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Associations Between Hand Anthropometric Measurements and Handgrip Strength in a Group of Administrative Workers in the City of Bogotá, Colombia*

Asociación entre las dimensiones antropométricas de la mano y la fuerza de agarre en un grupo de trabajadores administrativos de la ciudad de Bogotá, Colombia

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Abstract:

Handgrip strength is an indicator of the physical capacity and well-being in human beings, which is why it is relevant to characterize it.
Objective: The objective of this article was to determine the associations between handgrip strength and anthropometric hand measurements in a group of administrative workers in the city of Bogotá.
Materials and methods: The participants included 315 people between 18 and 63 years old who were measured using eight dimensions of the hand and handgrip strength in both hands.
Results and discussion: Through linear regression, the anthropometric measures with significant relationships with grip strength were found to be maximum hand width (MHW), hand thickness (HT), grip diameter (GD), and maximum hand circumference (MHC) for the dominant hand and MHW, HT, and GD for the nondominant hand.
Conclusion: Anthropometric measures showed a 52% incidence of dominant hand strength and a 50.6% incidence of nondominant hand strength. In the analysis of the dominant hand, it was found that individuals aged between 25 and 50 years exhibited an increase in strength, and that both men and women have greater grip strength at any age.
Keywords: Handgrip Strength, Antropometric Dimension, Workers.

Resumen:

La fuerza de agarre de la mano es un indicador de la capacidad física y del bienestar en el ser humano, por lo que es relevante caracterizarla.
Objetivo: el objetivo de este artículo fue determinar las asociaciones entre la fuerza de agarre y las dimensiones antropométricas de la mano en un grupo de trabajadores que desempeñan labores administrativas de la ciudad de Bogotá (Colombia).
Materiales y métodos: participaron 315 personas con edades entre los 18 y 63 años, a quienes se les midieron ocho dimensiones de la mano y la fuerza de agarre en las dos manos.
Resultados y discusión: mediante un modelo de regresión lineal, se encontró que las medidas antropométricas con relaciones significativas con la fuerza de agarre eran el ancho máximo de la mano (MHW), el espesor de la mano (HT), el diámetro de agarre (GD) y la circunferencia máxima de la mano (MHC) para la mano dominante, y MHW, HT y GD para la mano no dominante.
Conclusiones: las medidas antropométricas mostraron una incidencia del 52% en la fuerza de la mano dominante y una incidencia del 50,6% en la fuerza de la mano no dominante. En el análisis de la mano dominante, se encontró que las personas de entre 25 y 50 años presentaron un incremento de fuerza y que tanto en hombres como en mujeres la fuerza de agarre es mayor en cualquier edad.
Palabras clave: fuerza manual de agarre, dimensionamiento antropométrico, trabajadores.

Author notes

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Introduction

In the history of humanity, one of the most important evolutionary developments, as per the study by Fuentes et al. [1], was the anatomical changes that enabled an upright posture and bipedal walking, which allowed the involvement of the arms, forearms, and hands in tasks such as reaching, moving, and performing various important trades in people's lives. Based on Ramírez [2], the functional capacity of the upper limbs especially in tasks requiring manual dexterity and hand grip strength, has been crucial in occupational performance.

As shown in [2, 3], functions involving gripping and releasing actions utilize the muscular system of the hand and forearm section, enabling the execution of maximum finger grip force during normal activities. Weinstock-Zlotnick et al. [4] mentioned, handgrip strength (HGS), also known as the measure of maximal grip strength (MGS), represents a universal method for measuring disability related to one of the main body functions. It is categorized in the International Classification of Functioning Disability and Health code. According to Svensson et al. [5], it is a reliable and recognized method for strength assessments using various types of instruments and is quick and easy to perform.

Following the report of Conforto et al. [6], the inability to grip is common and has an impact on the quality of social and professional life. Therefore, grip strength assessments are of great importance. As affirmed by Conforto et al. [6], Guerra et al. [7] and Amo-Setién et al. [8], grip strength assessments are commonly used in clinical processes such as rehabilitation, disease diagnosis, presurgical assessments, injury evaluations, and occupational estimation Additionally, Weinstock-Zlotnick et al. [4] mentioned grip strength assessments are used to document the level of impairment in people with various musculoskeletal disorders (MSDs). As reported by Shah et al. [9], such assessments help identify the onset of diseases affecting people's daily lives, such as sarcopenia, carpal tunnel syndrome, and muscle fatigue Also, Wimer et al. [10] indicated that repetition of hand force movements is associated with the development of MSDs.

