Children´s Anthropometric measures ages in elementary school from Caborca, Sonora, Mexico.

M.C. Joaquín Vásquez Quiroga[1], M.C. Jesús Rodolfo Guzmán Hernández[2], Dr. Enrique Javier de la Vega Bustillos[3], M.C. Francisco Octavio López Millán[3]

[1] Program Coordinator and Professor, Department of Physics, Mathematics and Engineering, University of Sonora, Caborca Sonora, México. E.mail: jovaqui@caborca.uson.mx

[2] Professor, Department of Physics, Mathematics and Engineering University of Sonora, Caborca, Sonora, México. E-mail: rguz@caborca.uson.mx

[3] Professor and Researcher at the Instituto Tecnológico de Hermosillo. E-mail: e_delavega_mx@yahoo.com , lopezoctavio@yahoo.com.mx

ABSTRACT

Of the resources available than our society count man is maybe the most valuable, because this is the one that promotes and is advanced the society, the economy, politics and the technology, that's why we created the concern to developing an investigation will be introduced to predetermined measures to be used in furniture design appropriate for certain age ranges.

In Based on the definition of the problem is considered necessary to perform this study because if you do not take into account the anthropometric dimensions, children can have problems such as physical injury, poor performance, among others, that eventually they can affect their development.

With this study we can obtain information about children´s anthropometric measurements age of elementary school from Caborca, Sonora region.

The purpose of this study is to establish anthropometric dimension tables used to determine the 5%, 50% and 95% percentile for elementary school children in first through sixth grade of both sexes living in H. Caborca, Sonora, Mexico.

Once established percentiles, can be designed playgrounds, study (work), relaxation, entertainment or even clothing design. However, other points to consider are:

- Identify areas of development and its influence on the children´s health.
- Improve children´s quality life.
- Reduce the long risk illness term.
- Improve their performance, mood and health.

The project is limited to eight schools. Where will be measured sixty students by each of them, from first to sixth grade in elementary school 22 anthropometric measurements were recorded.

For obtain the information we were randomly selected eight schools from Caborca Sonora City. These were considered five boys and five girls from each grade one through six, the size of the sample was taken at random to perform This study

requires the participation of two people, while one was taking other measures to record the details in the letter anthropometric.

During the data collection in each school provided a conditioned classroom, where there is good lighting, low noise, ventilation, space, appropriate furnishings and absolute privacy, which accommodate the measurement instruments and proceeds to take measures, the students pass one by one to be measured.

The measurements are made and expressed in metric units, selecting only those that will actually help accomplish the goals.

Once the sample was taking from four hundred eighty children the information was captured we wrote it in a table of Microsoft Excel. Calculations were made of information from each of the measures resulting in the maximum, minimum and average.

Having as conclusion the importance of registration of the measures of elementary school children, and with these we can be sure than we create appropriate spaces to develop activities and reduce the chances of injury from poor posture or cumulative trauma injury.

Keywords: Anthropometric Measurements, Anthropometry and Ergonomics.

RESUMEN
De los recursos con que cuenta la sociedad, el hombre quizá sea el más valioso, debido a que éste es el que impulsa y hace avanzar la sociedad, la económica, la política y la tecnología, es por eso que nace la inquietud de desarrollar una investigación con lo cual se establecerán medidas predeterminadas que deben usarse en el diseño del mobiliario adecuado para ciertos rangos de edades.

En base a la definición del problema se considera que es necesario realizar este estudio ya que si no se toma en cuenta las dimensiones antropométricas, los niños pueden presentar problemas como daños físicos, bajo desempeño, entre otros, mismos que con el tiempo pueden afectar en su desarrollo.

Con el estudio se busca obtener información sobre las medidas antropométricas de la población infantil en edad escolar primaria de la región de Caborca, Sonora. El propósito del presente trabajo es establecer tablas de dimensiones antropométricas en donde se determine el 5%, 50% y 95% percentil para los niños de las escuelas primarias de primero a sexto grado de ambos sexos residentes en H. Caborca, Sonora, México.

Una vez establecidos los percentiles, se podrán diseñar áreas de juego, estudio (trabajo), descanso, diversión o incluso el diseño de vestimenta, sin embargo otros puntos a tomar en cuenta son:

- Determinar áreas de desarrollo y su influencia en la salud del los niños.
- Mejorar la calidad de vida de los niños.
- Reducir el riesgo de enfermedades a largo plazo.
- Mejorar su desempeño, estado anímico y de salud.

El proyecto se limita a ocho escuelas donde se medirán a sesenta alumnos por cada una de ellas, desde primero a sexto grado en nivel primaria. Se registraron 22 medidas antropométricas.

Para la obtención de datos se tomaron al azar ocho escuelas de la Ciudad de Caborca Sonora, de estas se consideraron a cinco niños y cinco niñas de cada grado de primero a sexto, el tamaño de la muestra se tomo de formas aleatoria, para la realización de este estudio se necesito la participación de dos personas, mientas una tomaba las medidas, la otra anotaba los datos en la carta antropométrica.

