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**A Study Assessing on Health-Related Physical Fitness of School
Children with The Components of Muscular Strength and
Endurance**

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Abstract:

The assessment-based study on Muscular Strength and endurance on health-related physical fitness was conducted with an objective of understanding the health-related fitness profile of school children of four districts of lower Assam. With 14.4 million obese children, India stands as the second largest country in the world and it is next to China as the home for obese children. Through various study and research, it is emerged as an established fact that obesity is linked to heart disease, high blood pressure, diabetes, respiratory problem and slow mental growth etc. In the study, schools were selected by using purposive sampling in consideration of feasibility aspect. The sample size of the study was 1000 school children comprising of government school and private school with age range of 6 to 10 years. It is concluded in the study by its findings that government school children carry higher significance on muscular strength and endurance than that of private school counterparts.

Keywords: Muscular strength, Muscular endurance, Obesity etc.

Introduction

The global issue of childhood obesity is becoming worse. Alarmingly, in certain western nations, it affects more than 18% of youngsters. Obesity in children is becoming a major global health concern. According to a World Health Organization (WHO) research, worldwide rates of childhood obesity have nearly tripled since 1975. The survey also claims that among children and adolescents aged 5 to 19 years, the prevalence of overweight and obesity shockingly soared from only 4% in 1975 to just 18% in 2016. (WHO, 2016). According to the National Family Health Survey of India (NFHS-5) conducted in 2019–21, 3.4% of children under the age of five are now overweight, up from 2.1% in 2015–16. According to the WHO estimation, 39 million children under the age of 5 were overweight or obese in the world in 2000. In 2016, there were more than 340 million children and adolescents aged 5 to 19 who were overweight or obese.

As a developing nation, India has recently seen a double burden of diseases, including childhood and adolescent obesity on the one hand and the threat of non-communicable diseases, malnutrition, and overweight on the other (Rajanitt et.al. 2016). The bulk of overweight and obese children reside in developing nations, where the rate is higher than that of industrialised nations by more than 30%. (WHO Report, 2018). The bulk of overweight and obese children reside in developing nations, where the rate is higher than that of industrialised nations by more than 30%. (WHO Report, 2018). Children and adolescent



obesity is steadily becoming a significant public health issue in several developing nations, including India (Pepkin BM et. al. 1998).

Obesity is characterised as an abnormal or excessive accumulation of fat that could harm one's health. It further underlines that an energy imbalance between calories consumed and burned is the main cause of obesity and overweight. An increase in physical inactivity as a result of the diverse occupations' increasing sedentary character, changing transportation options, and increased urbanisation is another factor contributing to obesity (Global Health Observatory 2021).

Children who are overweight or obese account for 15% of all cases. In private schools that serve upper-class families, the incidence has risen to 35–40%, indicating a worrisome rising growth tendency. Their health is seriously impacted by childhood obesity. Children who are obese are more likely to develop conditions such as high blood pressure, osteoarthritis, high cholesterol and triglycerides, Type 2 diabetes, stroke, gallbladder disease, respiratory issues, emotional difficulties, and some malignancies (Narayana Health, 2019).

According to WHO recommendations, obesity is a physical condition or state with a Body Mass Index (BMI) more than or equal to 30. Body Mass Index (BMI) is a formula that calculates body fat using a person's height and weight. Weight in kg divided by height in is used to determine the Body Mass Index (BMI).

Childhood obesity results from the interaction of natural selection, which favours those with more efficient energy metabolism, and the current consumerist society, which is characterised by the availability of foods high in energy and lower daily energy demands (Han JC, et al 210).

Overuse of technology, excessive snacking, oversized portion sizes at meals, and a decline in kids' physical activity are all factors that contribute to juvenile obesity. According to a study, using electronic devices for three or more hours each day raised the likelihood of becoming overweight or obese by 17–44% or by 10–16%, respectively (Cespedes ML, et al 2011).

Medical research reveals that Indians have a hereditary predisposition to obesity. However numerous studies have consistently demonstrated that environmental factors play a significant role in the rapid rise in childhood obesity.

According to the MIT Center for Health Promotion & Wellbeing, maintaining physical fitness is equivalent



to fine-tuning an engine. It makes it possible for someone to work to their full ability. Fitness can be defined as a state that enables someone to perform, feel, and look their best. The health of the heart, lungs, and muscles is also a component of physical fitness.

The definition of health-related physical fitness refers to a multidimensional construct that includes the elements of muscular strength, muscular endurance, flexibility, and body composition (Britton U et.al 2019).

Aerobic fitness, body composition, muscular strength, muscular endurance, and lower back and hamstring muscle flexibility are the most frequently mentioned characteristics of health-related physical fitness that are linked to certain aspects of general wellness or illness prevention (Medical Dictionary for the Health Professions and Nursing 2012). Physical fitness, comprising muscular strength and endurance, cardiovascular endurance, flexibility, and body composition, can improve health and is a prerequisite for doing so.

