COMPARISON OF ANTHROPHOMETRIC DATA OF IPT STUDENT WITH NON STUDENT WITH AGES OF 18-25 YEARS

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Abstract

Nowadays, industrial have faced the lacks of anthropometric data for making furniture. Anthropometry can be defined as a study of a human body dimension. Anthropometric data is used in designing area of clothing design, workspace design, environment design, design of equipment, tools, and machinery, and also in designing consumer product design. Anthropometry data is used in application to design something that will give comfortable to people with their working space to prevent danger, damages, and any unnecessary activity. The objective of this study is to gather the data of human body measurement as a collection for local anthropometric data for industrial to making furniture based on the anthropometric measurement. The measurement of human body was gather from UITM student and has been compare with non-student, that are working around Bandar Jengka region. As a conclusion, from the collecting data from my respondent, we can gather new data for anthropometric measurement for industrial furniture making. The ranges between the two variables are not very different, only small standard deviation is being gain from the result has been analyzed.

Keywords: anthropometric, working space, measurement

INTRODUCTION

In general Anthropometry can be defined as a study of a human body dimension. Human body measurements are very different in sizes and builds. Anthropometry data can be obtained by measuring the body parts, body sizes and also body potion (B. Mustafa, 1992). In anthropometry study also consider on collecting data on body segment masses, the center gravity of body segments, and the ranges of joint motion, which are used in biomechanical analyses of work and postures (Eastman Kodak Company, 1992). Another term that related to the anthropometry is also known as Kinanthropometry.Kinanthropometry is defined as the study of human size, shape, proportion, composition, maturation, and gross function, in order to understand growth, exercise, performance, and nutrition (Brenda Tsang et al, 1998).

Anthropometric and kinanthropometry is concerned with the measurement of individuals in a variety of morphological perspectives, its application to movement and those factors which influence movement, including also the components of body build, body measurements, proportions, composition, shape and maturation, motor abilities and cardiorespiratory capacities, physical activity including recreational activity as well as highly specialized sports performance. The predominant focus is upon obtaining detailed measurements upon the body composition are the interface between anatomy and movement. It is the application of a series of measurements made on the body and from these we can use the data that we gather directly or perform calculations using the data to produce various indices and body composition predictions and to measure and describe physique (Brenda Tsang et al., 1998).

LITERATURE REVIEW

Anthropometric in the definition of word derived from the Greek word "antropo" that give a meaning for human and the combination with another Greek word "metron" the word that define as a measurement. The field of anthropometry encompasses a variety of human body measurements (NHANES, 2007). Ergonomic can be term as a study of work. More specifically is the science of designing the job fit to the worker, rather than physically forcing the workers body to fit the job. Adapting tasks, work stations, tools and equipment to fit the worker can help to reduce the physical stress on a workers body and eliminate many potentially serious, disabling works related musculoskeletal disorders. Ergonomics draw on a number of scientific disciplines, including physiology, biomechanics, psychology, anthropometry, industrial hygiene and kinesiology (OSHA, 2000).

Basic Ergonomic Principles for Workstation Design and Work Postures "If it feels right, it probably is right. If it feels uncomfortable, there is probably something wrong with the design, not the worker". (ILO, 1996)

As mentioned above, with a properly designed workstation, a worker should be able to maintain a proper and comfortable work posture, thereby preventing a variety of health problems such as back injury, development of RSI and circulatory problems in the legs caused by poorly designed seats, long period of standing, reaching too far and inadequate lighting. Below are some general basic ergonomic principles for workstation design.

Head height

• Allow adequate space for the tallest possible worker.

• Position displays at or below eye level because people naturally look slightly downward.

Shoulder Height

• Control panels should be placed between shoulder and waist height.

• Avoid placing above shoulder height objects or controls that are used often.

Arm reach

• Place items within the shortest arm reach to avoid over-stretching while reaching up and outward.

• Position items needed for work so that the tallest worker does not need to bend while reaching down.

• Keep frequently used materials and tools close to and in front of the body.

Elbow height

• Adjust work surface height so that it is at or below elbow height for most job tasks.

Hand height

• Make sure that items that have to be lifted are kept between hand and shoulder height.

Leg length

• Adjust chair height according to leg length and the height of the work surface.

• Allow space so that legs can be outstretched, with enough space for long legs.

• Provide an adjustable footrest so that legs are not dangling and to help the worker change body position.

Hand size

• Hand grips should fit hands. Small hand grips are needed for small hands, larger hand grips for bigger hands.

• Allow enough work space for the largest hands.

Body size

• Allow enough space at the workstation for the largest worker.