Durante la recolección de datos en cada escuela se facilitó un aula acondicionada, donde existe buena iluminación, bajo nivel de ruido, ventilación adecuada, amplitud, muebles apropiados y absoluta privacidad, en la cual se acomodan los instrumentos de medición y se procede a la toma de medidas, los alumnos pasan uno a uno para ser medidos.

Las medidas se realizan y expresan en unidades del sistema métrico decimal, seleccionándose sólo aquellas que realmente van ayudar a cumplir los propósitos.

Una vez obtenida la muestra de cuatrocientos ochenta niños, los datos fueron capturados en una tabla de Microsoft Excel, se hicieron los cálculos de los datos de cada una de las medidas dando como resultado el máximo, mínimo y la media.

Teniendo como conclusión la importancia del registro de las medidas de los niños de las escuelas primarias, ya que con ello tendremos la seguridad de crear espacios adecuados para que desarrollen las actividades correspondientes y disminuir las posibilidades de lesiones por malas posturas o daños por traumatismo acumulado.

Palabras claves: Medidas Antropométricas, Antropometría y Ergonomía.

1.- INTRODUCTION.

Education of children is a commitment that every civilized nation takes. Educate future generations requires a considerable investment. Despite this, efforts should be made to make education the more people will become a benefic for economic and social development of humanity.

So that effort be less and not incurs additional costs for not taken it some precautions dimensions about children is important to consider the design and the anatomical structure of individuals to understand and develop those areas that involve human performance.

Recent studies such as (Andreasi, Michelin, Rinaldi, & Burini, 2010) where he analyzed the association between physical fitness and health-related anthropometric and demographic indicators of children in three elementary schools in Botucatu, Brazil, as well that (Brown, Gotshalk, Katzmarzyk, & Allen, 2011) which compared the measures of adiposity in two cohorts of school children in the area of Hilo in Hawaii and measures related to parental reports of ethnicity, family income and the level of primary education or that of (Kovárová, Vignerová, Bláha, & Osancová, 2002) studied the prevalence of obesity in which the evaluation was done by cross sectional method in elementary schools in all regions of the Czech Republic with children from 7 to 11 years, the survey covered a total of 3,362 children (1,668 girls and 1,694 children) 12 anthropometric dimensions were taken, the outcome was the proportion of obese children of both sexes in the Czech Republic (children with IMC values above the 97th percentile of reference

population) increased. These studies are an example of the importance of the use of ergonomics in the performance and prevention of diseases of children.

With all the technological advances that have occurred, you can have a better life. Studies have been conducted in several areas; one of them is the anthropometry, with which to determine the dimensions of the human body. In this area There are some studies in developed countries as in the case of (Habibi, Asaadi, & Hosseini, 2011) that examined the adequacy of school furniture for students of elementary schools Iranian participants aged between 7 and 12 years, it also in the same line is (Castellucci, 2010) who studied furniture design school assembly of the students where the main objective of the study was to register anthropometric, considered the main anthropometric dimensions of Portuguese students of elementary school.

Countries like the U.S., Canada, Japan, Chile, Brazil, Colombia, European Community, for mention some, they have anthropometric graphics representative of the population. The statistics tables are traditionally used in Mexico, only made reference to "Latin American people" where they include all the countries of Central and South America.

Panagiotopoulou (2003) conducted a study with the purpose of comparing the student's size of elementary school, with the dimensions of Desks to determine if the dimensions of the furniture is well designed and see if they promote good posture sitting considering the dimensions of children.

Jung (2005) developed a prototype of an adjustable chair for educational institutions, in which assesses their suitability according to international standards. His research began with simple mechanisms for height adjustment of chair legs and backrest height and seat depth.

In Mexico there are some anthropometric reference tables such as percentiles female population referred by (Avila 2001), percentile female population referred by (Liu 1999), percentile female population referred by (Lavender 2002), Anthropometric referenced letters design a the working population in Caborca, Sonora, Mexico from (Vasquez, Guzman, & Vega, 2010).

None of the above studies refer to children in elementary schools (Gonzalez, 2004) who analyzes the elementary school classrooms from the perspective of ergonomics, work is concentrated on a desk for education institutions prevail in the State of Sonora, suitable for the type of activities carried out, allowing the body to have good posture, with the aim of reducing the risk of injury and improve the teaching-learning process.

2.- MATERIALS AND METHODS

For the development of the research team used the following:
- Three anthropometer model 01140, 01290 and 01291 marks Lafayette.
- One stadimeter marks Seca.
- One analog scale marks Seca.
- Two measuring tape marks Powerlock Stanley.
- Two flexible tapes.
- One chair designed with a height adjustment system.

- One computer to recording information.

The methodology for taking the measures was as follows:

To obtain the information has taken randomly selected eight schools from Caborca Sonora City, these were considered in five boys and five girls from each grade one through six, the size of the sample was taken at random to perform. This study requires the participation of two people, while one was taking other measures to record the details in the anthropometric letter.