According to the study's findings, risk factors for both existing and newly discovered cardio vascular diseases are related to muscular strength and endurance. Moreover, improvements in muscle endurance, flexibility, and strength have a favourable impact on skeletal health (Ortega FB et. al 2008). One of the most important aspects of physical fitness that has a significant favourable impact on health status is muscular strength (Galancho-Reina I. et al 2019).

Health-related physical fitness is a physiological condition of wellness that lowers the risk of hypokinetic disease and provides energy for daily duties as well as involvement in sports (F W Booth, 2014).

Cardiovascular endurance, muscular strength, muscular endurance, flexibility, and body composition are the elements of health-related physical fitness. These five elements of health-related physical fitness are widely acknowledged in the fitness community.

The most force that a muscle can generate against a resistance in a single attempt is often referred to as its muscular strength.

The capacity to maintain or repeatedly perform a muscle contraction while avoiding tiredness is known as muscular endurance. The ability to carry out tasks that require a lot of physical effort is referred to as muscular strength. It can be found as a separate component of health-related fitness because evidence from studies suggests that muscular strength is linked to better posture and a decreased risk of musculoskeletal



injuries, strong bone mass, which reduces the risk of osteoporosis, improved glucose uptake, which provides better blood glucose control, and an increased metabolic rate when at rest, which also helps.

Muscular strength is defined as the ability to exert power against a force or opposition from the outside (Clark KP 2014). Muscular strength, according to the American Council on Exercise, is the maximum force that a muscle or group of muscles can exert during a contraction. The size of muscle fibres and the capacity of nerves to activate muscle fibres are the parameters that determine muscular strength. Muscular strength is another vital aspect of fitness for health.

Muscular strength is defined as the maximum force one can produce using a muscle or group of muscles in response to a strain (McCarthy HD et al., 2014). When a muscle or a set of muscles produces the most force during a single contraction, that is when muscular strength becomes an essential component of physical fitness (Micheo W, et al 2012).

It has been demonstrated that having strong muscles is good for your health, not just for adults but also for kids. Strength training may aid in weight management, increasing resting metabolic rate as a result, according to evidence derived from numerous studies. Strength training also promotes bone mineralization, which helps athletes avoid sports-related injuries. Although genetics play a major role in determining peak bone mass, strength training can improve bone mineral density, which is crucial for young people who are at risk of developing bone-related issues (Faigenbaum, AD 2000).

According to the Surgeon General's Report on Physical Activity and Health, USDHHS, 1996, which was based from Wilmore and Costill's 1994 work, muscular endurance is a health-related aspect of physical fitness that pertains to the muscle's ability to continue working without becoming fatigued. A person with muscular endurance is able to perform tasks assisted by a specific muscle group for an extended amount of time. The ability of a muscle to maintain a specific level of tension or to repeat comparable actions under strain for the longest amount of time while exerting their maximum effort is known as muscular endurance (Kansal 1996). The ability of some muscle units to maintain muscular force through repeated contractions until tiredness sets in is referred to as muscular endurance (Docherty, D. 1996).

The capacity to continue contracting a muscle, or group of muscles, despite resistance over time, such as weights or body weight, is known as muscular endurance. These muscles can continue to contract and resist these forces if their performance is improved. Muscle endurance refers to a muscle's ability to exert a



submaximal force over a specific range of motion or at a single spot for a specific amount of time (Barrow, 1964).

According to the Surgeon General's Report on Physical Activity and Health, USDHHS, 1996, which was based from Wilmore and Costill's 1994 work, muscular endurance is a health-related aspect of physical fitness that pertains to the muscle's ability to continue working without becoming fatigued. For its many beneficial effects, good muscular endurance is essential. Individuals with excellent physical posture are more resilient to muscle fatigue and are less prone to experience back problems (Barbieri F et al., 2013).

The objective of the study

1. To carry out an assessment study on muscular strength and endurance of Primary school children.
2. To find out the health related physical fitness level of Primary school children of Lower Assam Districts through two components muscular strength and endurance.

Statement of the Problem

The purpose of the study was to assess the Muscular endurance Muscular strength of Primary school children of Lower Assam.

Hypothesis of the study

In this study, the following hypothesis was put forth:

1. It was predicted that there would be a significant difference in Muscular Endurance and Muscular strength between the Private school children and Government school children.

Delimitation of the study

1. The study was conducted by randomly selecting 1000 school children as subjects of the study of Lower Assam districts comprising of Bongaigaon, Chirang, Baksa and Kokrajhar.
2. The study was delimited to Muscular endurance and Muscular strength out of the five components of the health-related physical fitness.

Limitation of the study

1. Limitation of the study comprised of those aspects of the subjects living style, economic condition, eating habits, genetic and environmental factors that were not controlled or identified throughout the



investigation and testing period.