The literature review reports various types of studies related to manual grip strength, some of which focus solely on identifying the relationships between HGS and the anthropometric dimensions of the hand, for example, reported by Maynard and Triyanti et al. [11]; while others as [9, 12, 13] analyze variables such as height, age, sex, and hand measurements in relation to HGS. Some studies, as [14, 15], relate anthropometry and body composition to grip strength.

In the study by Maynard and Triyanti et al. [11], the target population included university students in industrial engineering aged 18 to 21 years. They determined the correlations between hand anthropometric dimensions and developed HGS. Additionally, the authors proposed an equation based on linear regression that allowed the implementation of a predictive grip strength model in industrial engineering students at the Atma Jaya Catholic University of Indonesia.

Sirajudeen et al. [12] designed a study aiming to establish the correlations between HGS and variables, such as weight, height, body mass index (BMI), hand, and forearm dimensions in a group of apparently healthy male individuals. The results established significant positive correlations between grip strength in the dominant and nondominant hands and height, weight, BMI, forearm and wrist circumference, hand length, and width. In the research by Shah et al. [9], the authors reported that 1) HGS in the dominant hand was higher than that in the nondominant hand, 2) associations were found between HGS in both hands and variables such as weight, height, and forearm circumference, and 3) no association was found between HGS and BMI.

Conforto et al. [6] and Noh et.al [16] have established that manual strength increases with age, reaching its maximum development at approximately 35 to 45 years, and then it starts to decline. The strength exerted by the dominant hand is approximately 10% higher than that exerted by the nondominant hand, especially in right-handed individuals. In left-handed individuals, the strength is similar in both hands . The study by Ke Li et al. [17] sought to predict maximum grip strength based on anthropometric dimensions, such as forearm

circumference, wrist circumference, palmar length, and hand length. They found that hand circumference had the highest correlation with strength in their experimental design.

The report by Saremi and Rostamzadeh [18] compared grip strength and some hand dimensions in two types of populations: one engaged in manual work and the other primarily in computer work. The dimensions analyzed included length, palmar length, width, wrist circumference, and forearm circumference. This study determined the correlations between strength, palm width, and forearm circumference.

In the research conducted by Eidson C. et al. [19], which aimed to determine the relationship between anthropometric measures and grip strength in young adults, sex and hand width were identified as statistically significant variables associated with grip strength.

As affirmed in [20, 21, 22, 23, 24, 25, 26, 27], the characterization of hand strength has been recognized as a necessity that provides relevant information for monitoring, control, and intervention in human performance in different life domains. However, few studies in Colombia have been reported on this matter, and they have focused on specific populations. Authors have sought to determine the relationships between grip strength and variables such as sex, age, hand preference, occupation, height, weight, and demographic characteristics.

For example, Ramirez and Angarita [23] measured grip strength in healthy workers in the city of Manizales and assessed possible associations with age, sex, occupation, and dominance. The study involved 199 healthy workers, 53.8% of whom were female. In this case, no associations were found with occupation or dominance, and the results showed changes in grip strength associated with age and sex.

In the city of Cúcuta, the study by Bustos et al. [25] was cross-sectional and observational, with intentional non-probabilistic sampling involving 390 voluntary participants. The HGS results were categorized by sex, age, and hand dominance, revealing that HGS increased up to the age range of 30 to 39 years in both sexes. Additionally, no significant differences in HGS were established when considering hand dominance and the studied decades of life.

In the city of Bogotá, specifically in the Usaquén locality, a dynamometry study by Hincapié [24] aimed to establish grip strength characterization tables in apparently healthy people aged 20 to 70 years. The study involved 385 participants, and the results were categorized by sex, age, dominance, occupation, height, and weight. The research by Piñeda et al. [20], on a sample of people working in construction-related activities in Bogotá, sought to relate HGS and some hand dimensions, such as palm length, palm width, maximum palm width, total length, maximum diameter, and thickness. The study identified a weak correlation between HGS, hand length, and maximum hand diameter.

Other studies have attempted to characterize grip strength for specific occupations, such as study development by Zea et al. [26] about cleaning and cafeteria work. At the time of the review, no references were found regarding exclusively administrative populations. However, some research reports have considered some anthropometric variables in grip strength analyses.