During the data collection in each school provided a conditioned classroom, where there is good lighting, low noise, ventilation, space, appropriate furnishings and absolute privacy, which accommodate the measurement instruments and proceeds to take measures, the students pass one by one to be measured.

The 22 measures are shown in Table 1 are those reported for the case study of this work, according to the definitions used in similar anthropometric examinations conducted by the National Aeronautics and Space Administration (NASA 1978).

Table 1 Measures recorded in this study

Code	Name of the measure
N920	Weight
N805	Stature
N328	Standing eye height to
N23	Standing shoulder height
N949	Standing waist height
N80	Arm length from the wall
N122	Standing shoulder width
N223	Standing chest width
N931	Waist circumference stands
N178	Standing hip circumference
N758	Seat height sitting at the head
N330	Seat height sitting in the eye
N25	Seat height sitting shoulder
N312	Seat height to seated elbow to 90
N856	Sitting thigh-high
N2FGM	Height of sitting down

Code	Description
N4FGM	Seat height from floor to sit
N200	Back of the knee to the back of chair
N194	Length from knee to back of chair
N678	Height from floor to knee back
N529	Height from floor to knee
N381	Length from elbow to middle finger

3.- ANALYSIS OF RESULTS

The results of research carried out in each of the measurements are shown in tables or records anthropometric population of Caborca Sonora elementary schools as follows:

Table 2 through 7 shows the total data information from first year to sixth grade girls; of 8 to 13 males. The tables show the calculation of the percentiles 5, 50 and 95%, and the maximum and minimum measurements. The calculations were analyzed in an Excel spreadsheet. The calculation is given weight in kilograms; the other measures are in centimeters.

Table 2 Results of the study on girls in 1st grade girls.

Code	Name of the measure	Percentile			Minimum	Maximum
		5%	50%	95%		
N920	Weight	19.9	25.6	41.4	15.2	52.6
N805	Stature	113.9	125.0	134.1	112.0	136.0
N328	Standing eye height to	103.7	112.0	122.1	101.0	126.0
N23	Standing shoulder height	93.4	100.0	109.1	92.0	112.0
N949	Standing waist height	69.9	77.0	85.8	68.0	89.0
N80	Arm length from the wall	53.0	59.0	67.2	50.0	70.0
N122	Standing shoulder width	26.3	29.2	32.8	23.5	36.5
N223	Standing chest width	17.1	19.2	23.2	16.0	26.7
N931	Waist circumference stands	53.6	60.0	70.5	25.0	84.0
N178	Standing hip circumference	62.0	70.0	83.1	57.0	95.0

N758	Seat height sitting at the head	60.0	66.0	71.2	57.0	74.0
N330	Seat height sitting in the eye	49.9	55.0	61.2	47.0	63.0
N25	Seat height sitting shoulder	37.9	42.5	47.2	36.0	49.0
N312	Seat height to seated elbow to 90	11.9	16.0	20.1	11.0	21.0
N856	Sitting thigh-high	5.9	8.0	10.1	5.0	14.0
N2FGM	Height of sitting down	95.8	102.0	109.1	89.0	110.0
N4FGM	Seat height from floor to sit	33.5	37.0	37.1	31.5	38.0
N200	Back of the knee to the back of chair	30.0	33.5	37.6	30.0	39.0
N194	Length from knee to back of chair	37.0	41.0	46.0	35.0	48.0
N678	Height from floor to knee back	30.9	35.0	36.6	29.0	38.0
N529	Height from floor to knee	38.0	42.0	44.5	37.5	45.0
N381	Length from elbow to middle finger	29.0	32.0	35.0	28.0	36.0

Table 3 Results obtained from the study on girls in 2nd grade girls.

Code	Name of the measure	Percentiles			Minimum	Maximum
		5%	50%	95%		
N920	Weight	20.2	28.8	44.6	18.8	50.0
N805	Stature	116.0	128.0	136.5	114.0	142.5
N328	Standing eye height to	104.0	117.5	124.0	104.0	129.0
N23	Standing shoulder height	95.0	106.0	114.0	90.0	116.0
N949	Standing waist height	72.0	80.0	88.0	69.0	91.0
N80	Arm length from the wall	54.0	62.0	75.0	52.5	76.0
N122	Standing shoulder width	27.0	30.0	36.7	25.7	62.3
N223	Standing chest width	17.5	20.5	26.5	15.5	28.5
N931	Waist circumference stands	52.0	63.0	81.0	52.0	85.0
N178	Standing hip circumference	65.0	73.0	88.0	60.0	97.0
N758	Seat height sitting at the head	62.0	68.0	73.0	61.0	79.0
N330	Seat height sitting in the eye	52.0	58.0	62.0	51.0	69.0
N25	Seat height sitting shoulder	39.0	45.0	49.0	37.0	50.0
N312	Seat height to seated elbow to 90	13.0	17.0	20.5	12.5	28.0
N856	Sitting thigh-high	6.5	9.0	12.0	6.0	13.0
N2FGM	Height of sitting down	98.0	105.0	109.0	93.0	110.0
N4FGM	Seat height from floor to sit	33.0	37.0	37.0	31.0	37.0
N200	Back of the knee to the back of chair	31.5	34.5	38.5	30.0	41.0
N194	Length from knee to back of chair	39.0	43.0	48.0	37.0	49.0
N678	Height from floor to knee back	31.0	35.5	38.0	28.0	38.5
N529	Height from floor to knee	36.0	43.0	46.0	34.5	47.5
N381	Length from elbow to middle finger	31.0	34.0	38.0	29.0	40.0