Materials and Method of Data Collection

Total 1000 students studying in primary level from Class I to Class V of government and private schools with age group of 6 to 10 years who volunteered to participate in the study. Before commencement of the study, the participants were informed of the test protocols and procedures and to ascertain equal efforts in the test, participants were encouraged throughout the test. Participants were made acquainted with the test prior to the study. The voluntary written consent was obtained from each participant and parents prior to the start of the study. The study was conducted in the primary schools of Bongaigaon, Chirang, Kokrajhar and Baksa districts of Lower Assam. As an important and cardinal part of ethical research work, the nature and scope of study were explained to the subjects and their respective parents. Further, the necessary permission was obtained from the school authorities and Office of the District Elementary Education. Officer (DEEO) of the above mentioned four districts for conducting the study.

Out of the five components of the Health related physical fitness, to assess the Muscular strength and endurance the Bent Knee -Push-up and Bent Knee Sit-up were applied in the study. Those two test batteries were selected considering the age of the subjects and easy applications. The muscle endurance of the subjects was assessed by using 1-Min Push-up and 1-Min Sit-up Test. The validity and reliability of push-up and sit-up test were widely documented (Ortega et al., 2008). The push-up exercise is an outstanding exercise to develop arms, shoulders, and upper body strength/endurance; accordingly after considering its positive aspects, it is widely used in physical preparation and training (Cogley et al., 2005; Mayhew et al., 1991). The validity of the upper limb Simple Muscle Strength Test indicators is also more prominent for bent-knee push-ups (Pate RR, et al., 1993).

Statistical Analysis and Interpretation of the results

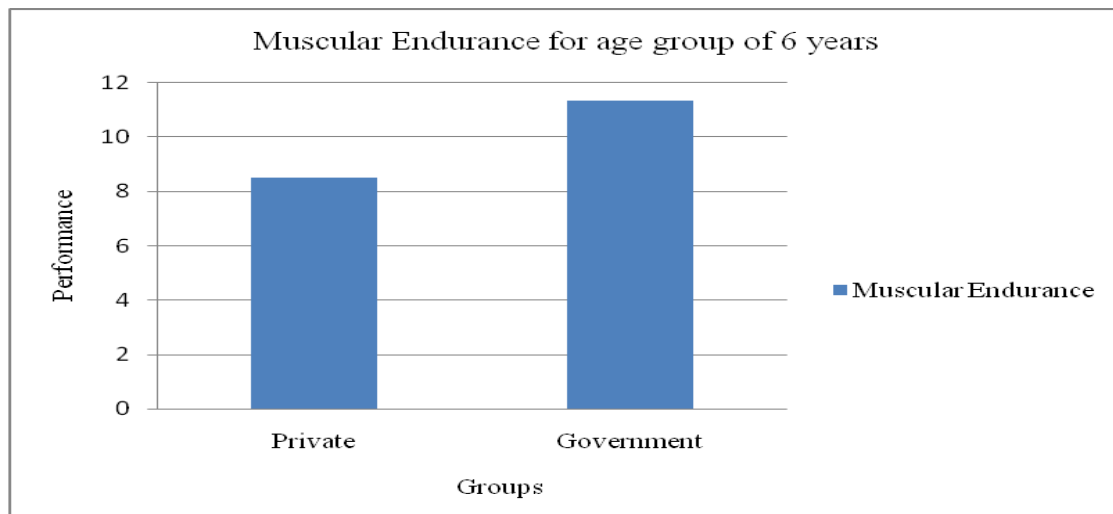
In the study, for the purpose of data analysis the IBM SPSS STATISTIC 28.0.1 version was used. He Descriptive Statistics, Independent t –Test and ANNOA Two Way were employed to find out the significant differences.

The table No 1 denotes the age wise Mean, Median, Standard Deviation, Minimum and Maximum of age group of 6 years children of Government vis-à-vis Private schools in Muscular Endurance:



Table No 1

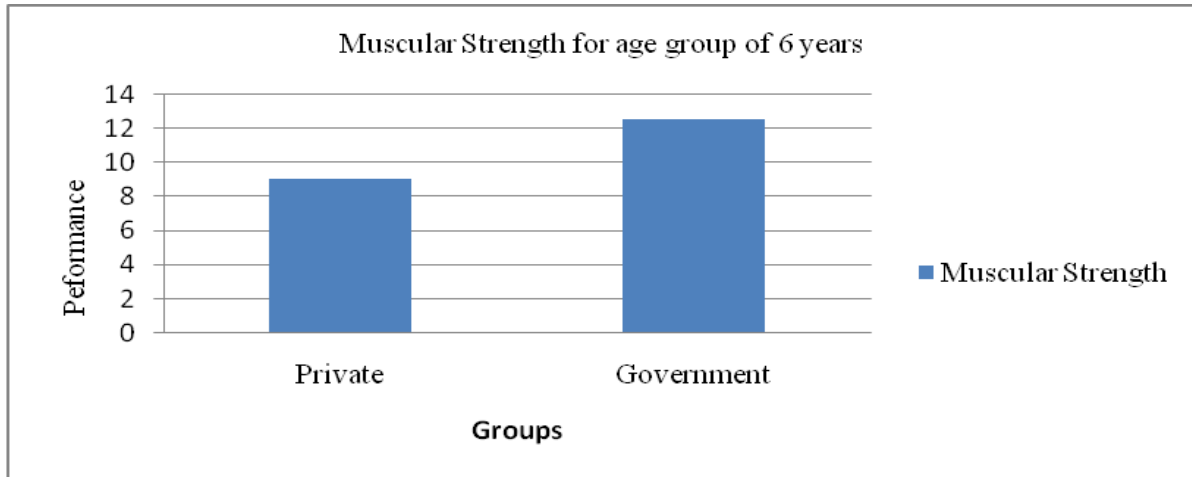
Group	N	Mean	Median	Standard Deviation	Minimum	Maximum
Private schools	100	8.53	9	1.0584	7	11
Government schools	100	11.36	11	1.5473	8	14



