ISSN: 0976-3031

Available Online at http://www.recentscientific.com

CODEN: IJRSFP (USA)

International Journal of Recent Scientific Research
Vol. 8, Issue, 11, pp. 21566-21570, November, 2017

International Journal of Recent Scientific Research

DOI: 10.24327/IJRSR

Research Article

HAND ANTHROPOMETRY BASED ON THE GENDER OF MEXICAN INDIVIDUALS, RESIDENTS OF THE STATE OF SONORA, MEXICO

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DOI: http://dx.doi.org/10.24327/ijrsr.2017.0810.1096

ARTICLE INFO

Article History:

Received 10th August, 2017
Received in revised form 14th September, 2017
Accepted 08th October, 2017
Published online 28th November, 2017

Key Words:

Ergonomics, anthropometry, factors and risk, hands.

ABSTRACT

Anthropometric studies are needed today in order to identify the physical requirements that are needed to design tools, equipment and workstations, and adapt these to the person who uses them and not for the person to adapt to them. Being able to rely on correct measurements such as those of the hand, acquire great relevance because of sensitive issues that could arise due to a poorly designed equipment or tool under different parameters. The present study involved measurements of 94 men and 73 women between the ages of 18 and 28. The results obtained show that the average dimensions of a male dominant hand is greater than that of the non-dominant hand; likewise, the dimensions of female hands present a greater variation between one measurement and another. The percentiles in each of the measurements were estimated and then registered in anthropometric charts in order to have a reference at the moment of designing tools; they will be of great help in the prevention of occupational hazards. This method was determined acceptable or valid through the R & R study in one of the dimensions where 13.91% reproducibility and 0% reproducibility were obtained. Supporting the immediate use of anthropometric charts, will allow follow-up to the study as the impact of indicators relevant to the industry is determined and new variables are explored, such as the height and body mass index, which will bring in more information of greater importance for decision-making.

INTRODUCTION

According to the International Association of Ergonomics (IEA, 2014) Ergonomics is the scientific discipline that studies the interaction between humans and other elements of a system, and an occupation. It applies theory, principles, data and methods to design, in order to optimize the well-being of people, the global performance system. It is responsible for supplying data regarding the body (Singleton, 1972, cited by Avila, 2007) and it seeks to create a favorable work environment through the design and proper distribution of workstations (INSHT, 2017).

Ergonomics branches into Anthropometry, the discipline that describes the quantitative differences in the human body measurements. It studies dimensions using different anatomical structures as a reference in order to adapt the environment to people (Mondelo, 2001). The poor or non-adaptation of work equipment to anthropometric measurements leads to the presence of occupational hazards (McCormick, 1987) when having to adopt fixed postures for long periods of time and, in addition, having to carry out undue exertion, consequently affecting the worker's health and performance (Nariño, Alonso and Hernández, 2016). It is therefore necessary to conduct studies (Mungarro and Monge, 2001) and ergonomic assessment methods aimed at their control (Rodriguez, 2010).

Studies such as the one conducted with 3,000 mining workers in Peru have confirmed that there is an amplitude in their thorax, and have set the foundations for the design of a backhoe machine in which workers can reach the pedals and drive in optimal conditions in a seated position (Campos and Iglesias, 1957, Frisancho, 1975, cited by Ramírez, 2006). In the field of sports, differences have been found in the size of football players depending on their position in the game field, which lead to information that can be taken into account when deciding the type of moves, or certain individual actions such as those in the air (Zubeldia and Mazza 2002). The human body measurements of an entire Latin American population have been recorded through anthropometric charts, which stand out by the percentiles determined for each dimension, which

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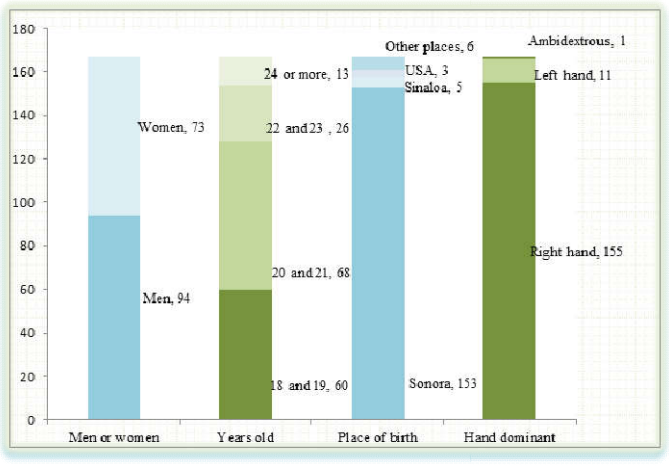
will be of great help in designs (Avila, Prado and Gonzalez, 2007). However, it does not consider the dimensions of either the hand or the phalanges.