Table 4 Results obtained from the study on girls in 3rd grade girls.

Code	Name of the measure	Percentile			Minimum	Maximum
		5%	50%	95%		
N920	Weight	24.0	31.6	45.6	23.2	73.0
N805	Stature	128.0	134.8	147.0	123.0	158.0
N328	Standing eye height to	115.5	124.0	134.2	113.0	148.0
N23	Standing shoulder height	105.0	111.3	121.7	103.5	134.0
N949	Standing waist height	79.0	86.8	91.0	77.0	106.0
N80	Arm length from the wall	60.8	67.0	72.0	57.0	80.0
N122	Standing shoulder width	28.0	31.9	36.6	26.8	48.0
N223	Standing chest width	18.3	21.6	26.7	17.7	30.4
N931	Waist circumference stands	55.0	64.0	78.2	50.0	92.0
N178	Standing hip circumference	67.0	76.5	89.1	66.0	106.0
N758	Seat height sitting at the head	67.0	71.0	75.1	66.0	80.0
N330	Seat height sitting in the eye	57.0	61.0	66.3	56.0	73.0
N25	Seat height sitting shoulder	43.4	47.0	50.1	40.0	57.0
N312	Seat height to seated elbow to 90	14.0	18.0	21.5	12.0	23.0
N856	Sitting thigh-high	7.0	9.5	13.1	6.5	16.0
N2FGM	Height of sitting down	103.0	108.0	112.7	103.0	123.0
N4FGM	Seat height from floor to sit	36.0	37.0	40.1	36.0	41.5
N200	Back of the knee to the back of chair	33.0	36.0	41.1	31.0	43.0
N194	Length from knee to back of chair	40.0	45.0	52.1	39.0	56.0
N678	Height from floor to knee back	34.9	36.5	41.0	33.0	43.0
N529	Height from floor to knee	36.2	44.0	48.1	16.5	57.0
N381	Length from elbow to middle finger	32.9	36.0	39.0	31.0	44.0

Table 5 Results of the study on girls in 4th grade girls.

Code	Name of the measure	Percentile			Minimum	Maximum
		5%	50%	95%		
N920	Weight	22.7	36.2	58.9	20.0	66.2
N805	Stature	127.9	142.0	153.1	125.0	161.0
N328	Standing eye height to	117.9	131.0	143.1	114.0	149.0
N23	Standing shoulder height	106.0	119.0	130.0	102.5	136.0
N949	Standing waist height	80.0	90.0	99.1	78.0	100.0
N80	Arm length from the wall	61.8	70.0	75.0	58.0	82.0
N122	Standing shoulder width	28.8	32.8	37.4	27.4	38.2
N223	Standing chest width	18.3	22.0	27.5	18.1	31.4
N931	Waist circumference stands	55.8	65.0	83.4	53.0	88.0
N178	Standing hip circumference	66.7	80.0	96.2	64.0	102.0
N758	Seat height sitting at the head	64.0	74.0	82.0	63.0	83.0
N330	Seat height sitting in the eye	54.0	63.0	71.1	32.0	72.0
N25	Seat height sitting shoulder	42.9	49.0	55.1	40.0	57.0
N312	Seat height to seated elbow to 90	14.9	19.0	25.0	13.0	39.5
N856	Sitting thigh-high	7.5	10.0	14.0	7.0	15.0
N2FGM	Height of sitting down	102.9	113.0	122.1	98.0	130.0
N4FGM	Seat height from floor to sit	37.0	39.0	43.0	35.0	46.0
N200	Back of the knee to the back of chair	34.0	39.0	43.6	32.5	45.0
N194	Length from knee to back of chair	43.3	48.0	54.1	39.5	55.0
N678	Height from floor to knee back	35.5	39.0	43.0	33.0	43.5
N529	Height from floor to knee	42.0	47.5	53.8	36.0	56.5
N381	Length from elbow to middle finger	34.0	38.0	41.3	33.5	43.5

Table 6 Results of the study in girls 5th grade girls.