The table No 2 denotes the age wise Mean, Median, Standard Deviation, Minimum and Maximum of age group of 6 years children of Government vis-à-vis Private schools in Muscular Strength:

Table No 2

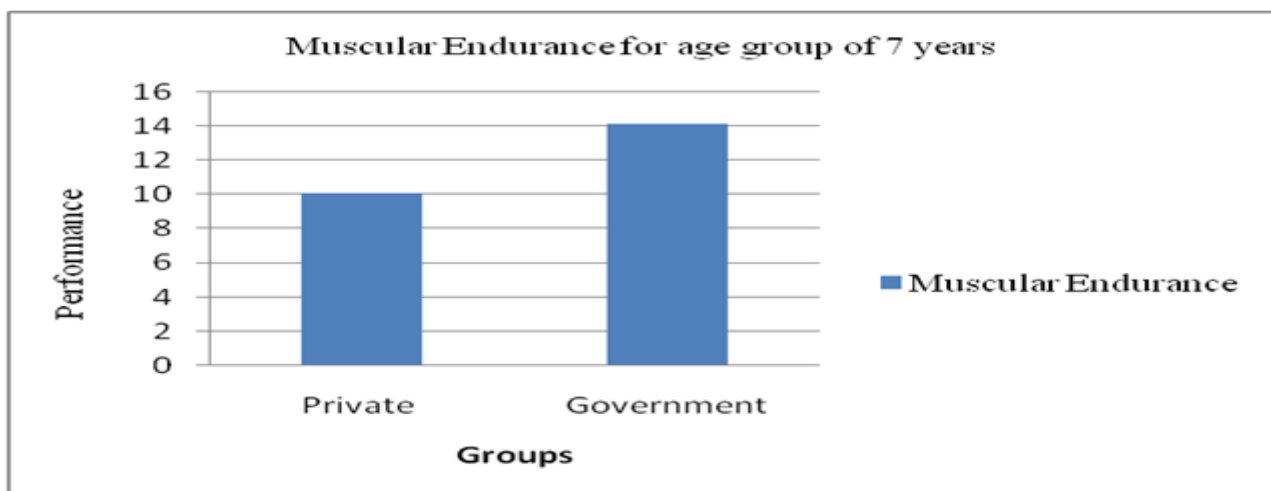
Group	N	Mean	Median	Standard Deviation	Minimum	Maximum
Private schools	100	9.06	9	0.9191	7	9
Government schools	100	12.53	13	1.4245	11	15



The table No 3 depicts the age wise Mean, Median, Standard Deviation, Minimum and Maximum of age group of 7 years children of Government vis-à-vis Private schools in Muscular Endurance:

Table No 3

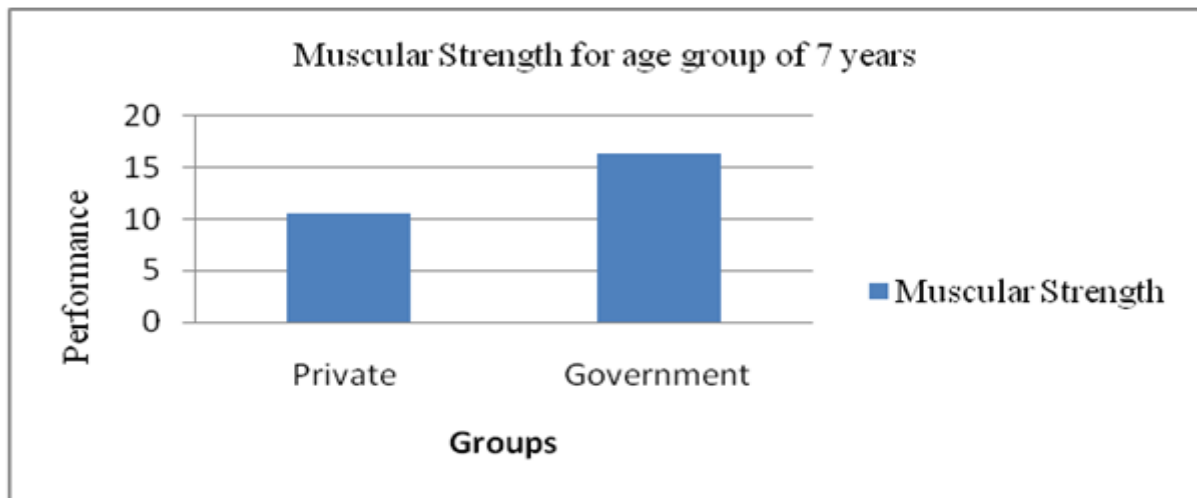
Group	N	Mean	Median	Standard Deviation	Minimum	Maximum
Private schools	100	10.1	10	1.2593	8	13
Government schools	100	14.15	14	1.1130	12	17



