International Journal of Engineering & Scientific Research
Vol. 6 Issue 2, February 2018,
ISSN: 2347-6532 Impact Factor: 6.660
Journal Homepage: http://www.esrjournal.com Email: esrjeditor@gmail.com Double-
Blind Peer Reviewed Refereed Open Access International Journal - Included in the International Serial Directories Indexed & Listed at:
Ulrich's Periodicals Directory ©, U.S.A., Open J-Gage as well as in Cabell's Directories of Publishing Opportunities, U.S.A

Effect of Continuous Sitting by High School Girl Students

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ABSTRACT

Ergonomics is the science of "fitting the man to the Environment" or the adaptation of tasks and tools to fit the user. Ergonomics covers all aspects of a job from physical stress to environmental factors. Ergonomic design is the practice of creating workplaces, machines and tasks to match the capabilities and limitation of the human body.

The present study was envisioned to review of existing Furniture for high school children in Bangalore city. The objectives of the study were to measure the dimensions of furniture provided at the school, to study the anthropometric measurements of the children, to find out the comfortability of the furniture among the children. The sample size for the present study was 150 girl students from Bangalore city out of which75 students each belonging to government school and Private school were chosen. Purposive random sampling method was used for the survey. Data was collected through a structured interview schedule. 2 government school and 3 private schools were selected upon willingness.

Results for the present study revealed that most of the respondents used furniture type 6 in government schools and furniture type 1 to 5 in private schools. Wooden furniture was mostly used by both. There was a significant variation in standing anthropometric measurements like maximum arm reach, functional reach and total arm span and in sitting anthropometric measurements like sitting height, eye height, mid-shoulder height, thigh clearance, popliteal height and buttock-knee length. The girl students were very conscious and uncomfortable to sit during their menstruation period. It was found that students of both government and private managements were not comfortable sitting in classroom furniture for longer hours due to which they suffered from back pain.

Key Words: School Furniture, Government School, Private School, Girl students

INTRODUCTION

Ergonomics is the science of refining the design of products to optimize them for human use. Human characteristics, such as height, weight and proportions are considered, as well is information about human hearing, sight, temperature preferences, and so on. Ergonomics is sometimes known as human factors engineering (Margaret Rouse, 2007).

Compatibility is a key word in ergonomics. For effective functioning of a work system comprising man, machine (job) and environment, compatibility should be ensured. Two factors are very important in this respect; job demand (i.e., workload), human capabilities and limitations. When one of the components in the system is the manual work the demand-fitness compatibility should be looked into from physiological considerations.

METHODOLOGY

The aim of the study was to find out the Health Effect of Continuous Sitting by High School Girl Students in Bangalore City. The objective for the study was to measure the dimensions of furniture provided at the school, to study the anthropometric measurements of the children and to find out the comfortability of the furniture among the children. It was hypothesized that the furniture provided is comfortable for the High school children

Survey method was used for the study.An interview schedule was developed to elicit information from the respondents. It included close ended questions that was administered personally.

Anthropometric Measurements: height & weight (in cm).

Standing Measurements: eye height, acromial height, waist height, elbow height, buttock height, liable height, ankle height, maximum arm reach, functional reach, overhead grasp, total arm span.

- Sitting Measurements: sitting height, eye height, mid-shoulder height, elbow rest height, upper lumbar, lower lumbar, thigh clearance, popliteal height, buttock popliteal height, buttock knee length, thigh-to-thigh length.
- **Specific Information:** Specific information included questions like the well spread of the furniture's, comfort and discomfort due to sitting for long hours and so on.

The sample for the present study consisted of 150 high school girl students in the age group of 13 to 15 years. Hence, Girl students in 8^{th} and 9^{th} standard were identified for the study. The sample included 75 students each from two government schools and three private schools. The samples schools were randomly selected based on the willingness and cooperation of the management to be part of the study.