Code	Name of the measure	Percentile			Minimum	Maximum
		5%	50%	95%		
N920	Weight	28.6	42.5	63.3	27.8	87.0
N805	Stature	136.0	146.0	156.2	135.0	170.0
N328	Standing eye height to	126.0	134.0	147.0	125.0	158.0
N23	Standing shoulder height	114.0	122.0	134.1	110.0	146.0
N949	Standing waist height	83.0	93.0	100.1	43.0	113.0
N80	Arm length from the wall	62.0	72.0	80.0	60.0	85.0
N122	Standing shoulder width	30.3	34.2	39.4	29.8	43.0
N223	Standing chest width	20.0	23.0	30.0	18.8	32.3
N931	Waist circumference stands	56.9	69.5	87.2	54.0	95.0
N178	Standing hip circumference	71.0	85.0	103.3	70.0	114.0
N758	Seat height sitting at the head	70.7	75.0	83.0	69.0	83.0
N330	Seat height sitting in the eye	60.0	65.5	72.1	59.0	74.0
N25	Seat height sitting shoulder	46.0	51.0	56.0	45.0	59.0
N312	Seat height to seated elbow to 90	17.0	20.0	24.0	14.0	26.0
N856	Sitting thigh-high	9.0	11.5	15.1	8.0	18.5
N2FGM	Height of sitting down	108.9	117.5	123.1	103.5	130.0
N4FGM	Seat height from floor to sit	37.0	40.8	43.5	37.0	47.0
N200	Back of the knee to the back of chair	35.5	40.8	49.6	33.0	52.5
N194	Length from knee to back of chair	42.5	49.5	59.1	40.0	63.0
N678	Height from floor to knee back	36.9	40.0	45.5	35.0	51.0
N529	Height from floor to knee	44.4	50.0	56.0	41.5	60.0
N381	Length from elbow to middle finger	36.0	39.3	44.3	34.5	51.0

Table 7 Results of the study on girls in 6th grade girls.

Code	Name of the measure	Percentile			Minimum	Maximum
		5%	50%	95%		
N920	Weight	32.4	51.1	72.7	27.4	92.8
N805	Stature	141.0	154.0	161.0	133.0	165.0
N328	Standing eye height to	130.0	143.0	151.0	122.0	155.0
N23	Standing shoulder height	118.0	129.0	135.2	110.0	138.0
N949	Standing waist height	88.0	97.0	103.5	79.0	104.0
N80	Arm length from the wall	69.0	75.0	81.2	67.0	86.0
N122	Standing shoulder width	31.6	36.6	44.5	30.2	45.6
N223	Standing chest width	20.8	24.9	30.4	18.8	32.5
N931	Waist circumference stands	61.9	75.0	94.6	59.0	106.0
N178	Standing hip circumference	75.0	92.5	108.6	75.0	120.0
N758	Seat height sitting at the head	72.9	79.0	84.1	71.0	87.0
N330	Seat height sitting in the eye	63.0	69.0	74.1	62.0	77.0
N25	Seat height sitting shoulder	49.0	54.0	57.0	48.0	58.0
N312	Seat height to seated elbow to 90	17.0	20.5	24.0	16.0	26.0
N856	Sitting thigh-high	9.5	12.5	17.0	8.5	21.0
N2FGM	Height of sitting down	110.0	121.0	125.1	109.0	128.0
N4FGM	Seat height from floor to sit	37.0	41.0	44.0	36.0	45.0
N200	Back of the knee to the back of chair	35.0	43.0	49.1	32.5	51.0
N194	Length from knee to back of chair	44.0	54.0	60.1	41.0	61.0
N678	Height from floor to knee back	38.0	41.0	43.1	34.5	45.0
N529	Height from floor to knee	44.3	51.5	55.5	36.0	56.5
N381	Length from elbow to middle finger	38.0	41.3	43.5	34.0	45.0

Table 8 Results of the study in children in 1st grade boys.

Code	Name of the measure	Percentile			Minimum	Maximum
		5%	50%	95%		
N920	Weight	20.8	24.9	35.6	19.6	41.8
N805	Stature	117.0	124.3	132.1	114.0	135.0
N328	Standing eye height to	104.0	112.0	117.2	102.0	121.0
N23	Standing shoulder height	93.8	100.0	105.1	90.5	109.0
N949	Standing waist height	70.4	75.0	79.5	68.0	83.0
N80	Arm length from the wall	55.0	60.0	64.2	54.0	69.0
N122	Standing shoulder width	26.7	28.8	32.6	25.8	34.3
N223	Standing chest width	18.0	19.5	22.6	16.5	24.1
N931	Waist circumference stands	53.0	58.0	73.6	53.0	85.0
N178	Standing hip circumference	64.0	69.0	85.0	63.0	89.0
N758	Seat height sitting at the head	61.0	66.0	71.1	59.0	72.0
N330	Seat height sitting in the eye	50.0	56.0	60.2	49.5	93.0
N25	Seat height sitting shoulder	39.0	42.0	47.1	37.0	78.0
N312	Seat height to seated elbow to 90	13.0	16.0	21.6	11.0	51.0
N856	Sitting thigh-high	6.0	7.5	10.0	6.0	42.0
N2FGM	Height of sitting down	95.0	103.0	107.0	92.0	109.0
N4FGM	Seat height from floor to sit	33.0	37.0	38.0	32.5	38.0
N200	Back of the knee to the back of chair	30.0	33.1	40.0	29.0	42.0
N194	Length from knee to back of chair	37.0	40.0	47.0	37.0	48.0
N678	Height from floor to knee back	31.0	34.5	37.0	29.5	37.5
N529	Height from floor to knee	38.0	41.5	44.0	36.0	45.0
N381	Length from elbow to middle finger	31.0	33.0	35.1	29.5	43.0

Table 9 Results of the study on children in 2nd grade boys.