(ILO, 1996)

MATERIALS AMD METHODOLOGY

This paper project is based on collecting the anthropometric data. All the data is measured by thirteen dimensions of a body part. The thirteen dimension that will be taken are: stature, shoulder breadth, chest depth, sitting height, sitting eye height, sitting shoulder height, popliteal height, sitting knee height, forearm hand length, sitting elbow height, thigh clearance, buttock breadth and head length. Stature, shoulder breadth, chest depth and head length will be taken in standing position and the rest will be taken in sitting position. This data are collected because they are related to the chair and table designing process.These thirteen anthropometry data are measured because they aredirectly related in designing furniture. Four dimensions were collectedwhile the participants in the standing position, the remaining eight dimensions were taken while theparticipants remained seated. All anthropometric data collected were based on MS ISO 7250 (2003)standard (Malaysian Standard, 2003).

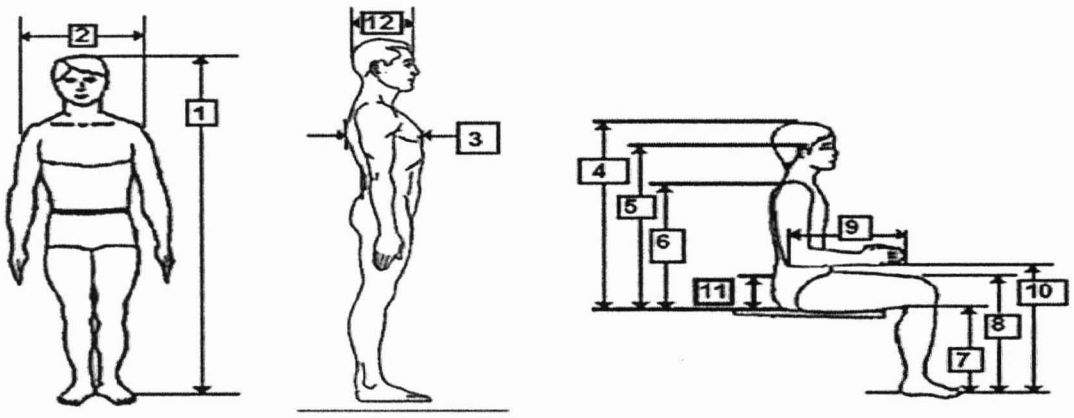

Figure 1: Thirteen Measured Anthropometric Data

The equipment has been used to gather data from human body are measuring tape, Vanier caliper, long ruler and portable height scale. Then the data were analyzed using SPSS for windows 11.5 and SPC for excel.

RESULTS AND DISCUSSIONS

From the data has been gathered from 100 respondent can be shown by the table has been given. The tables are including with mean, standard deviation, 5^{th} percentile and 95^{th} percentile. From table 1, it has shown the anthropometric data for male student. The tables had shown the value of means, standard deviation, 5^{th} percentile and 95^{th} percentile.

Table 1: Data of male student

DIMENSIONS	Mean	S.D	α	5^{th} percentile	95^{th} percentile
1. stature	1647.2	78.6	129.7	1517.50	1776.90
2. shoulder breadth	423.12	22.4	36.9	386.18	460.06
3. chest depth	210.56	30.3	49.9	160.63	260.49
4. sitting height	875.2	34.7	57.2	818.02	932.38
5. sitting eye height	762	32.1	53.0	708.99	815.01
6. sitting shoulder height	565.4	41.2	67.9	497.45	633.35
7. popliteal height	425.6	19.2	31.7	393.92	457.28
8. sitting knee height	518	27.0	44.5	473.48	562.52
9. forearm hand length	455.6	23.2	38.2	417.38	493.82
10. sitting elbow height	604.4	41.8	68.9	535.48	673.32
11. thigh clearance	116	17.7	29.1	86.86	145.14
12. head length	180.44	16.9	27.8	152.59	208.29
13. buttock breadth	331.44	22.5	37.2	294.27	368.61

Note: All linear dimension are in mm; S.D=standard deviation,

From the table 2, it has shown the anthropometric data for female student. The tables had shown the value of means, standard deviation, 5th percentile and 95th percentile.

Table 2:Data of female student

DIMENSION	Mean	S.D	α	5^{th} percentile	95^{th} percentile
1. stature	1549.6	51.6	85.1	1464.50	1634.70
2. shoulder breadth	372.64	24.8	40.9	331.71	413.57
3. chest depth	220.6	23.5	38.7	181.89	259.31
4. sitting height	790.44	30.2	49.9	740.55	840.33
5. sitting eye height	658	46.7	77.1	580.89	735.11
6. sitting shoulder height	530	45.4	75.0	455.04	604.96
7. popliteal height	410	17.2	28.4	381.61	438.39
8. sitting knee height	490	20.0	33.0	457.00	523.00
9. forearm hand length	418	19.6	32.3	385.67	450.33
10. sitting elbow height	644.4	20.8	34.3	610.08	678.72
11. thigh clearance	205.6	27.4	45.3	160.33	250.87
12. head length	176.84	13.2	21.7	155.14	198.54
13. buttock breadth	335.76	25.7	42.5	293.28	378.24

Note: All linear dimension are in mm; S.D=standard deviation,

From table 3 and table 4, it has shown the anthropometric data for male non-student and data for female non-student. The tables have shown the value of means, standard deviation, 5^{th} percentile and 95^{th} percentile.