The aim of the present study was to establish possible correlations of HGS with some anthropometric dimensions of the hands in a group of administrative workers whose tasks are mainly carried out using video terminals. These workers support legal, financial, accounting, human resources, social work, and archival areas, among others, in a public entity in the city of Bogotá. The study characterizes grip strength behavior considering sex and age variables. Additionally, a predictive model of strength for dominant and nondominant hands is proposed.

Materials and Methods

Study Type

This study was cross-sectional, and the registration of variables of interest was conducted in 2019 among people working in the administrative area of a public institution in Bogotá.

Participant Population

The study involved 341 administrative workers performing office tasks supporting legal, financial, accounting, human resources, social work, and archival areas, among others, in a public entity in Bogotá. Twenty-six people were excluded from the study based on the following criteria: 1) they reported having any disability related to hand or forearm diseases, 2) they engaged in any upper limb training or exercise, or 3) they did not perform activities related to the use of video terminals (Table 1).

TABLE 1.
Characteristics of the participant population.

Description	Number of participants	Percentage participation
Total participant population	315	100%
Participation by sex		
Women	207	65.7%
Men	108	34.3%
Participation by age range		
< 23 years	5	1.6%
24-33 years	83	26.3%
34-43 years	109	34.6%
44-53 years	60	19.0%
54-63 years	58	18.4%
Dominant hand of participants		
Right hand (right-handed)	291	92.4%
Left hand (left-handed)	24	7.6%

Source: Own creation.

Information collection

Participation was voluntary, and informed consent forms for the protocols used for data collection were signed by each attendee. The protocols were approved by the Ethics and Research Committee of the Faculty of Engineering of the Pontifical Javeriana University and the Santo Tomás University, Bogotá.

Information collection began with the signing of an informed consent form, followed by the registration of sociodemographic and work-related information, and concluded with anthropometric measurement of the participants' hands and assessments of maximum grip strength. Anthropometric measurements were performed with a tape measure, caliper, and anthropometric cone considering 8 hand dimensions: maximum hand width (MHW), hand width (HW), palmar length (PL), maximum hand length (MHL), hand

circumference (HC), grip diameter (GD), maximum hand circumference (MHC), and hand thickness (HT).

The anthropometric measurement techniques for the hand followed those established by Mohammad et al. [28], aligning with NASA 1024 (Anthropometric Source Book III – 1978), and were consistent with the techniques used by Cerda et al. [29] in a study designed to determine anthropometric dimensions and pressure forces applicable to manual tool design conducted in Santiago, Chile (Table 2).

TABLE 2.
Methodology used for hand dimension characterization following the guidelines reported by Mohammad et al. [28].

Maximum Hand Length (MHL)	From the most distal and palmar fold of the wrist to the distal end of the phalanx of the third finger (1).	
Palmar Length (PL)	From the most distal and palmar fold of the wrist to the line projected from the most proximal fold of the second finger (2).	
Hand Width (HW)	Distance between the heads of the second and fifth metacarpals from their lateral side (3).	
Maximum Hand Width (MHW)	Distance from the lateral side of the head of the fifth metacarpal to the lateral side of the head of the first metacarpal (4).	
Hand Thickness (HT)	Distance between a line projected from the palmar side of the head of the second metacarpal to a line projected from the dorsal side of the second metacarpal (5).	
Grip Diameter (GD)	Measures the maximum grip diameter between the first and third fingers around a conical structure (6).	

Source: Own creation.

The assessment of maximum grip strength in each participant was conducted considering the posture suggested by the American Society of Hand Therapists (ASHT), a posture employed in various studies as [18, 30, 31]: the person had to be seated in a chair with lumbar support, knees flexed at 90°, feet properly

positioned on the floor, shoulders without rotation, the elbow of the arm used for force at 90° flexion, and the arm entirely parallel to the body ensuring that the wrist was in a neutral position. The equipment used was a hydraulic dynamometer from the Jamar brand, which was properly calibrated according to the ABNT-NBR-8197:2012 standard.