Code	Name of the measure	Percentile			Minimum	Maximum
		5%	50%	95%		
N920	Weight	21.0	27.2	47.6	20.0	55.4
N805	Stature	121.8	129.5	140.2	115.0	144.0
N328	Standing eye height to	109.8	119.0	129.0	105.0	132.0
N23	Standing shoulder height	97.8	106.5	117.0	93.5	120.0
N949	Standing waist height	69.9	80.0	88.1	66.0	89.0
N80	Arm length from the wall	57.0	64.0	71.1	55.0	75.0
N122	Standing shoulder width	27.0	30.0	37.2	26.0	37.4
N223	Standing chest width	17.9	19.9	25.5	16.8	26.8
N931	Waist circumference stands	53.5	58.5	81.0	52.0	89.0
N178	Standing hip circumference	63.9	72.0	88.1	61.0	95.0
N758	Seat height sitting at the head	63.0	69.0	73.0	62.0	75.0
N330	Seat height sitting in the eye	53.5	58.3	63.0	53.0	68.5
N25	Seat height sitting shoulder	40.0	44.5	49.1	39.5	51.0
N312	Seat height to seated elbow to 90	14.5	17.0	20.0	14.0	22.0
N856	Sitting thigh-high	6.0	8.0	11.5	6.0	13.0
N2FGM	Height of sitting down	98.0	106.0	110.3	98.0	118.0
N4FGM	Seat height from floor to sit	35.0	37.0	37.0	32.5	41.0
N200	Back of the knee to the back of chair	31.0	34.0	38.0	30.0	42.5
N194	Length from knee to back of chair	39.0	42.8	47.1	37.0	53.0
N678	Height from floor to knee back	32.0	35.5	41.7	28.5	45.0
N529	Height from floor to knee	38.0	42.5	46.1	32.0	49.0
N381	Length from elbow to middle finger	31.5	34.3	38.0	30.0	40.5

Table 10 Results of the study in children 3rd grade boys.

Code	Name of the measure	Percentile			Minimum	Maximum
		5%	50%	95%		
N920	Weight	22.6	31.1	49.2	21.2	70.6
N805	Stature	126.0	138.0	145.1	124.0	149.0
N328	Standing eye height to	114.0	125.5	133.0	111.0	136.0
N23	Standing shoulder height	103.8	113.8	122.5	100.0	123.0
N949	Standing waist height	79.0	84.0	92.1	77.0	93.0
N80	Arm length from the wall	60.0	67.0	78.0	57.0	79.0
N122	Standing shoulder width	27.8	31.4	36.7	27.3	42.5
N223	Standing chest width	18.0	21.0	25.8	17.2	30.3
N931	Waist circumference stands	53.9	63.0	79.5	32.0	101.0
N178	Standing hip circumference	65.0	77.0	94.1	64.0	112.0
N758	Seat height sitting at the head	65.0	71.0	76.1	64.0	80.0
N330	Seat height sitting in the eye	56.0	61.0	67.1	54.0	71.0
N25	Seat height sitting shoulder	41.9	46.0	52.0	39.0	53.0
N312	Seat height to seated elbow to 90	14.0	17.0	21.0	11.5	24.0
N856	Sitting thigh-high	7.0	9.3	12.5	6.5	13.5
N2FGM	Height of sitting down	102.0	109.0	117.1	101.0	119.0
N4FGM	Seat height from floor to sit	36.5	37.0	40.0	36.0	41.5
N200	Back of the knee to the back of chair	32.0	35.5	40.1	30.5	44.5
N194	Length from knee to back of chair	40.0	44.5	50.1	40.0	52.0
N678	Height from floor to knee back	35.0	37.2	42.1	34.5	43.0
N529	Height from floor to knee	39.4	44.8	49.2	37.0	52.0
N381	Length from elbow to middle finger	33.0	36.5	40.0	32.0	41.0

Table 11 Results of the study on children in 4th grade boys.