Table 3:Data of male non-student

DIMENSION	Mean	S.D	α	5^{th} percentile	95^{th} percentile
1. stature	1694.00	42.24	69.69	1624.31	1763.69
2. shoulder breadth	420.24	26.75	44.14	376.10	464.38
3. chest depth	223.48	23.38	38.58	184.90	262.06
4. sitting height	876.00	41.67	68.75	807.25	944.75
5. sitting eye height	773.60	41.75	68.89	704.71	842.49
6. sitting shoulder height	620.00	34.87	57.54	562.46	677.54
7. popliteal height	431.60	14.88	24.55	407.05	456.15
8. sitting knee height	529.20	19.58	32.31	496.89	561.51
9. forearm hand length	466.00	28.57	47.13	418.87	513.13
10. sitting elbow height	608.00	35.78	59.03	548.97	667.03
11. thigh clearance	138.40	26.79	44.20	94.20	182.60
12. head length	176.08	32.96	54.38	121.70	230.46
13. buttock breadth	329.52	31.91	52.65	276.87	382.17

[a]Note: All linear dimension are in mm; S.D=standard deviation,

Table 4: Data of female non-student

DIMENSION	Mean	S.D	A	5^{th} percentile	95^{th} percentile
1. stature	1564.40	59.40	98.01	1466.39	1662.41
2. shoulder breadth	388.96	40.29	66.47	322.49	455.43
3. chest depth	232.16	55.29	91.23	140.93	323.39
4. sitting height	804.40	45.70	75.41	728.99	879.81
5. sitting eye height	670.40	51.18	84.45	585.95	754.85
6. sitting shoulder height	534.80	55.87	92.18	442.62	626.98
7. popliteal height	418.40	16.66	27.48	390.92	445.88
8. sitting knee height	498.00	23.49	38.77	459.23	536.77
9. forearm hand length	424.80	17.92	29.56	395.24	454.36
10. sitting elbow height	652.00	28.84	47.59	604.41	699.59
11. thigh clearance	208.40	34.26	56.52	151.88	264.92
12. head length	179.20	17.02	28.09	151.11	207.29
13. buttock breadth	337.24	43.34	71.52	265.72	408.76

Note: All linear dimension are in mm; S.D=standard deviation,

From the table 5, it can be seen the differentiate between the two samples. We can see the large differentiate on the means of the stature, which means the standard deviation of this two sample at 65.09 and 50.82. Then it follows by value of shoulder breadth and chest depth. The values of standard deviation of this two dimension of data collecting are 23.59 for student and 33.52 for non-student whereby chest depth are 26.86 for student and 39.33 for non-student.

Table 5: Comparisons data of all students and all non-students

		All student				All non-student			
	DIMENSION	Mean	S.D	5^{th}	95^{th}	Mean	S.D	5^{th}	95^{th}
1.	stature	1598.4	65.09	1491.00	1705.80	1629.2	50.82	1545.35	1713.05
2.	shoulder breadth	397.88	23.59	358.95	436.81	404.6	33.52	349.29	459.91
3.	chest depth	215.58	26.86	171.26	259.90	227.82	39.33	162.92	292.72
4.	sitting height	832.82	32.45	779.28	886.36	840.2	43.68	768.12	912.28
5.	sitting eye height	710	39.43	644.94	775.06	722	46.47	645.33	798.67
6.	sitting shoulder height	547.7	43.31	476.25	619.15	577.4	45.37	502.54	652.26
7.	popliteal height	417.8	18.20	387.77	447.83	425	15.77	398.98	451.02
8.	sitting knee height	504	23.49	465.24	542.76	513.6	21.54	478.06	549.14
9.	forearm hand length	436.8	21.38	401.52	472.08	445.4	23.24	407.05	483.75
10.	sitting elbow height	624.4	31.28	572.78	676.02	630	32.31	576.69	683.31
11.	thigh clearance	160.8	22.55	123.59	198.01	173.4	30.52	123.04	223.76
12.	head length	178.64	15.01	153.87	203.41	177.64	24.99	136.40	218.88
13.	buttock breadth	333.6	24.14	293.77	373.43	333.38	37.63	271.29	395.47

Note: All linear dimension are in mm; S.D=standard deviation,

From table 6, the data has been gather from two samples are shown the large differentiate between standard deviation of stature male student and male non-student. The values are at 78.6 and 42.24. Then if look at the sitting eye height and sitting height, each data shown the result at 32.1 for male student and 41.75 for male non-student