According to Binvignat, Almagia, Lizana and Olave (2012), the hands are perhaps, followed by the senses of sight and hearing, one of the most important parts of the human body, due to the constant activity they are subjected to during the working day; therefore, any damage or injury to them can affect the quality of life of a person. The results of a study conducted within a Chilean population, indicate that the measurements are different from those of any other ethnic group, suggested perhaps by the generation gap. Yunnis (2005) establishes the measurements in a population in Jordan, and offers a comparison between the dimensions of both hands among men and women; the same as Avila, (2007) who discloses percentiles in each dimension.

Nowadays, most of the designs and equipment utilized are purchased without previous analysis; therefore, they are imported from different countries which do not take into account the proper dimensions for the Mexican population, due to lack of information. The aforementioned, in addition to the conviction of offering alternative solutions to achieve an efficient relationship between the worker and his environment, has led to an anthropometric study of the hands so as to contribute to the design of work tools, improve performance, and avoid the possibility of occupational hazards.

METHOD

The study was carried out at an institution of higher education located in Guaymas Sonora, focusing on enrolled female and male students. To conduct the study, a representative selection of 167 out of 508 students which comprises the total population, was chosen. The characteristics and values of such sample are shown in figure 1.



Graph 1 Characterization of subject sampling

Out of the 167 subjects studied, there were 94 men and 73 women. With regards to the age of the participants we have the following: 60 were aged between 18 and 19; 68 ranged from 20 to 21 years old; 26 were between 22 and 23 years old; and 13 were 24 years old or more. As for their place of birth, 153 were born in the State of Sonora, 5 in Sinaloa, 3 in the United States and the rest were born in other places. Furthermore, the right hand was dominant in 155, and the left hand was dominant in 11, while one person claimed to be ambidextrous. All subjects were in good health at the time of the measurements, none of them lacking any extremities or hands, and all were given information related to the measurement technique.

The utilized materials were: the anthropometric charts which, for purpose of design and sizing of hands and phalanges, suggests ISO 7250-1 norm, and measuring tape, used for the timely measurement of the extremities indicated in the previous chart, which are those shown in table 1. The dimensions measured for both right and left hands in men and women were: hand length (1), palm length (2), palm width (3), hand width (4), phalangeal length (5), proximal phalangeal width (6) and the distal phalangeal width (7). As for the measurement of phalanges: (5, 6 and 7), the 5 phalanges in each hand were considered.

1. Hand length
2. Palm length
3. Palm width
4. Hand width
5. Phalangeal length (F1, F2, F3, F4, F5)
6. Proximal phalangeal width (F1, F2, F3, F4, F5)
7. Distal phalangeal width (F1, F2, F3, F4, F5)

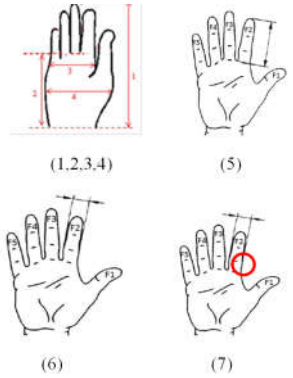


Table 1 Dimensions considered in the anthropometric study

For the development or implementation, the previously mentioned anthropometric measurements were taken, recording the obtained information in a database specifically designed for the occasion. After this, calculations were made to obtain the variables of interest, among which were the average, standard deviation, minimum value, maximum and the percentage differentiation. The next step consisted in discussing the results as percentiles were determined, and then validating the method and equipment used by means of a repeatability and reproducibility study.

RESULTS

Once the anthropometric measurements of each of the 167 individuals were taken, the information was sorted by gender or sex (male, female), listing the dimensions in each row and in each column; a reference was made to the average, standard deviation, the minimum and maximum value of each of the dimensions of both right and left hand in men and women. Likewise, it was possible to appreciate the percentage in relation to the difference of the average values of both hands in each category. The columns on the right side show the differentiation of the different dimensions among men and women (see table 2). Dimensions such as those of the right-hand palm in the sample of 94 Men, to mention one, had an average of 10.53, standard deviation of 0.73, a minimum value of 8.7, a maximum of 12.2; it was different by 1.14% with regards to the left-hand palm and different in 13.30% and

12.49% with respect to the same measurement in the right and left hand in women respectively.

