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ANTHROPOMETRIC PROFILE OF BRAZILIAN TRUCK DRIVERS

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ABSTRACT

In Brazil, the road freight has a great importance in the economy. The objective of this work is to define the anthropometric profile of the Brazilian truck drivers and to develop an anthropometric table, based on ABNT (Brazilian Association of Technical Standards). Anthropometric data were collected from 719 Brazilian truck drivers from all over the country. Through the statistical treatment, the average, standard deviation and the percentiles 5%, 20%, 80% and 95% of each body dimension were obtained. The values found were compared with those described in the literature and is the reference for future studies.

KEYWORDS: anthropometry; truck drivers; ergonomics; anthropometric profile.

1. INTRODUCTION

In Brazil, the transportation of goods is largely carried out by road means. According to the National Confederation of Transport in its "CNT 2005 Road Survey," there are 1,940,751 trucks in circulation. Despite the lack of accuracy in these numbers, it is possible through them to be aware of the quantity of truck drivers in Brazil, assuming that there is at least one driver for each truck. With this, the quantitative importance that the profession has gained for the country's economy is emphasized (KAPRON, 2012).

Characteristics of this professional activity, such as the intense pace, few breaks, long periods of sitting, constant attention demand, external factors influencing worker well-being such as congestion, pollution, and road conditions, as well as socio-economic issues, make the driver's routine stressful and exhausting (KILESSE, 2005; KAPRON, 2012).

The restricted space to perform tasks, the seated position, and the attention to controls on the dashboard, ceiling, or elsewhere require the driver to repeat fundamental actions to properly operate the vehicle. The motor demands of the profession are specific because they require that the head, trunk, upper and lower limbs be used coordinately during activity execution (KILESSE, 2005).

Ergonomic studies aim to adapt work to humans, through task analysis, posture, and worker actions, their physical and psychological demands, aiming to reduce physical and mental fatigue, adjusting a comfortable and safe workstation, thereby increasing work efficiency (KILESSE, et al; 2006).

Considering that natural body postures and movements are conditions for efficient work, it is essential to adapt the workplace to human body dimensions. To do this, anthropometric measurements should be taken (GRANDJEAN, 1998).

As mentioned by Lopes (1996), knowing the characteristics of the worker through a profile survey is essential for developing new projects. For this reason, this article aimed to define the anthropometric profile of truck drivers in Brazil, based on ABNT standards.

2. DEVELOPMENT

The present research was of a descriptive and quantitative nature, where anthropometric data related to the mean, standard deviation, and percentiles of the sample were surveyed, characterizing it as a quantitative study.

Measurements were taken in the city of Curitiba-PR and its metropolitan region by physiotherapists, focusing on the right side of the drivers. They were wearing light clothing and no footwear and received instructions about the study and its objectives at the measurement site.

The equipment used included a digital scale for weight measurement in kilograms and a stadiometer graduated in millimeters to obtain anthropometric measurements in both standing and seated postures. After the data collection was completed, the data were tabulated and analyzed.

A total of 719 truck drivers, both employees and self-employed, participated in the study. The number of individuals was determined according to ISO 15535:2012, which recommends that the minimum sample size for an anthropometric study be calculated using the body measure that presents the highest coefficient of variation from a previous study of the same population. In this case, the study titled "Evaluation of ergonomic factors in truck driver workplaces used in agriculture" by Kilesse et al. (2006) was used.

Considering a sample with a 95% confidence level and a 1.5% margin of error, it was established through the equation (ISO 15535:2012):

$$N = \left(\frac{1,96.CV}{1,5}\right)^2 . 1,534^2$$

N = number of required samples;

1,96 = critical value of z, representing 95% confidence;

CV = coefficient of variation.