The table No 4 depicts the age wise Mean, Median, Standard Deviation, Minimum and Maximum of age group of 7 years children of Government vis-à-vis Private schools in Muscular Strength:

Table No 4

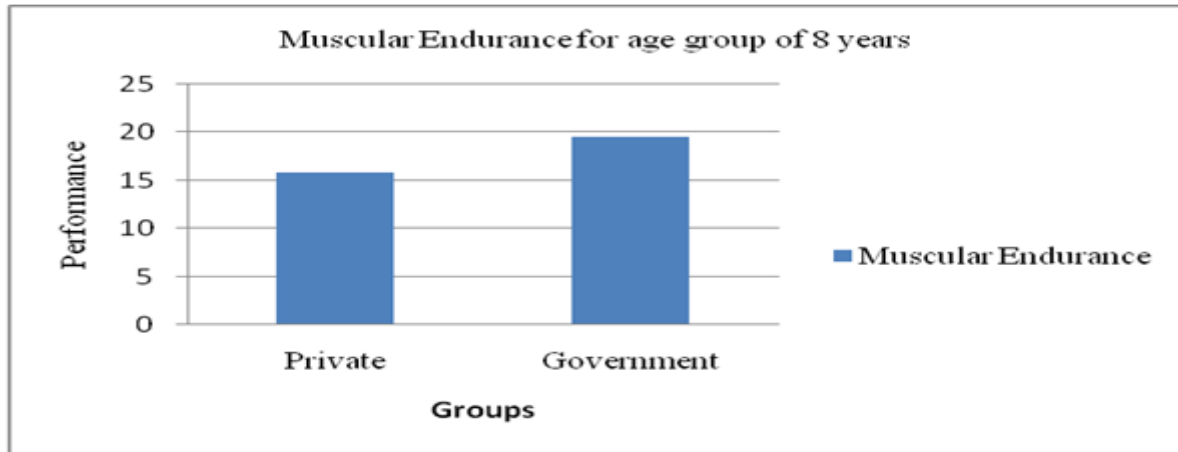
Group	N	Mean	Median	Standard Deviation	Minimum	Maximum
Private schools	100	10.5	10	1.3065	8	13
Government schools	100	16.38	16	1.4892	14	20



The table No 5 depicts the age wise Mean, Median, Standard Deviation, Minimum and Maximum of age group of 8 years children of Government vis-à-vis Private schools in Muscular Endurance:

Table No 5

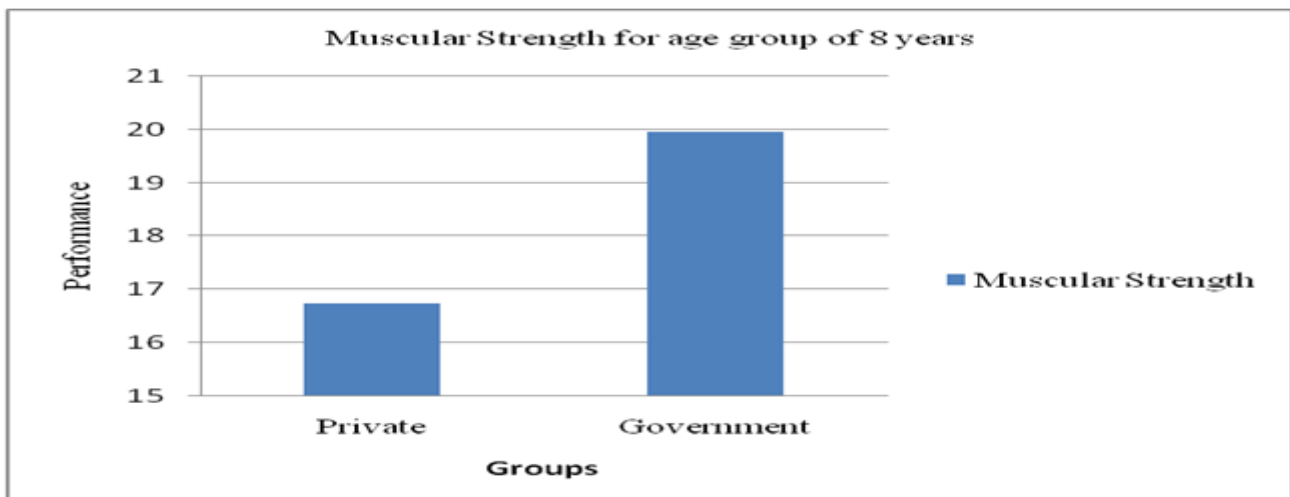
Group	N	Mean	Median	Standard Deviation	Minimum	Maximum
Private schools	100	15.81	16	1.4612	12	20
Government schools	100	19.66	20	1.5388	15	23