In contrast, the proximal width in F4, and the F2 and the F3 phalange length did not show a difference.

Table 2 Average, standard deviation, and difference percentage of the various right and left hand dimensions in men and women.

Hand dimensions	Men n= 94							Women n= 73							Difference (%) among the width in women and men's hands	
	Right hand	Min	Max	Left hand	Min	Max	Difference (%)	Right hand	Min	Max	Left Hand	Min	Max	Difference (%)	Right hand	Left hand
1	18.89±0.88	16.7	22.2	19.03±0.94	16.7	20	-0.74	17.27±0.84	15.3	20	17.31±0.87	15.2	20	-0.23	8.58	9.04
2	10.78±0.68	8.9	12.5	10.84±0.63	8.8	12	-0.56	9.87±0.56	8.8	11.5	9.91±0.58	8.4	11.5	-0.41	8.44	8.58
3	8.91±0.7	6.3	10.9	8.85±0.65	6.5	9.5	0.67	7.65±0.51	6.8	9.5	7.6±0.47	6.8	8.8	0.65	14.14	14.12
4	10.53±0.73	8.7	12.2	10.41±0.7	8.6	11	1.14	9.13±0.56	8	11	9.11±0.54	8.1	10.7	0.22	13.3	12.49
5.1	6.48±0.7	4.7	7.8	6.5±0.64	5	7.3	-0.31	5.72±0.53	4.5	7.3	5.81±0.57	4.5	7.2	-1.57	11.73	10.62
5.2	7.23±0.48	6.3	8.4	7.32±0.51	6.2	7.7	-1.24	6.66±0.42	5.5	7.7	6.66±0.42	5.7	8	0	7.88	9.02
5.3	8.08±0.55	7	9.7	8.13±0.54	7	8.5	-0.62	7.42±0.38	6.7	8.5	7.42±0.38	6.6	8.5	0	8.17	8.73
5.4	7.41±0.57	6.1	8.9	7.47±0.54	6.2	7.7	-0.81	6.78±0.39	6	7.7	6.76±0.42	6	8.1	0.29	8.5	9.5
5.5	6.06±0.5	5.1	7.2	6.05±0.47	5	6.9	0.17	5.49±0.41	4.3	6.9	5.44±0.37	4.6	6.4	0.91	9.41	10.08
6.1	2.15±0.23	1.5	2.8	2.14±0.24	1.5	2.4	0.47	1.92±0.17	1.6	2.4	1.91±0.18	1.3	2.3	0.52	10.7	10.75
6.2	1.99±0.21	1.2	2.5	1.97±0.17	1.6	2	1.01	1.73±0.16	1.3	2	1.74±0.16	1.3	2	-0.58	13.07	11.68
6.3	2.02±0.23	1.2	2.6	1.98±0.21	1.3	2.2	1.98	1.73±0.2	1.1	2.2	1.72±0.2	1.1	2.2	0.58	14.36	13.13
6.4	1.87±0.21	1.3	2.3	1.81±0.22	1.2	2	3.21	1.58±0.18	1.2	2	1.58±0.17	1.1	2	0	15.51	12.71
6.5	1.7±0.2	1.1	2.1	1.63±0.21	1	1.8	4.12	1.42±0.17	1	1.8	1.4±0.17	1	1.8	1.41	16.47	14.11
7.1	2.21±0.36	1.1	2.9	2.17±0.3	1.3	2.7	1.81	1.97±0.24	1.4	2.7	1.91±0.22	1.2	2.3	3.05	10.86	11.98
7.2	1.79±0.19	1.3	2.1	1.8±0.18	1.3	1.9	-0.56	1.59±0.15	1.3	1.9	1.57±0.15	1.3	2.2	1.26	11.17	12.78
7.3	1.82±0.2	1.3	2.2	1.79±0.19	1.2	1.9	1.65	1.57±0.15	1.2	1.9	1.53±0.15	1	1.8	2.55	13.74	14.53
7.4	1.67±0.18	1.2	2	1.63±0.18	1	1.7	2.4	1.43±0.13	1.1	1.7	1.4±0.11	1.1	1.7	2.1	14.37	14.11
7.5	1.54±0.18	1.2	2	1.45±0.17	1	1.6	5.84	1.3±0.13	1	1.6	1.26±0.13	1	1.7	3.08	15.58	13.1

When comparing the right and left hands in men it was possible to see a 5.84% difference in the distal width of the F5 phalange and 4.12% in the proximal width of the same. In contrast, the aforementioned phalanx length had the lowest percentage of variation with 0.17%. In the case of women, the distal width of the phalanges was the measurement with the most significant difference with 3.05%, 2.55% and 3.08% for the F1, F3 and F5 phalanges, respectively.