RESULTS AND DISCUSSIONS:

TABLE 1 Age and Class of the Students

N = 150

Characteristics	Category	Respondents						χ^2 Test
		Government (n=75)		Private (n=75)		Combined (N=150)		
		N	%	N	%	N	%	
Age group (years)	13 Years	11	14.7	28	37.3	39	26.0	18.40^{*}
	14 Years	38	50.7	40	**53.3**	78	52.0	
	15 Years	40	**53.3**	7	9.3	47	3.3	
Class	8^{th} std	31	41.3	42	**56.0**	73	48.7	3.23^{NS}
	9^{th} std	44	**58.7**	33	44.0	77	51.3	
Total		75	100.0	75	100.0	150	100.0	

*Significant at 5% level NS: Non-significant

It can be observed from table-1 that 53.3 percent each of the respondents from government and private school were in the age group of 15 and 14 years respectively. About 58.7 percent of the government school students were in class 9^{th} while 56.0 percent of the students from private school were in class 8^{th}. Statistical analysis by application of chi-square test reveals that there is significant variation in the age of the students from government and private schools.

TABLE 2 Family members and Monthly income

N=150

Characteristics	Category	Respondents						χ^2 Test
		Government (n=75)		Private (n=75)		Combined (N=150)		
		N	%	N	%	N	%	
No. of Family members	3-4	11	1.7	17	22.7	28	18.7	1.78^{NS}
	5-6	44	**58.7**	42	**56.0**	86	57.3	
	7+	20	26.7	16	21.3	36	24.0	
Family Income/month (Rupees)	<Rs. 10,000	56	**74.7**	0	0.0	56	37.3	102.31^{*}
	Rs. 10,001-30,000	19	25.3	32	42.7	51	34.0	
	>Rs. 30,000	0	0.0	43	**57.3**	43	28.7	
Total		75	100.0	75	100.0	150	100.0	

*Significant at 5% level, NS: Non-significant

It is clear from the above table that 58.7 percent and 56.0 percent of government and private schools students' families consist of 5-6 members. Statistical analysis by application of chi-square test reveals that there is no significant variation in the number of family members of the students from government and private schools. (Table 4.2)

Majority of the government school students' family's (74.7 percent) earned a monthly income of less than Rs.10,000 whereas 57.3 percent of family income/month of the students' belonging to private schools was more than Rs. 30,000. Statistical analysis by application of chi-square test reveals that there is a significant variation in the monthly family income earned by the families of student coming from government and private schools.

TABLE 3 Furniture Types

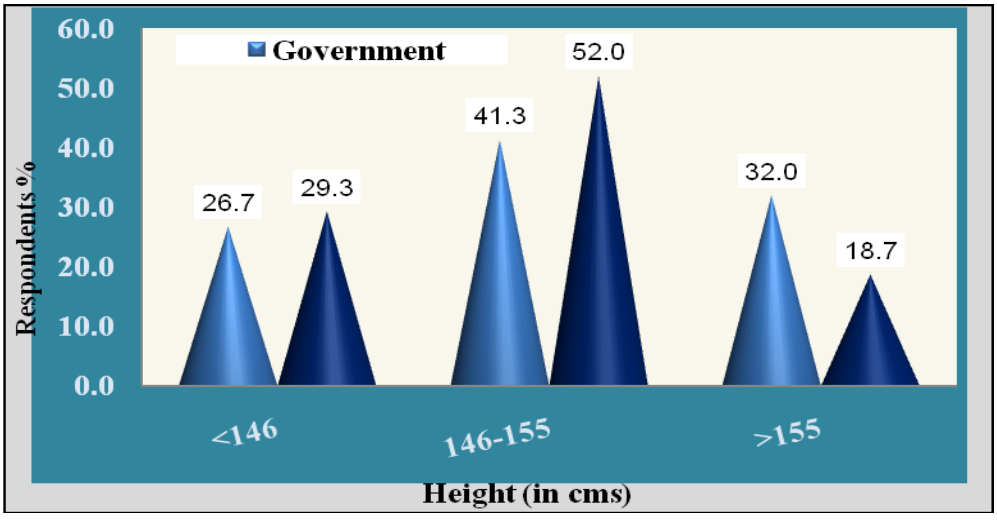
N = 150

Furniture type	Respondents					
	Government (n=75)		Private (n=75)		Combined (N=150)	
	N	%	N	%	N	%
1-5	0	0.0	75	**100.0**	75	50.0
6	75	**100.0**	0	0.0	75	50.0
Total	75	100.0	75	100.0	150	100.0

It is observed from the above table that cent percent of the students from government school use furniture type. 6 and cent percent of the students from private school were using furniture type 1 to 5.