Data Analysis

Data analysis was performed using SPSS software. Initially, the data were analyzed with descriptive statistics to determine whether the grip strength data followed a normal distribution. The Kolmogorov-Smirnov test was applied, followed by a paired-sample t test to compare grip strength between the dominant and nondominant hands. Finally, to identify possible relationships between hand dimensions and the grip strength of both hands, a linear regression analysis was applied with the following mathematical model (1):

$$Y_j = \beta_0 + \beta_1 X_1 + \cdots + \beta_8 X_8 + \varepsilon \quad (1)$$

where
Yj = Maximum grip strength of the hand, j = 1,.
Y_1 = Maximum grip strength of the dominant hand (MGD.
Y_2 = Maximum grip strength of the nondominant hand (MGND.
B_0 y β_i = Coefficients of the equatio.
X_1 = Maximum hand length (MHL.
X_2 = Palmar length (PL.
X_3 = Hand width (HW.
X_4 = Maximum hand width (MHW.
X_5 = Hand thickness (HT.
X_6 = Grip diameter (GD.
X_7 = Maximum hand circumference (MHC.
X_8 = Hand circumference (HC.
ε = Sampling error

Results

Anthropometric Dimensions of the Hand

Table 3 presents the results for the anthropometric dimensions of the hand categorized by sex and dominant hand. The average values for men were slightly higher and exhibited less variability than those obtained for women. Regarding dominance, similar anthropometric values were observed in the dominant hand for right-handed and left-handed individuals. Therefore, dominance may not be considered a determining variable for anthropometric dimensions.

TABLE 3.
Anthropometric dimensions of the hand by sex and dominance.

Dimension (cm)	Sex								Dominance							
	Women				Men				Right-handed				Left-handed			
	Min	Max	Prom	DS	Min	Max	Prom	DS	Min	Max	Prom	DS	Min	Max	Prom	DS
MHL	15.00	20.50	17.33	1.35	16.40	22.00	18.58	1.15	15.00	22.00	17.78	1.40	15.00	20.00	17.55	1.53
PL	7.80	12.60	9.98	1.10	8.50	13.50	10.62	0.89	7.80	13.50	10.21	1.07	8.00	12.50	10.09	1.22
HW	6.00	10.80	7.97	0.99	7.20	11.00	8.72	0.90	6.00	11.00	8.24	1.02	6.40	10.00	8.10	1.01
MHW	7.20	12.60	9.56	1.05	8.95	13.00	10.62	0.95	7.20	13.00	9.94	1.14	8.00	11.50	9.75	1.01
HT	1.90	3.02	2.57	0.27	2.50	3.50	3.00	0.35	1.90	3.50	2.72	0.36	2.06	3.50	2.61	0.41
GD	12.00	17.30	14.57	1.03	13.00	18.30	15.83	1.05	12.00	18.30	15.02	1.20	12.80	17.30	14.79	1.09
MHC	19.20	25.00	22.01	1.25	19.80	25.00	23.77	1.08	19.20	25.00	22.63	1.44	19.50	25.00	22.43	1.73
HC	15.30	23.00	18.67	1.37	16.00	22.00	19.98	1.30	15.60	23.00	19.14	1.45	15.30	21.90	18.88	1.85

Source: Own creation.

When comparing anthropometric dimensions by age in Table 4, these dimensions generally increase as age advances. Considering that most measures assess the width and thickness of the hand, this behavior aligns with that reported by Ávila Chaurand et al. [32], who mention that the increase in body segment width occurs after 24 years, and a slight decrease is observed after 50 years.

TABLE 4.
Anthropometric dimensions of the dominant hand by age range.

Dimention (cm)	<= 24 years				25-50 years				51-63 years			
	Min	Max	Prom	DS	Min	Max	Prom	DS	Min	Max	Prom	DS
MHL	15.00	19.00	16.53	1.21	15.00	22.00	17.77	1.34	15.00	21.50	17.86	1.59
PL	8.80	11.00	9.43	0.72	7.80	13.20	10.23	1.04	8.00	13.50	10.20	1.19
HW	6.40	9.80	7.53	1.04	6.00	11.00	8.21	1.02	6.40	11.00	8.36	1.02
MHW	8.14	11.60	9.27	1.11	7.20	13.00	9.89	1.08	8.00	13.00	10.08	1.26
HT	2.20	3.00	2.65	0.29	1.90	3.50	2.71	0.36	2.00	3.50	2.73	0.37
GD	13.50	15.50	14.56	0.73	12.00	18.30	15.10	1.18	12.00	18.30	14.72	1.25
MHC	19.60	24.20	21.70	1.63	19.20	25.00	22.54	1.46	20.00	25.00	22.94	1.40
HC	15.60	20.00	18.03	1.60	15.30	22.00	19.04	1.43	16.40	23.00	19.49	1.55

Source: Own creation.

In general, the evaluated population did not show significant variability in anthropometric dimensions of the hand in the sex, dominance, and age analyses. In all cases, the data followed a normal distribution.

