.; Data collection: M.K.S.; Data analysis and interpretation: H.H.G., M.K.S., S.E.; Drafting the article: H.H.G., M.K.S.; Revising and final approval of the manuscript: H.H.G., M.K.S., S.E.

Conflict of interest

MKS works as a dietitian at General Directorate of IETT Enterprises. There is no conflict of interest reported by the other authors.

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Ethics statement

Written and verbal consent was obtained from the volunteer participants prior to enrollement. In addition, necessary permissions were obtained from the general directorate of IETT enterprises. The study was approved by the Non-interventional Research Ethics Committee of Istanbul Medipol University (no. MedipolE.17840).

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