Figure-1 Heights of the Students

N=150



It is observed from the above graph that the height of 41.3 percent and 52.0 percent of the students from government and private schools respectively was 146-155 cm and moderate percentage (32.0%) of the students from government schools are >155 cm height while 29.3 percent of the students from private school are <146 cm of height.

TABLE 4 Weights of the Students

N = 150

Weight (kg)	**Respondents**						**$\chi 2$ Test**
	Government (n=75)		**Private (n=75)**		**Combined (N=150)**		
	N	**%**	**N**	**%**	**N**	**%**	
<40	32	**42.7**	17	22.7	49	65.3	
41-50	27	36.0	40	**53.3**	67	89.3	7.23*
>50	16	21.3	18	24.0	34	45.3	
Total	75	100.0	75	100.0	150	100.0	

*Significant at 5% level

It is clear from the above data collected that highest percentage (42.7%) of the students from government schools weight <40 kg, while 53.3 percent of the students from private school weight between 41-50 kg.

Statistical analysis by application of chi-square test reveals that there is significant variation in the weight of the students from government and private schools.

TABLE 5 Standing Anthropometric Measurements of the Students

N = 150

Standing measurement	Respondents				't' Test
	Government (n=75)		Private (n=75)		
	Mean	SD	Mean	SD	
Eye height	143.6	7.3	143.4	6.1	0.19^{NS}
Acromial height	128.5	13.1	128.4	4.8	0.08^{NS}
Waist height	102.5	5.6	103.2	5.3	0.80^{NS}
Elbow height	98.3	4.9	98.9	4.2	0.80^{NS}
Buttock height	75.1	3.6	74.8	3.7	0.54^{NS}
Lateral height	49.1	3.9	48.2	3.6	1.38^{NS}
Ankle height	8.4	1.0	8.2	1.3	1.10^{NS}
Maximum arm reach	70.2	6.8	67.3	3.3	3.34^{*}
Functional reach	80.8	5.8	83.4	4.1	3.09^{*}
Overhead grasp	184.	8.7	183.2	9.93	1.10^{NS}
Total arm span	154.8	7.9	158.4	9.1	2.58^{*}

*Significant at 5% level NS: Non-significant

From table 5 it is seen that there is a significance difference of anthropometric measurements between the selected samples in maximum arm reach, functional reach, and total arm span. While there is no significance difference between eye height, acromial height, waist height, elbow height, buttock height, lateral height and ankle height followed by overhead grasp.