Maximum Grip Strength

The average grip strength was higher in the dominant hand (MGD) at 33.57 Kgf (SD 10.19) than in the nondominant hand (MGND) at 31.65 Kgf (SD 9.97 Kgf). Considering a 95% confidence level and applying the Kolmogorov-Smirnov test, the data behavior of the two groups of interest (MGD and MGND) had a normal distribution, reflecting a p value greater than 0.05 in both cases. Furthermore, a significant difference was found between the values of MGD and MGND with the application of a paired-sample mean difference student t-test, which yielded a p value of 1.280E-17.

The behavior of grip strength concerning dominance is similar in men and women. Higher values were reported in the dominant hand than in the nondominant hand. Among women, for right-handed individuals, the average MGD was 27.91 Kgf, and the MGND was 26.15 Kgf; for left-handed individuals, the average MGD was 26.94 Kgf, and the MGND was 25.58 Kgf. Among men, right-handed individuals recorded an average MGD of 44.71 Kgf and MGND of 42.29 Kgf, while left-handed individuals reported an MGD average of 42.76 Kgf and MGND of 42.01 Kgf The variation between MGD and MGND was, on average, 2 Kgf (Table 5).

TABLE 5.
Grip strength by sex and dominance.

Grip strength (Kgf)	Female				Male			
	Right-handed		Left-handed		Right-handed		Left-handed	
	MGD	MGND	MGD	MGND	MGD	MGND	MGD	MGND
Min	16.70	16.30	16.30	18.30	26.70	23.70	31.30	32.30
Max	45.30	44.00	42.70	46.70	62.70	61.70	56.30	54.70
Prom	27.91	26.15	26.94	25.58	44.71	42.29	42.76	42.01
DS	5.43	5.19	6.88	7.36	7.73	7.99	7.89	7.51

Source: Own creation.

Table 6 shows the analysis of HGS considering dominance and age variables. MGD and MGND increased from 24 to 50 years, and, from that age, a slight decrease occurred. However, MGD in individuals aged 51 to 63 years was higher than that in those aged 18 to 24 years. The greatest variability in MGD and MGND occurred in the 25-50 years age range.

TABLE 6.
Description of grip strength by age range

Grip strength (Kgf)	Age					
	≤ 24 years		25-50 years		51-63 years	
	MGD	MGND	MGD	MGND	MGD	MGND
Min	21.30	20.00	16.30	17.00	16.70	16.30
Max	40.30	43.70	62.70	61.70	62.30	55.30
Prom	30.20	30.88	34.02	32.12	32.57	30.28
DS	6.78	7.79	10.48	10.34	9.48	8.90

Source: Own creation.

Relationship between MGD and anthropometric dimensions of the hand

Table 7 presents the linear regression model for dominant hand grip strength (MGD). Anthropometric dimensions that correlated with MGD were MHW, with a significance of 0.023, while the dimensions HT, GD, and MHC had a significance of 0.000. Other dimensions showed no correlation. The model reports an R = 0.721 and an R2 = 52%.

TABLE 7.
Linear regression model for MGD

Model	Nonstandardized coefficients		Standardized coefficients	t	Sig.
	β	Std. Error	Beta		
(Constant)	-79.771	7.067		-11.287	0.000
MHL	0.731	0.818	0.101	0.893	0.373
PL	-1.946	0.993	-0.206	-1.959	0.051
HW	-2.342	1.450	-0.235	-1.615	0.107
MHW	3.078	1.351	0.343	2.279	**0.023**
HT	6.990	1.313	0.248	5.324	**0.000**
GD	2.715	0.434	0.319	6.259	**0.000**
MHC	2.645	0.608	0.379	4.352	**0.000**
HC	-0.552	0.566	-0.080	-0.975	0.330

Source: Own creation

The β coefficients of the hand dimensions that showed correlation with MGD behaved positively, with the highest value associated with hand thickness (HT). The resulting general model for MGD is:

$$MGD = -79.771 + (0.731 * MHL) - (1.946 * PL) - (2.342 * HW) + (3.078 * MHW) + (6.990 * HT) + (2.715 * GD) + (2.645 * MHC) - (0.552 * HC) + \varepsilon$$

Relationship between MGND and anthropometric dimensions of the hand

The results of the linear regression model corresponding to MGND are shown in Table 8. The reported values are R = 0.711 and R2 = 50.06%. Anthropometric dimensions with a statistically significant contribution to predicting MGND were hand thickness (HT), grip diameter (GD), and maximum hand circumference (MHC).