The greatest difference between right hands of men and women took place in the proximal and distal width dimensions of the phalanges, averaging 14% and 13% respectively, in addition to the 14.14% in the palm width, and the 13.3% in the hand width. As for the left hand, the greatest difference was in the phalanges distal width with 13.3%, and in the palm and hand width, with 14.12% and 12.49% respectively. All measurements between men and women showed a difference of at least 7.88%.

Table 3 Percentiles of the different right-hand and left-hand dimensions (cms.) in participating men and women.

Hand dimensions	Percentile 5				Percentile 50				Percentile 95			
	Men		Women		Men		Women		Men		Women	
	Right hand	Left hand	Right hand	Left hand	Right hand	Left hand	Right hand	Left hand	Right hand	Left hand	Right hand	Left hand
1	17.47	17.5	16.06	15.92	19	19	17.3	17.3	20.2	20.5	18.58	18.54
2	9.9	9.9	9	9	10.7	10.8	9.9	10	12	11.94	10.78	10.88
3	7.93	7.93	6.96	6.9	9	8.9	7.6	7.6	9.8	9.94	8.5	8.34
4	9.43	9.3	8.2	8.2	10.5	10.3	9.1	9.1	11.84	11.74	10	9.98
5.1	5.3	5.5	5	5	6.5	6.5	5.7	5.7	7.6	7.54	6.5	6.84
5.2	6.5	6.57	6	6.1	7.2	7.3	6.7	6.7	8	8.1	7.3	7.3
5.3	7.3	7.3	6.92	6.86	8	8	7.4	7.4	9	9	8.14	8
5.4	6.5	6.6	6.2	6.16	7.4	7.5	6.8	6.8	8.34	8.24	7.4	7.32
5.5	5.27	5.3	4.9	4.86	6	6	5.5	5.4	6.9	6.7	6.1	6
6.1	1.8	1.77	1.7	1.6	2.1	2.1	1.9	1.9	2.5	2.5	2.2	2.14
6.2	1.57	1.7	1.46	1.5	2	2	1.7	1.8	2.2	2.3	2	2
6.3	1.6	1.6	1.4	1.4	2	2	1.7	1.7	2.3	2.3	2	2
6.4	1.5	1.4	1.3	1.3	1.9	1.9	1.6	1.6	2.2	2.1	1.8	1.8
6.5	1.4	1.27	1.16	1.1	1.7	1.65	1.4	1.4	2	1.9	1.7	1.64
7.1	1.57	1.6	1.5	1.5	2.2	2.2	2	2	2.7	2.6	2.24	2.2
7.2	1.47	1.47	1.36	1.4	1.8	1.8	1.6	1.6	2.04	2.04	1.8	1.8
7.3	1.5	1.47	1.3	1.26	1.8	1.8	1.6	1.5	2.1	2.1	1.8	1.7
7.4	1.4	1.3	1.26	1.2	1.7	1.6	1.4	1.4	1.9	1.9	1.6	1.6
7.5	1.3	1.2	1.1	1.06	1.5	1.5	1.3	1.2	1.8	1.7	1.5	1.44

In order to have tooling design parameters, the corresponding 5, 50 and 95 percentiles were estimated for each right-hand and left-hand dimension, taking into account men and women (table 3), and then globally, regardless of participants' sex (table 4).

being between 10 and 30%. According to the author, in terms of repeatability, identified as the variation of the averages of the operators, this appears at zero indicating that the response among analysts was almost null, which makes the study more trustworthy.

Table 4 Average, standard deviation and percentile values of the different right-hand and left-hand dimensions regardless of participants' sex.