Code	Name of the measure	Percentile			Minimum	Maximum
		5%	50%	95%		
N920	Weight	27.6	41.7	65.7	24.8	75.4
N805	Stature	132.5	141.5	154.0	130.0	157.0
N328	Standing eye height to	121.0	130.0	145.0	120.0	146.0
N23	Standing shoulder height	109.0	119.0	132.0	107.0	135.5
N949	Standing waist height	81.4	88.0	97.0	79.0	99.0
N80	Arm length from the wall	64.9	71.0	80.0	61.0	86.0
N122	Standing shoulder width	30.0	33.8	40.5	23.5	41.0
N223	Standing chest width	19.2	22.9	29.5	18.8	31.2
N931	Waist circumference stands	58.0	75.5	90.2	55.0	98.0
N178	Standing hip circumference	69.0	84.0	102.1	67.0	108.0
N758	Seat height sitting at the head	70.0	74.0	79.1	69.0	80.0
N330	Seat height sitting in the eye	60.0	64.0	69.5	59.0	71.0
N25	Seat height sitting shoulder	45.0	49.0	56.0	44.0	57.0
N312	Seat height to seated elbow to 90	14.0	18.0	24.1	13.0	27.0
N856	Sitting thigh-high	7.5	10.3	14.5	7.0	16.0
N2FGM	Height of sitting down	107.0	113.5	122.1	105.0	126.0
N4FGM	Seat height from floor to sit	37.0	39.5	43.0	37.0	43.0
N200	Back of the knee to the back of chair	33.0	37.8	43.0	31.0	43.5
N194	Length from knee to back of chair	42.0	47.3	54.1	41.5	56.0
N678	Height from floor to knee back	35.4	38.8	43.0	34.0	43.5
N529	Height from floor to knee	44.0	47.5	54.0	43.0	55.0
N381	Length from elbow to middle finger	35.0	38.5	42.0	34.0	43.0

Table 12 Results of the study in children 5th grade boys.

Code	Name of the measure	Percentile			Minimum	Maximum
		5%	50%	95%		
N920	Weight	29.2	41.6	73.2	27.4	82.8
N805	Stature	135.5	146.0	158.0	133.0	164.0
N328	Standing eye height to	124.0	134.0	147.0	123.0	152.0
N23	Standing shoulder height	111.5	122.0	134.0	110.5	140.0
N949	Standing waist height	83.5	91.0	100.0	80.0	102.0
N80	Arm length from the wall	67.0	72.0	81.0	64.0	83.0
N122	Standing shoulder width	31.0	34.7	40.5	30.6	42.0
N223	Standing chest width	20.0	23.0	32.0	19.2	34.5
N931	Waist circumference stands	60.0	72.0	102.0	58.0	105.0
N178	Standing hip circumference	70.0	85.0	106.0	69.0	113.0
N758	Seat height sitting at the head	70.0	75.5	82.0	69.0	83.0
N330	Seat height sitting in the eye	59.0	66.0	71.0	58.0	73.5
N25	Seat height sitting shoulder	46.0	50.0	55.0	44.0	56.0
N312	Seat height to seated elbow to 90	15.0	19.0	24.5	13.5	25.0
N856	Sitting thigh-high	8.0	11.0	15.0	7.5	16.5
N2FGM	Height of sitting down	109.0	116.0	126.0	106.0	128.0
N4FGM	Seat height from floor to sit	38.0	40.0	44.5	37.3	44.5
N200	Back of the knee to the back of chair	35.0	38.5	44.0	33.5	45.0
N194	Length from knee to back of chair	43.5	49.0	55.5	43.0	57.0
N678	Height from floor to knee back	36.0	39.5	45.0	35.5	49.5
N529	Height from floor to knee	44.5	49.0	56.5	38.5	57.0
N381	Length from elbow to middle finger	36.5	39.0	44.0	36.0	44.0

Table 13 Results of the study in children 6th grade boys.

Code	Name of the measure	Percentile			Minimum	Maximum
		5%	50%	95%		
N920	Weight	36.4	48.0	76.3	30.6	90.4
N805	Stature	141.9	151.5	167.1	140.0	173.6
N328	Standing eye height to	131.9	141.5	156.2	130.0	164.0
N23	Standing shoulder height	120.0	127.8	140.0	119.0	144.0
N949	Standing waist height	88.0	94.0	104.1	78.5	109.5
N80	Arm length from the wall	70.0	77.0	83.1	69.0	92.0
N122	Standing shoulder width	32.6	36.5	41.4	31.4	43.3
N223	Standing chest width	21.5	23.9	31.4	20.0	33.6
N931	Waist circumference stands	60.9	73.0	104.1	58.0	106.0
N178	Standing hip circumference	76.0	87.5	109.1	70.0	116.0
N758	Seat height sitting at the head	71.0	78.0	86.1	70.0	89.0
N330	Seat height sitting in the eye	62.0	68.0	76.1	62.0	78.0
N25	Seat height sitting shoulder	48.0	52.8	58.1	47.0	61.0
N312	Seat height to seated elbow to 90	16.0	20.0	25.0	15.0	27.0
N856	Sitting thigh-high	9.0	12.8	17.0	8.0	19.0
N2FGM	Height of sitting down	112.0	117.5	131.1	107.0	134.0
N4FGM	Seat height from floor to sit	37.5	41.3	46.6	36.0	48.0
N200	Back of the knee to the back of chair	35.0	40.5	47.5	33.0	56.0
N194	Length from knee to back of chair	45.4	50.3	57.1	43.0	59.0
N678	Height from floor to knee back	38.0	41.5	46.9	35.0	54.0
N529	Height from floor to knee	47.0	51.8	56.0	44.0	59.0
N381	Length from elbow to middle finger	38.5	42.0	47.1	38.0	48.0

4.- **CONCLUSIONS AND RECOMMENDATIONS**.