Table 6: Comparisons data of male student and male non-student

		male student				male non-student			
	DIMENSION	Mean	S.D	5^{th}	95^{th}	Mean	S.D	5^{th}	95^{th}
1.	stature	1647.2	78.6	1517.50	1776.90	1694.00	42.24	1624.31	1763.69
2.	shoulder breadth	423.12	22.4	386.18	460.06	420.24	26.75	376.10	464.38
3.	chest depth	210.56	30.3	160.63	260.49	223.48	23.38	184.90	262.06
4.	sitting height	875.2	34.7	818.02	932.38	876.00	41.67	807.25	944.75
5.	sitting eye height	762	32.1	708.99	815.01	773.60	41.75	704.71	842.49
6.	sitting shoulder height	565.4	41.2	497.45	633.35	620.00	34.87	562.46	677.54
7.	popliteal height	425.6	19.2	393.92	457.28	431.60	14.88	407.05	456.15
8.	sitting knee height	518	27.0	473.48	562.52	529.20	19.58	496.89	561.51
9.	forearm hand length	455.6	23.2	417.38	493.82	466.00	28.57	418.87	513.13
10.	sitting elbow height	604.4	41.8	535.48	673.32	608.00	35.78	548.97	667.03
11.	thigh clearance	116	17.7	86.86	145.14	138.40	26.79	94.20	182.60
12.	head length	180.44	16.9	152.59	208.29	176.08	32.96	121.70	230.46
13.	buttock breadth	331.44	22.5	294.27	368.61	329.52	31.91	276.87	382.17

Note: All linear dimension are in mm; S.D=standard deviation, 5^{th} percentile and 95^{th} percentile

From table 7, the data has been gathering from two samples, female student and female non-student are shown the shoulder breadth and chest depth are large value. Shoulder breadth show 24.8 for female student while 40.29 for female non-student. Then, the value of chest depth show 23.5 for female student while 55.29 for female non-student.

Table 7: Comparisons data of female student and female non-student

		female student				female non-student			
	DIMENSION	Mean	S.D	5^{th}	95^{th}	Mean	S.D	5^{th}	95^{th}
1.	stature	1549.6	51.6	1464.50	1634.70	1564.40	59.40	1466.39	1662.41
2.	shoulder breadth	372.64	24.8	331.71	413.57	388.96	40.29	322.49	455.43
3.	chest depth	220.6	23.5	181.89	259.31	232.16	55.29	140.93	323.39
4.	sitting height	790.44	30.2	740.55	840.33	804.40	45.70	728.99	879.81
5.	sitting eye height	658	46.7	580.89	735.11	670.40	51.18	585.95	754.85
6.	sitting shoulder height	530	45.4	455.04	604.96	534.80	55.87	442.62	626.98
7.	popliteal height	410	17.2	381.61	438.39	418.40	16.66	390.92	445.88
8.	sitting knee height	490	20.0	457.00	523.00	498.00	23.49	459.23	536.77
9.	forearm hand length	418	19.6	385.67	450.33	424.80	17.92	395.24	454.36
10.	sitting elbow height	644.4	20.8	610.08	678.72	652.00	28.84	604.41	699.59
11.	thigh clearance	205.6	27.4	160.33	250.87	208.40	34.26	151.88	264.92
12.	head length	176.84	13.2	155.14	198.54	179.20	17.02	151.11	207.29
13.	buttock breadth	335.76	25.7	293.28	378.24	337.24	43.34	265.72	408.76

Note: All linear dimension are in mm; S.D=standard deviation, 5^{th} percentile and 95^{th} percentile

CONCLUSIONS

A good data of anthropometric can be more useful to the industrial for making furniture to make sure the furniture has been finish can be comfortable to the user. It is also can be a factor to make sure the quality in production management. Then if the anthropometric has been followed, it can reduce the problems such as fatigue, lack of focus; decrease of study or work performance and the main risk is musculoskeletal disorder such as lower back pain and upper back pain.

In conclusion, from the result gathered based on thirteen bodies measurement has been taken from 100 respondent, student and non-student in the range of age from 18 years old to 25 years old. The result showing the comparison between student and non-student was not very different. The means of every measurement show very small value if it was being compared. So the result show the mean for physical dimension is significant between student and non-student. So the effect of interaction people between environment such as nutritional factors, workplace factors, lifestyle and others factors not bring a big effect to the people. Normally in Malaysia have a same lifestyle between each other's. This data also has been compared to the existing data from Deros et al (2009). The data show the same trend with the existing data.

For recommendation, when the measurement of the body dimension must be done in close room and it must be taken by the same gender, for example male taken by male. Then, the close room also needed to give some privacy to the respondent to make sure the measurement more accurate. This is because the respondent can give more concentrate during their body are measure. For the equipment for gathering data collection process, use the scientific tools to get an accurate measure.

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