Given that the coefficient of variation used as the basis for the calculation was related to the "arm length" from the study mentioned above, with a value of 9.1, the result obtained was N=333, as shown below:

$$N = \left(\frac{1,96.9,1}{1,5}\right)^2 . 1,534^2$$

N = 333

3. RESULTS AND DISCUSSIONS

All individuals studied were male. The age of the drivers ranged from 20 to 81 years, with a mean of 46 years (SD = 12), and the age groups of 40-49 and 30-39 years had the highest number of individuals, accounting for 29.01% and 27.18% respectively. Among the drivers in the sample, there is a smaller proportion of young individuals (6.48%) and elderly individuals (14.3%). It was observed that the predominant age group is 40 to 49 years (29.01%), followed by ages 30 to 39 years (27.18%), which is consistent with the study by Penteado et al. (2008), who analyzed data from 400 truck drivers and found that a large number (40%) were between 40 and 49 years old, with 21% aged between 30 and 39 years. Similarly, Palácio et al. (2015) analyzed truck drivers involved in cargo transportation accidents and found that the majority were aged 40 to 44 years (15.3%). Similar findings to other studies are present in the literature (SILVEIRA et al., 2005; MASSON, MONTEIRO, 2010).

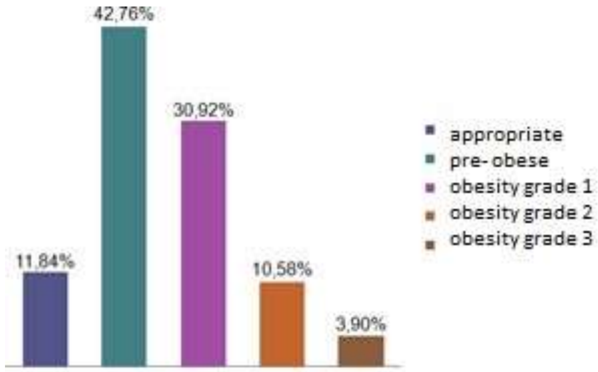
Regarding the drivers' birthplaces, considering the place of birth, 46.71% were from Paraná, followed by São Paulo with 12.45%, Santa Catarina and Rio Grande do Sul with 11.33% and 8.67% respectively.

The duration of the drivers' profession ranged from 3 months to 61 years, with 29.84% working in this area between 10 and 20 years and 22.45% between 5 and 10 years.

Regarding education, according to the data collected, 33.62% completed high school, 31.77% completed elementary school, and 25.39% did not complete elementary school. Compared to the survey conducted by Kilesse et al. (2006), this number was 50%, indicating a significant increase in the education level of this profession.

The body mass index (BMI) was also evaluated, which is used to relate whether the body weight is appropriate for the individual's height, using the formula: BMI = Weight (in kg) divided by the square of height (in meters). The result is then classified into normal BMI (between 18.5 to 24.9 kg/m^2), overweight (25.0 to 29.9 kg/m^2), or obesity (> 30 kg/m^2) (REZENDE, 2010). Kilesse (2005) observed that 36% of the drivers who participated in his research were diagnosed with overweight, which in the current classification is comparable to pre-obesity, and 19% had obesity. Comparing to the current study, based on BMI calculation, approximately 43% of individuals have pre-obesity and 30.92% can be considered as having obesity grade I, as shown in Figure 1.

Graph 1: Sample Distribution Related to BMI Classification



According to a survey conducted by the Getulio Vargas Foundation (FGV) in 2001, back pain, tendon, and joint pain affect 35% of drivers, while 80.5% of drivers have experienced back or spinal pain. Similarly, Penteado et al. (2008) mention that 67.75% of drivers reported constant or occasional posture problems.

Prolonged sitting in the same position, increased working hours, and the inability to take spontaneous breaks, combined with furniture and equipment that do not provide comfort, are determining factors for the occurrence of work-related diseases (TODESCHINI, 2008). In order to reduce these discomforts, anthropometry can be considered one of the basic tools for the analysis and design of all physical environments related to human beings (PHEASANT and HALESGRAVE, 2006).

These studies have reinforced the motivation to understand the anthropometric profile of the population in question.

Regarding anthropometric variables, the value in the study by Kilesse et al. (2006) for the 95th percentile height was 181.0 cm, while by Fragoso et al. (2015) it was 185.5 cm, which was similar to the present study (184.01 cm). As for the 5th percentile height, the results between this study and that of Kilesse et al. (2006) were similar, with values of 160.43 cm and 159.0 cm, respectively.