The table No 6 depicts the age wise Mean, Median, Standard Deviation, Minimum and Maximum of age group of 8 years children of Government vis-à-vis Private schools in Muscular Strength:

Table No 6

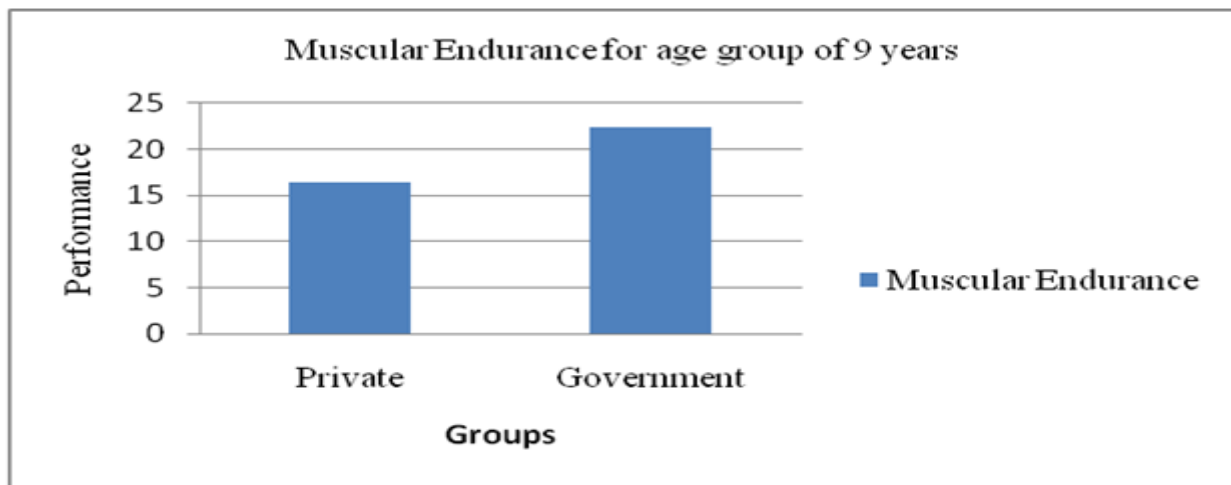
Group	N	Mean	Median	Standard Deviation	Minimum	Maximum
Private schools	100	16.74	17	1.9623	10	21
Government schools	100	19.96	20	1.4349	16	24



The table No 7 depicts the age wise Mean, Median, Standard Deviation, Minimum and Maximum of age group of 9 years children of Government vis-à-vis Private schools in Muscular Endurance:

Table No 7

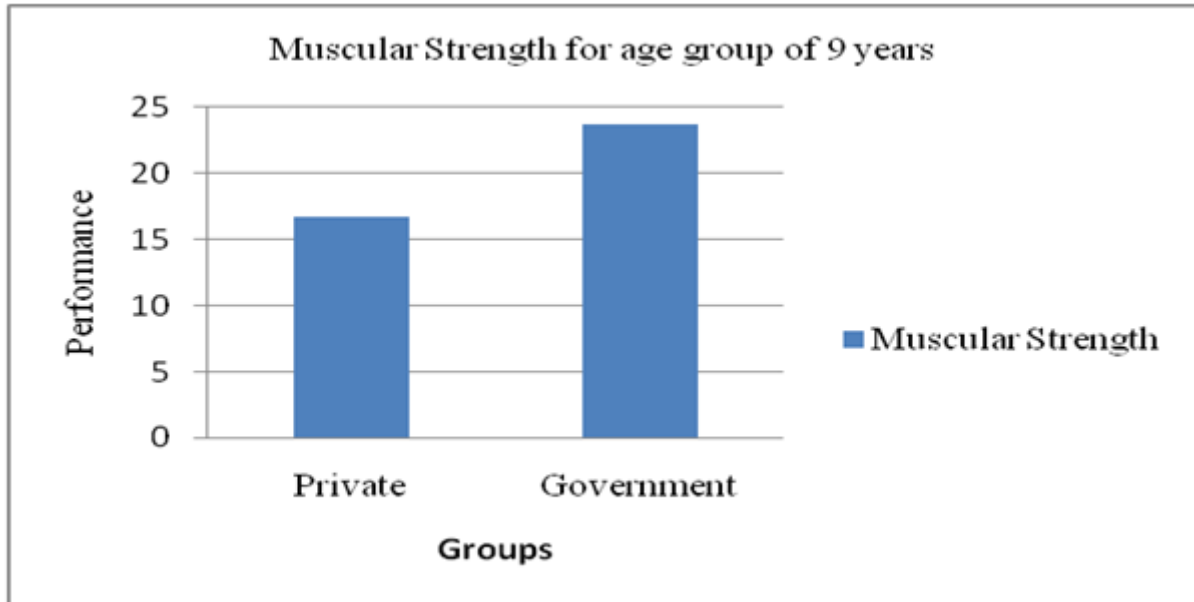
Group	N	Mean	Median	Standard Deviation	Minimum	Maximum
Private schools	100	16.37	16	2.0183	12	23
Government schools	100	22.34	23	2.1283	17	26