TABLE 6 Sitting Anthropometric Measurements of the Students

N = 150

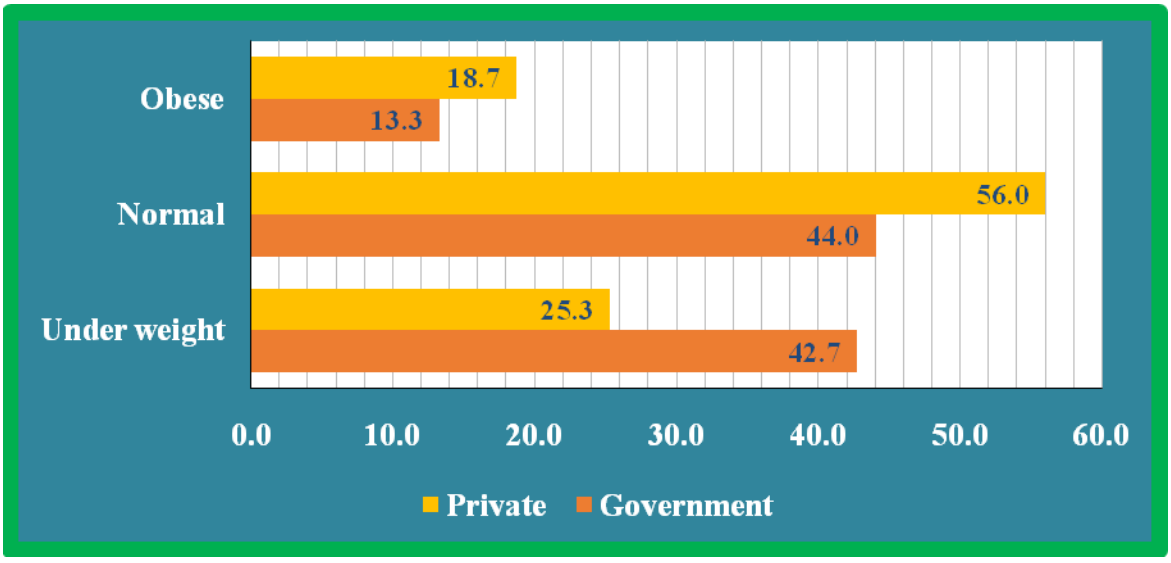
Sitting measurement	Respondents				't' Test
	Government(n=75)		Private(n=75)		
	Mean	SD	Mean	SD	
Sitting height	82.1	4.5	83.6	4.5	2.03*
Eye height	69.4	5.4	724	5.0	3.58*
Mid shoulder height	50.3	4.6	52.7	3.6	3.57*
Elbow rest height	21.7	4.1	21.0	3.2	1.24NS
Upper lumbar	28.9	3.7	29.8	3.3	1.68NS
Lower lumbar	19.3	4.3	18.4	3.3	1.42NS
Thigh clearance	19.8	3.9	18.6	3.3	2.01*
Popliteal height	50.7	4.2	48.0	5.1	3.58*
Buttock popliteal height	53.8	7.0	55.6	4.7	1.80NS
Buttock knee length	63.5	7.2	67.0	5.7	3.30*
Thigh-to-thigh length	18.6	3.8	18.0	4.0	0.92NS

*Significant at 5% level, NS: Non-significant

It is proved from table 6 that there is a significance differences in anthropometric measurement between government and private school students in sitting height, eye height, mid shoulder height, thigh clearance, popliteal height and buttock-knee length whereas, there is so no significance difference between elbow rest height, upper lumbar, lower lumbar, buttock popliteal height and thigh-to thigh length.

Figure 2Body Mass Index of the Students

N = 150



NS: Non-significant

Figure 2 depicts the body mass index of the students. 44.0 percent and 56.0 percent of the students from government and private schools are of normal weight.

Statistical analysis by application of chi-square test reveals that there is no significant difference in the body mass index of the students from government and private schools.

TABLE 5 Materials used for Furniture

N = 150

Aspects	Response	Respondents						χ^2 Test
		Government (n=75)		Private (n=75)		Combined (N=150)		
		N	%	N	%	N	%	
Furniture in classroom well spread	Yes	8	10.7	18	24.0	26	17.3	4.65*
	No	67	**89.3**	57	**76.0**	124	82.7	
Material of furniture	Wooden	75	**100.0**	67	**89.3**	142	94.7	8.45*
	Steel	0	0.0	8	10.7	53.3	53.3	
Total		75	100.0	75	100.0	150	100.0	

NS: Non-significant

According to table 5, 89.3 percent of the classrooms in government schools and 76.0 percent of the private school's classroom furniture's are not well spread. Cent percent of government schools and 89.3 percent of the private schools use wooden furniture in their classrooms.Chi-square analysis reveals that there is a significant difference in the furniture materials used in classroom for students in government and private schools.