Table 1 presents the mean and standard deviation of the studied body dimensions, as well as the values of the 5th, 20th, 80th, and 95th percentiles of the sample in question. The results show that 5% of drivers have a height below 160.43 cm, as indicated by the calculation of the 5th percentile for this variable, while 5% have a height above 184.01 cm, according to the 95th percentile. Thus, 90% of workers would have a height between 160.00 and 184.01 cm. The same analysis is considered for the other variables described in Table 1.

Table 1 - Mean, Standard Deviation, and Values of the 5th, 20th, 80th, and 95th percentiles of the anthropometric variables analyzed in standing and sitting positions

				Percentis (cm)		
Body Measurements	Média (cm)	Desv. padrão (cm)	5 %	20%	80%	95%
Weight (in KG)	89,25	16,49	62,04	75,4	103,1	116,46
Height	172,22	7,15	160,43	166,22	178,22	184,01
Floor-to-Eye Height	159,37	7	147,83	153,5	165,25	170,92
Shoulder Height	143,81	6,97	132,31	137,96	149,67	155,31
Nipple Line Height	125,76	6,06	115,76	120,67	130,85	135,76
Xiphoid Process Height	121,51	5,91	111,76	116,55	126,48	131,27
Elbow-to-Floor Height	107,6	5,63	98,32	102,88	112,33	116,89
Wrist-to-Floor Height	84,77	4,78	76,89	80,76	88,78	92,65
Thumb-to-Floor Height	80,34	4,7	72,59	76,39	84,28	88,08
Pubic Height	82,76	5,19	74,2	78,4	87,11	91,31
Knee Height	44,75	5,56	35,58	40,09	49,42	53,92
Arm Length	37,96	2,72	33,48	35,68	40,24	42,44
Elbow-to-End of Index Finger	47,9	3,08	42,82	45,31	50,49	52,98
Elbow-to-Thumb Crease	35,91	2,22	32,25	34,05	37,77	39,56
Shoulder Width	49,9	4,39	42,66	46,22	53,59	57,14
Trunk Width	35,76	3,01	30,79	33,23	38,29	40,72
Hip Width while standing	36,77	2,82	32,12	34,4	39,14	41,42
Seat - Head	84,56	4,22	77,59	81,01	88,11	91,53
Seat - Eye	72,3	4,63	64,65	68,41	76,19	79,94
Seat - Shoulder	57,68	3,84	51,35	54,46	60,91	64,02
Seat - Nipple Height	39,53	3,58	33,62	36,52	42,54	45,45
Seat - Xiphoid Process Height	35,69	3,24	30,34	32,97	38,41	41,04
Seat - Elbow	21,39	3,33	15,89	18,59	24,18	26,88
Seat - Thigh Height	15,83	2,62	11,51	13,63	18,02	20,14
Foot-to-Popliteal Fossa Height	44,14	2,44	40,12	42,09	46,19	48,16
Sacro-Popliteal Length	48,02	4,15	41,18	44,53	51,5	54,86
Popliteal-to-End of Knee	15,45	2,56	11,22	13,3	17,61	19,68
Foot Length	26,17	1,5	23,7	24,91	27,43	28,65
Foot Width	10,48	0,93	8,94	9,7	11,27	12,02

Hip Width (while sitting)	40,15	3,71	34,02	37,03	43,26	46,27
Abdominal Depth (while sitting)	29,29	4,85	21,29	25,22	33,36	37,29
Abdominal Circumference	101,92	12,36	81,53	91,54	112,31	122,32

Comparing the other measurements of the 95th percentile found in the study by Fragoso et al. (2015), the findings most similar to those of this study are hip width (37.1 and 41.42 cm respectively); foot length (26.4 and 28.6 cm); and foot width (10.2 and 12.2 cm). As for the 5th percentile, the values found in this research are more similar to those of the study by Kilesse (2005), where the results were similar for shoulder height (132.31 cm in this study and 130 cm for Kilesse (2005)) and arm length (33.48 cm and 32 cm, respectively).

4. CONCLUSION

In addition to outlining a profile of truck drivers and creating a table with the values of the 5th, 20th, 80th, and 95th percentiles for various body dimensions analyzed in Brazilian truck drivers, this study allowed us to conclude that the data found mostly corroborate with those found in the existing literature. This article serves as a reference for a Brazilian anthropometric table in future ergonomic studies.

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