The table No 8 depicts the age wise Mean, Median, Standard Deviation, Minimum and Maximum of age group of 9 years children of Government vis-à-vis Private schools in Muscular Strength:

Table No 8

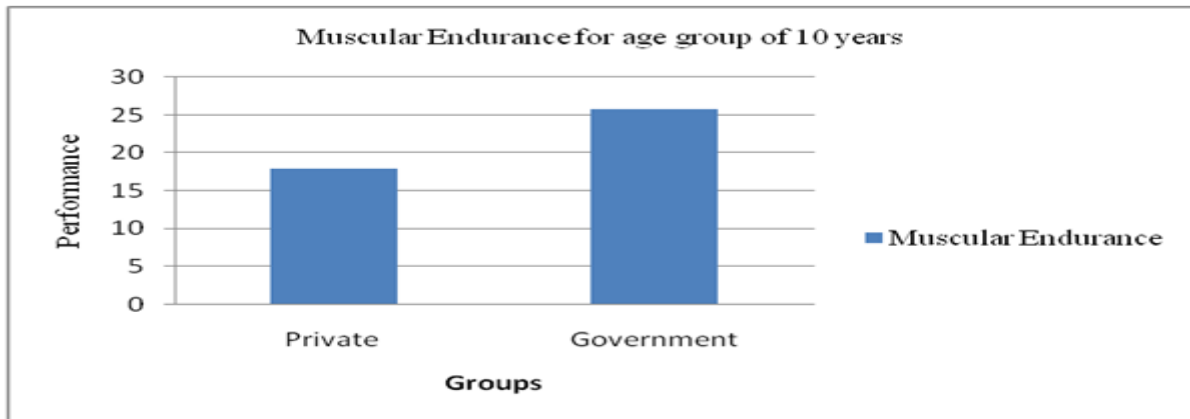
Group	N	Mean	Median	Standard Deviation	Minimum	Maximum
Private schools	100	16.75	16	2.2219	13	25
Government schools	100	23.77	24	2.1966	17	27



The table No 9 depicts the age wise Mean, Median, Standard Deviation, Minimum and Maximum of age group of 10 years children of Government vis-à-vis Private schools in Muscular Endurance:

Table No 9

Group	N	Mean	Median	Standard Deviation	Minimum	Maximum
Private schools	100	17.88	18	2.0902	14	24
Government schools	100	25.71	26	2.2620	19	30



The table No 10 depicts the age wise Mean, Median, Standard Deviation, Minimum and Maximum of age group of 10 years children of Government vis-à-vis Private schools in Muscular Strength:

Table No 10

Group	N	Mean	Median	Standard Deviation	Minimum	Maximum
Private schools	100	18.02	18	2.2109	14	24
Government schools	100	26.92	27	1.9729	20	30

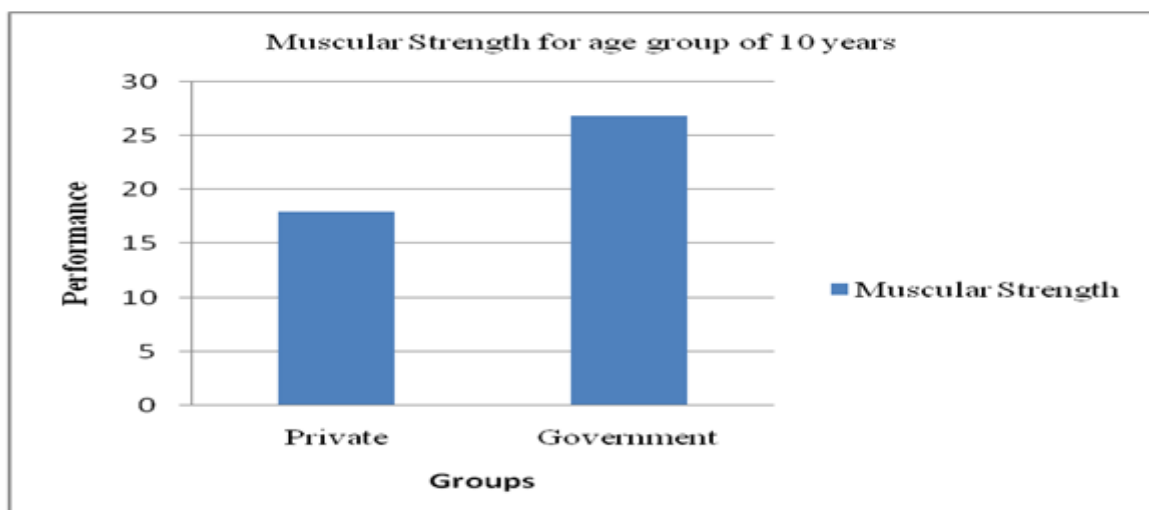




Table1: Independent t –test for Muscular Endurance of children of Government school and Private school