TABLE 6 Awareness of Ergonomically Designed Furniture

N = 150

Aspects	Response	Respondents						χ^2 Test
		Government (n=75)		Private (n=75)		Combined (N=150)		
		N	%	N	%	N	%	
Aware of Ergonomically designed	Yes	11	14.7	22	29.3	33	22.0	4.70*
	No	64	**85.3**	53	**70.7**	117	78.0	

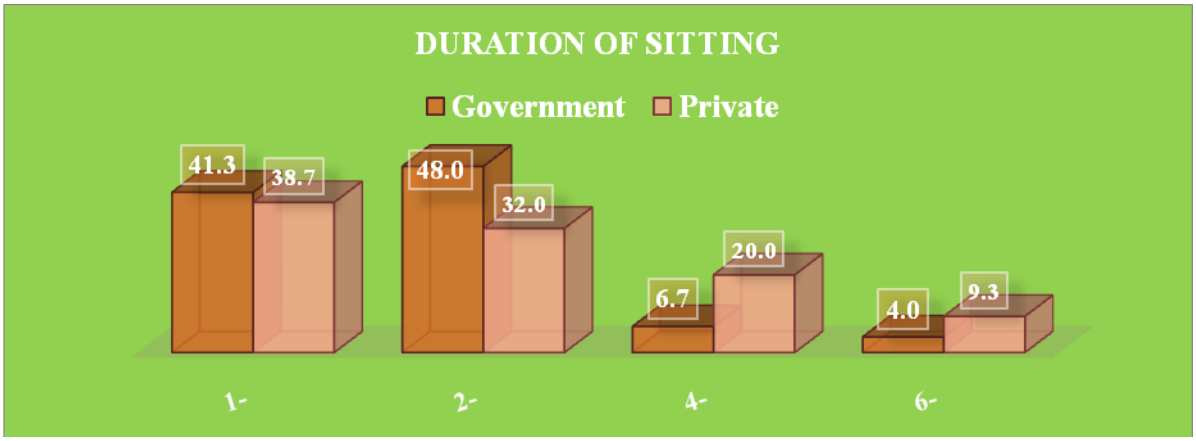
*Significant at 5% level

It is evident from the above table that majority i.e., 85.3 percent and 70.7 percent of the students from private and government school are not aware of ergonomically designed furniture's.

But statistical analysis by application of chi-square test reveals that there is a significant difference in the awareness among the students belonging to government and private schools regarding availability of ergonomically designed furniture.

FIGURE.3: DURATION OF CONTINOUS SITTING IN A DAY

N=150



In the above table it is seen about 48.0 percent of the students from government schools sit continuously for about 2-4 hours against 38.7 percent of the students from private schools sitting continuously only for about 1-2 hours.

Statistical analysis by application of chi-square test reveals that there is a significant difference in the duration of sitting in a day by the students from government and private schools.

TABLE 9 Health Effect of Sitting Long Duration

N = 150

Aspects	Effects	Respondents						$\chi 2$ Test
		Government (n=75)		Private (n=75)		Combined (n=150)		
		N	%	N	%	N	%	
Sitting in a static posture affects health	Yes	35	46.7	17	22.7	52	34.7	9.54*
	No	40	**53.3**	58	**77.3**	98	65.3	
Health effect of sitting long duration	Back pain	40	**53.3**	33	**44.0**	73	48.7	7.86*
	Leg pain	9	12.0	12	16.0	21	14.0	
	Elbow pain	4	5.3	0	0.0	4	26.7	
	Neck pain	2	2.6	4	5.3	6	4.0	
	Any other	1	1.3	0	0.0	1	0.6	
	None of the above	19	25.3	26	34.7	45	3.0	