Currently, tools and techniques used are increasing in sophistication and accuracy. The computer has made it possible to record and process data information for immediate results in the form of clear graphics and simulations. Anthropometry has many practical uses, and some of them beginners. For example, is used to assess nutritional status, growth monitoring of children, assist the design of work environments and everyday objects, etc.

The resulting values from this study are of fundamental importance for the design elements that should be used by children in these age groups, such as furniture for schools, parks, transportation items, sports equipment, toys, clothing and so any element with which the children should live.

In Mexico there are not enough studies of child anthropometry, compared to other countries where if you have been given more importance to this sector, which is why research has focused on the child population in elementary schools from H. Caborca, Sonora.

With these records may initiate what could be the study of children at a national level as said Daniel Vergara Lope, which recommended that studies be conducted with the Mexican population, because they are imported products and equipment that did not be able to fit dimensions of Mexicans.

The data information provided in this work could be taken as a basis for further studies, which used to see changes in the physical development of infants. There are variations in weight, size of children of similar age and design for workstations, we refer them to places where children develop their daily activities.

These studies set the stage for forming a database containing the dimensions of children of elementary schools in Sonora.

BIBLIOGRAPHY

Andreasi, V., Michelin, E., Rinaldi, A. E., & Burini, R. C. (2010). Physical fitness and associations with anthropometric measurements in 7 to 15-year-old school children. *J Pediatr (Rio J), 86*(6), 497-502.

Avila R; Prado L; Gonzalez E (2001) Dimensiones Antropometrícas de población Latinoamericana. Universidad de Guadalajara. Centro de Investigación en Ergonomía.Brown, D. E., Gotshalk, L. A., Katzmarzyk, P. T., & Allen, L. (2011). Measures of adiposity in two cohorts of Hawaiian school children. *Ann Hum Biol.*

Castellucci, I. (2010). Ergonomic Design of School Furniture: Challenges for the Portuguese Schools. In M. A. Gonçalves (Ed.) (USA Publishing ed., Vol. 1, pp. 10). AHFE International: Ignacio Castellucci.

Georgia, Panagiotopoulou, Kosmas Christoulas, Anthoula Papanckolaou, Konstantinos Mandroukas (2003). Classroom furniture dimensions and anthropometric measures in primary school. Ergophysiology Laboratory, Department of Physical Education and Sports Science, Aristotle University of Thessaloniki, Thessaloniki 62100, Greece. Applied Ergonomics 35 (2004) 121–128. 2004.

González, H. M. G. (2004). Antropometría en las Aulas de Educación Primaria en el Estado de Sonora. (Congreso Internacional de ergonomía ed., pp. 21-30). Sociedad de Ergonomistas de México AC.

Habibi, E., Asaadi, Z., & Hosseini, S. M. (2011). Proportion of elementary school pupils' anthropometric characteristics with dimensions of classroom furniture in Isfahan, Iran. *J Res Med Sci, 16*(1), 98-104.

Hwa S.Jung. A prototype of an adjustable table and an adjustable chair for schools. Department of Industrial Engineering, Dongshin University, 252 Daehodong, Naju, Chonnam 520-714, Republic of Korea. International Journal of Industrial Ergonomics 35 (2005) 955–969.

Kovárová, M., Vignerová, J., Bláha, P., & Osancová, K. (2002). Bodily characteristics and lifestyle of Czech children aged 7.00 to 10.99 years, incidence of childhood obesity. *Cent Eur J Public Health, 10*(4), 169-173.

Liu, W.C., D. Sanchez-Monrroy, and G. Parga(1999) Anthropometry of Female Maquiladora Workers. Int. J. Ind. Ergonom. 24:273–280.

NASA (National Aeronautics and Space Administration), 1978. Anthropology Research Project 1978 Anthropometric Source Book, Vol. I: Anthropometry for Designers, NASA Reference Publication 1024' Webb Associates (Ed.). National Aeronautics and Space Administration Scientific and Technical Information Office, Houston, Texas, USA.

Vasquez, J., Guzman, R., & Vega, E. d. l. (2010). DESIGN ANTHROPOMETRIC REFERENCED LETTERS TO THE LABOR POPULATION OF CABORCA CITY IN SONORA MEXICO. (Sociedad de Ergonomistas de Mexico A.C. ed., Vol. 3, pp. 20-38). Ciudad Juarez Chihuahua: SEMAC.