TABLE 8.
Linear regression model for MGND

Model	Nonstandardized coefficients		Standardized coefficients	t	Sig.
	β	Std. Error	Beta		
(Constant)	-77.472	7.016		-11.042	0.000
MHL	0.039	0.813	0.006	0.048	0.962
PL	-1.104	0.986	-0.119	-1.119	0.264
HW	-2.123	1.440	-0.218	-1.475	0.141
MHW	2.567	1.341	0.292	1.915	0.056
HT	7.687	1.303	0.279	5.898	**0.000**
GD	2.428	0.431	0.291	5.640	**0.000**
MHC	2.402	0.603	0.352	3.981	**0.000**
HC	0.005	0.562	0.001	0.008	0.993

Source: Own creation.

The β coefficients of the linear regression model of the hand variables for which a correlation was established were positive, with the highest value associated with hand thickness (HT). The overall model for MGND is.

$$MGND = -77.472 + (0.039 * MHL) + (1.104 * PL) - (2.123 * HW) + (2.567 * MHW) + (7.687 * HT) + (2.428 * GD) + (2.402 * MHC) - (0.005 * HC) + \varepsilon$$

Conclusions

According to the objective of this research, the grip strength in the dominant hand (MGD) for both men and women at any age was established to be greater than the strength in the nondominant hand (MGND), which is consistent with reports by Conforto et al. [6] and Shah et al. [9]. In women with dominance in the right hand, the MGD was 27.91 Kgf and MGND was 26.15 Kgf. In the same sex but with dominance in the left hand, the average MGD was 26.94 Kgf, and MGND was 25.58 Kgf. For males, right-handed individuals had an average MGD of 44.71 Kgf, and MGND was 42.29 Kgf. Similarly, left-handed men reported an MGD of 42.76 Kgf and an MGND of 42.01 Kgf.

In the age analysis, similar results to those reported by Conforto et al. [6] and Noh et al. [16] were obtained. People between the ages of 25 and 50 reported an increase in grip strength in the dominant hand (MGD),

with an average value of 30.20 Kgf up to 34.02 Kgf. After that age, a slight decrease to 32.57 Kgf was identified. The same behavior was observed in the nondominant hand (MGND), where strength in the 25 to 50 age group showed incremental values from 30.8 Kgf to 32.21 Kgf and a decrease after 50 years with an average value of 30.28 Kgf.

Linear regression analysis determined that the analyzed anthropometric dimensions generally impact grip strength in the dominant hand (MGD) by 52% and grip strength in the nondominant hand (MGND) by 50.6%. The hand dimensions with higher correlations are maximum hand circumference (MHC), grip diameter (GD), hand thickness (HT), and maximum hand width (MHW). The hand dimension that presented a higher correlation for both MGD and MGND was hand thickness (HT).

Notably, data collection was carried out at different times of the day and under specific work conditions for a population performing only administrative tasks. Therefore, the results may not be generalizable to other types of economic activities. In future studies, people engaged in various work activities should be involved to account for the demand for strength and repetitive movements required by different tasks. Including populations from other regions of the country would also be necessary to broaden and update information on the characterization of physical capabilities and manual grip strength (HGS) among the Colombian working population.

In addition to the presented results, this study contributes to characterizing the hand dimensions and HGS of the Colombian population, which is scarce in the country. Despite Resolution 1536 (year 2015) by the Ministry of Health [33], which establishes that "Health Promoting Entities and other Benefit Plan Administrators have, among their responsibilities, to elaborate the population characterization of all the population under their care in the departments, districts, and municipalities where they have affiliated population", no publications from any entity allowing the consultation, management, and comparison of information related to the characterization process are currently available.

Twenty-five years ago, the work carried out by Professor Jairo Estrada [34], from the Faculty of Public Health at the University of Antioquia – Medellín, became available. The objective was to publish the anthropometric parameters of the Colombian working population. This is the last attempt registered to carry out a national-level characterization; however, the age of the data in that document precluded the use of the information for comparisons in the development of this document.

Finally, from an occupational perspective, this study represents an important input for the prevention of work-related MSDs by providing a grip strength estimation model that can be used as an indicator for the diagnosis, assessment, and monitoring of the level of deterioration or recovery of people suffering from any MSD as shown in [4, 6, 8, 9]. Additionally, the characterization of hand dimensions and HGS could be used as a reference for the design of manual tools, equipment, and personal protective elements.

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Notes

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