*Significant at 5% level

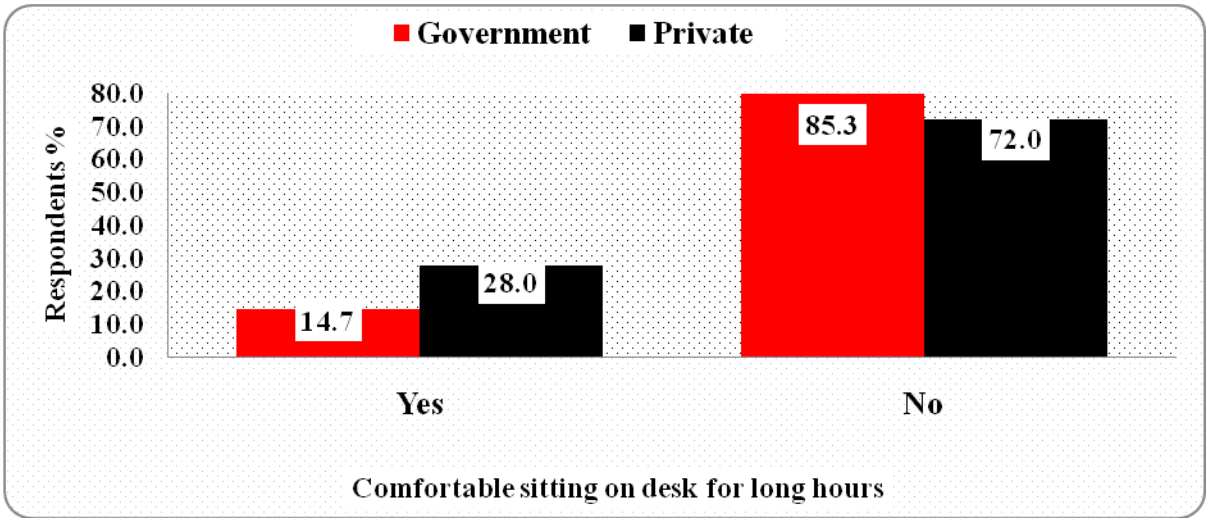
It is seen from the above table that 53.3 percent and 77.3 percent from government and private schools students' health is affected by sitting in a static posture.

Statistical analysis by application of chi-square test reveals that there is a significant difference in the static posture of the students from government and private schools.

It was found that the students experienced a lot of discomforts for sitting long hours. About 53.3 percent and 44.0 percent of the students from government and private schools suffer from back pain while sitting on their classroom desk, against 25.3 percent and 34.7 percent of the students from government and private schools who do not suffer any discomforts like back pain, leg pain, elbow pain, neck pain and so on whilst sitting on classroom desk.

FIGURE 4 Comfort Level of Furniture

N = 150



*Significant at 5% level,

Above graph confirms that 85.3 percent and 72.0 percent of the students from government and private schools respectively are not comfortable sitting for longer duration.

Statistical analysis by application of chi-square test reveals that there is a significant difference in the level of comfortlessness expressed by the students of government and private schools while sitting on the classroom furniture.

SUMMARY AND CONCLUSION

To find out the comfort level of the furniture among the high school girl children.Cross sectional survey was conducted from different schools. Survey method and questionnaire was the tool used for obtaining the required information. The sample for the study consisted of 150 high school children, out of which 75 each were from government schools and private schools.

It was seen that most of the respondents from government and private schools were in the age group of 15 and 14 years. And highest percentage of the government school students were in class 9th while 56 percent of the students from private schools were in class 8th.

It was clear fromthat maximum number of government and private schools students' families consist of 5-6 members. Majority of the government school students' family's earned a monthly income of less than Rs. 10,000, whereas 57.3 percent of family income/month of the students' belonging to private schools was more than Rs. 30,000.

It was proved that cent percent of the students from government school use furniture type. 6 and cent percent of the students from private school used furniture type 1-5.

It was observed from the data collected that moderate percentage of the students from government schools are of >155 cm height, while 29.3 percent of the students from private school are of <146 cm of height. The highest percentage of the students from government schools weight <40 kg, while 53.3 percent of the students from private school weight between 41-50 kg.

The body mass index of the students depicts that most percent of the students from government and private schools are of normal weight. Cent percent of government schools and high percent of the private schools use wooden furniture in their classrooms.

Highest percentage of the students from private and government school were not aware of ergonomically designed furniture's.It wasobserved that about many students from government schools sit continuously for about 2-4 hours against moderate students from private schools sitting continuously only for about 1-2 hours.

Many students from government and private schools suffer from back pain while sitting on their classroom desk. It was seen that most of the students from government and private schools do not prefer sitting for longer duration. It was found that the students experienced a lot of discomforts for sitting long hours.

CONCLUSION: There is a significant difference between standing and sitting anthropometric measurements among government and private school students. The furniture provided for students in schools are not comfortable and most of them experienced discomfort sitting for long durations

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