Hand dimensions				Percentile 5		Percentile 50		Percentile 95	
	Right hand	Left hand	Difference (%)	Right hand	Left hand	Right hand	Left hand	Right hand	Left hand
1	18.18±1.18	18.24±1.4	-0.33	16.3	16.30	18.20	18.30	20.00	20.20
2	10.39±0.77	10.42±0.78	-0.29	9.2	9.13	10.30	10.40	11.77	11.77
3	8.43±1.19	8.32±0.85	1.30	7	7.00	8.30	8.30	9.80	9.67
4	9.85±1.06	9.79±0.99	0.61	8.2	8.36	9.80	9.80	11.60	11.27
5.1	6.15±0.75	6.22±0.71	-1.14	5	5.13	6.00	6.20	7.40	7.50
5.2	6.99±0.55	7.04±0.58	-0.72	6.2	6.20	7.00	7.00	8.00	8.00
5.3	7.79±0.58	7.8±0.61	-0.13	7	7.00	7.70	7.70	8.84	8.90
5.4	7.13±0.6	7.15±0.62	-0.28	6.2	6.20	7.00	7.10	8.17	8.17
5.5	5.79±0.61	5.78±0.53	0.17	5.03	5.00	5.80	5.80	6.80	6.60
6.1	2.06±0.25	2.03±0.25	1.46	1.7	1.60	2.00	2.00	2.47	2.50
6.2	1.88±0.23	1.87±0.21	0.53	1.5	1.50	1.90	1.90	2.20	2.20
6.3	1.9±0.27	1.86±0.25	2.11	1.5	1.43	1.90	1.90	2.30	2.20
6.4	1.74±0.24	1.71±0.23	1.72	1.33	1.40	1.70	1.70	2.10	2.00
6.5	1.59±0.26	1.53±0.23	3.77	1.2	1.20	1.60	1.50	2.00	1.90
7.1	2.11±0.33	2.06±0.29	2.37	1.5	1.53	2.10	2.00	2.60	2.50
7.2	1.71±0.22	1.69±0.2	1.17	1.4	1.40	1.70	1.70	2.00	2.00
7.3	1.71±0.24	1.68±0.22	1.75	1.4	1.40	1.70	1.70	2.1	2.00
7.4	1.56±0.2	1.53±0.19	1.92	1.3	1.30	1.60	1.50	1.90	1.80
7.5	1.44±0.22	1.37±0.18	4.86	1.13	1.10	1.40	1.40	1.80	1.70

DISCUSSION

Tables 3 and 4 show information of great relevance for decision-making regarding the design of hand tools, gloves, mechanisms and/or utensils. It can be appreciated that the length of phalange 3 (middle finger) had the highest values in each percentile explored. There are few hand anthropometric studies, as seen. However, if the information obtained from the phalanges length dimension is compared to the results of Binvignat, in (2012) very similar values can be observed. Nevertheless, the same author has pointed out that they are slightly different from those set forth by Aydinlioglu, Akpinar and Tosun (1998) and Case and Ross (2007) perhaps due to factors such as ethnicity and generation. With regards to hand length, palm length, palm width and hand width, the values seem to be very similar to those proposed by Yumis (2005) given that the maximum difference is 3%, although they are different among each other due to age, sex and height.

According to Hernández and Reyes (2007), the reliability of the measurements should be validated through a study called R&R; this is why the variation between the method and the results of thirty measurements of the hand length dimensions of the dominant hand to the same number of sampling subjects was conducted by two analysts. When entering the data to the minitab software, the metrics of Repeatability, Reproducibility, % R&R and the precision Index were obtained, which are shown in the following table:

Morales, (2007) recommended that 5 or more categories are needed in order to be able to render acceptable the adequate measurement system, which in this study was favorable as the value resulted in 10. The reproducibility, registered in the red box, which indicates the variation with respect to the equipment used, resulted in 13.91% making it acceptable for

Table 5 Gage R&R Hand length measurement

Gage R&R

Source	VarComp	%Contribution (of VarComp)
Total Gage R&R	0.02350	1.94
Repeatability	0.00000	0.00
Reproducibility	0.02350	1.94
Operators	0.00338	0.28
Operators*Parts	0.02012	1.66
Part-To-Part	1.19057	98.06
Total Variation	1.21407	100.00

Source	StdDev (SD)	Study Var (6 × SD)	%Study Var (%SV)
Total Gage R&R	0.15330	0.91978	13.91
Repeatability	0.00000	0.00000	0.00
Reproducibility	0.15330	0.91978	13.91
Operators	0.05813	0.34879	5.28
Operators*Parts	0.14185	0.85108	12.87
Part-To-Part	1.09113	6.54681	99.03
Total Variation	1.10185	6.61110	100.00

Number of Distinct Categories = 10

While exploring the dimensions, it was noted that the average dimensions of the male dominant hand was greater than those of the non-dominant hand, with 13 values greater in a total of 19, and with respect to women, the dominant hand dimensions were also higher with 15 of 19 values. Likewise, the difference in hand dimensions between men and women was remarkable, and the dominant hand had small variations with greater dimensions to that of the non-dominant one.