	Group	Number of subject (N)	Mean	Standard Deviation (SD)	Standard Error (SE)	t	Sig.
Muscular endurance	Private school children	500	13.74	4.05	0.18	<.001	15.94
	Government School children	500	18.64	5.54	0.25		

p<0.05

N=Number of students, SD (σ) =Standard Deviation, SE=Standard Error, t=Student't distribution

In the table 1, it is found that the Mean of Muscular Endurance of Private school children was found 13.74 whereas it was 18.64 for Government school children. Standard Deviation of Private school children and Government school children was 4.05 and 5.54 respectively. There was significant difference in Muscular endurance between Private school children and Government school children.

Table 2: Independent t-test for Muscular Strength of children of Government school and Private school

	Group	Number of subject (N)	Mean	Standard Deviation (SD)	Standard Error (SE)	t	Sig.
Muscular Strength	Private school children	500	14.21	4.10	0.18	<.001	18.79
	Government School children	500	19.91	5.40	0.24		



$p < 0.05$

N=Number of students, SD (σ)=Standard Deviation, SE=Standard Error, t=Student't distribution

In the table 2, it was observed that the Mean of Muscular Strength of Private school children and Government school children was 14.21 and 19.91 respectively. Standard Deviation of Private school children was 4.10 whereas it was 5.40 for Government school children. There was significant difference in Muscular strength between Private school children and Government school children.

Age wise comparison between the children of Government and Private Schools in Muscular Strength and Muscular Endurance by using ANOVA Two Way:

Muscular Endurance for age group of 6 years

		Sum of Squares	Df	Mean Square	F	P-value
MUSCULAR ENDURANCE	Between Groups	200.2225	1	200.2225	227.8721	5.42456E-41
	Within Groups	347.95	396	0.878662		
	Total	548.1725	397			

Muscular Strength for age group of 6 years

		Sum of Squares	Df	Mean Square	F	P-value
MUSCULAR STRENGTH	Between Groups	301.0225	1	301.0225	418.9243	4.88328E-64
	Within Groups	284.55	396	0.718560606		
	Total	585.5725	397			



Muscular Endurance for age group of 7 years

		Sum of Squares	Df	Mean Square	F	P-value
MUSCULAR ENDURANCE	Between Groups	410.0625	1	410.0625	580.4638	1.27863E-79
	Within Groups	279.75	396	0.706439		
	Total	690.4325	397			

Muscular Strength for age group of 7 years

		Sum of Squares	Df	Mean Square	F	P-value
MUCULAR STRENGHT	Between Groups	864.36	1	864.36	880.9104	1.0158E-102
	Within Groups	388.56	396	0.981212		
	Total	1252.92	397			

Muscular Endurance for age group of 8 years

		Sum of Squares	Df	Mean Square	F	P-value
MUSCULAR ENDURANCE	Between Groups	370.5625	1	370.5625	329.1451	5.65653E-54
	Within Groups	445.83	396	1.125833		



	Total	816.3925	397			
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Muscular Strength for age group of 8 years

		Sum of Squares	Df	Mean Square	F	P-value
MUCULAR STRENGTH	Between Groups	259.21	1	259.21	175.4412	2.0897E-33
	Within Groups	585.08	396	1.477475		
	Total	844.29	398	260.687475		

Muscular Endurance for age group of 9 years

		Sum of Squares	Df	Mean Square	F	P-value
MUSCULAR ENDURANCE	Between Groups	891.0225	1	891.0225	4985.208	1.52617E-63
	Within Groups	851.75	396	414.2588	414.2588	
	Total	1742.7725	397			

Muscular Strength for age group of 9 years

		Sum of Squares	Df	Mean Square	F	P-value
MUCULAR STRENGTH	Between Groups	1231.01	1	1231.01	504.8072	1.13308E-72
	Within Groups	966.46	396	2.440556		
	Total					



	Total	2197.47	397			
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Muscular Endurance for age group of 10 years

		Sum of Squares	Df	Mean Square	F	P-value
MUSCULAR ENDURANCE	Between Groups	1532.723	1	1532.723	646.2845	3.07819E-85
	Within Groups	939.15	396	2.371591		
	Total	2471.873	397			

Muscular Strength for age group of 10 years

		Sum of Squares	Df	Mean Square	F	P-value
MUCULAR STRENGTH	Between Groups	1980.25	1	1980.25	902.0602	3.9142E-104
	Within Groups	869.32	396	2.195253		
	Total	2849.57	397			

Conclusion

Within the limitations and delimitations of the study, the following conclusion was drawn:

1. The children of Government school were found higher Muscular endurance and significantly greater values than the children of Private school.
2. Again, it is concluded with the findings of the study that the children of Government school were found significantly higher Muscular strength and greater values than the Private school.



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