With regards to percentiles, 95 was the most interesting, since it is the one that covered the largest amount of data and in which the desired decisions could be made; there was an average of 38 measurements of the hand dimensions and it

reflected a total of 160 people that were below the said percentile and on average 6 were excluded from it.

The anthropometric charts obtained, highly contribute to the design and construction of material or tools such as gloves, tweezers, scissors, screwdrivers, and everything related to this body extremity. This will reduce the costs associated to illnesses due to the presence of Cumulative Traumatic Disorders (CTD). The continuity of the project is recommended by analyzing new variables such as the body mass index and the height of the participant, trying to find a correlation that facilitates decision-making.

Publicación financiada con recursos PFCE 2016. Los recursos del PFCE son de carácter público y queda prohibido su uso con fines partidistas o de promoción personal

References

Avila C. Rosalio. 2014. Métodos y Técnicas para el Análisis Ergonómico del Puesto de Trabajo. México. Universidad de Guadalajara.

Aydinlioglu, A.; Akpinar, F. & Tosun, N. Mathematical relations between the lengths of the metacarpal bones and phalanges: Surgical significance. *Tohoku J. Exp.Med*., 185: 209-16, 1998.

Binvignat, O, Almagià, A, Lizana, P, & Olave, E. (2012). Aspectos Biométricos de la Mano de Individuos Chilenos. *International Journal of Morphology*, 30(2), 599-606. https://dx.doi.org/10.4067/S0717-95022012000200040

Campos J, Iglesias B. Observaciones anatomopatológicas en 49 personas normales, nativos y residentes de altura, muertas en accidentes. *Rev Lat Amer Anat Patol*. 1957;1:109.

Case, T & Ross, A. Sex determination from hand and foot bone lenght. *J. Forensic Sci*. 52(2): 264-70, 2007.

Frisancho AL, Borkan GA, Klayman JE. Pattern of growth of lowland and highland Peruvian Quechua of similar genetic composition. *Human Biologic*. 1975;47(3):233.

Hernández, H. & Reyes, P. (2007). Estudios de Repetibilidad y de Reproducibilidad R&R.

McCormick EJ, Sanders MS. Human factors in engineering and design. New York: McGraw Hill; 1987. http://www.scielo.org.pe/scielo.php?pid=S1025-55832006000400004&script=sci_arttext

Morales J. (2007). Aplicación de la metodología seis sigma, en la mejora del desempeño en el consumo de combustible de un vehículo en las condiciones de uso del mismo (Tesis de maestría, Universidad Iberoamericana, México D.F.). Recuperada de http://www.bib.uia.mx/tesis/pdf/014873/014873.pdf

Mungarro, C. y Monge, R. (2001). . Antropometría Obregón: Instituto Tecnológico de Sonora, dirección de investigación y estudios de postgrado.

Nariño, Alonso y Hernández, 2016. http://www.redalyc.org/pdf/1492/149250081003.pdf. Página 48-49.

Ramírez, A. 2006. Antropometría del trabajador minero de la altura. http://www.scielo.org.pe/scielo.php?pid=S1025-55832006000400004&script=sci_arttext#tab01

Rodríguez, A. H. (2010). Ergonima en Español. Recuperado el Agosto de 25 de 2015, de http://www.juntadeandalucia.es/export/drupaljda/1_2048_causas_ergonomicas_trastornos_musculoesqueleticos.pdf

Yunis (2005). Anthropometric characteristics of the hand based on laterality and sex among Jordanian. *International Journal of Industrial Ergonomics*, 747-754. http://www.sciencedirect.com/science/article/pii/S0169814105000454

Zubeldía, G. y Mazza, O. 2002. https://g-se.com/es/entrenamiento-en-futbol/articulos/ caracteristicas-antropometricas-y-funcionales-en-futbolistas-de-14-a-15-anos-pertenecientes-a-racing-club-215

How to cite this article:

Ernesto Ramírez Cárdenas *et al*.2017, Hand Anthropometry Based on The Gender of Mexican Individuals, Residents of The State of Sonora, Mexico. *Int J Recent Sci Res.* 8(11), pp. 21566-21570.
DOI: http://dx.doi.org/10.24327/ijrsr.2017.0811.1096

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