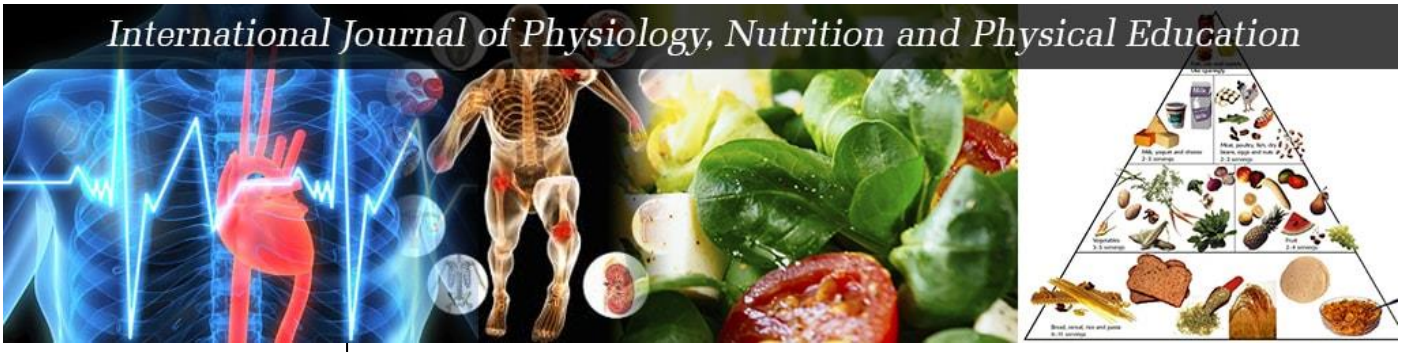

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Influence of screen based sedentary behaviours on body composition of children

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Abstract
Evidence suggested that children of developed counties are spending huge amount of time with different screen media and it has great impact on children's physical, mental, and social health. However, enough evidence regarding screen based sedentary behaviour and its health consequences among Indian children has not been found. Thus, the purpose of the study to verify the influence of excessive screen use on body composition of children.The study used a cross-sectional analytical design. 416 boys reading in class-V-and VI (Mean age 11.31 yrs.) of four Government aided school from semi urban areas of North 24 Parganas district in West Bengal, India were included as the subject of the study. Screen time was assessed using self-reported seven day recall questionnaire and Body composition was assessed using skinfold measurement. Descriptive statistics Mean, Standard deviation, Range, Frequency and Percentage were used. Independent –t test and One way Analysis of Variance (ANOVA) followed by Least Significant Difference (LSD) post-hoc test was conducted to understand the influence of Screen based sedentary behaviour on Body composition. Results revealed that majority of the subjects were crossed the recommended Screen time (<2hrs).and the average sum of skinfolds of the entire sample was much higher than normal level. The difference on Body Composition (Sum of Skinfold) among various ST groups was statistically significant at 0.05 level ($p<0.05$) and lower Screen time groups were almost always better in respect of body composition.

Keywords: Screen time, sedentary behaviour, body composition, skinfold, children

Introduction
The Screen based sedentary behaviours are spending time with various screen devices such as TV, Laptop, Smart phones, Video game console, I pad, I pod etc. Excessive screen use culture is common among children of present generation. Now- a -days, children from a very young age are allowed unlimited access to a wide variety of screen devices. Several studies have been reported that children of developed counties like USA, UK, Canada, Australia, New Zealand etc. are spending huge amount of time with screen media. Kaiser Family Foundation (Rideout, V.J and Roberts, D.F, 2010) [14] American Academy of Pediatrics (Strasburger, V.C and Hogan, M.J, 2013) [16] and other similar type organization agreed that the average 8- to 10-year-old spends nearly 8hours a day with a variety of different media. Some developed countries like USA, Canada, and Australia etc. have established recommendations to limit children's screen time. In the USA, the American Academy of Pediatrics (AAP), 2013 recommended screen time less than 2 hours per day.
Human body builds with a number of its constituents; bone, muscles and fat are the primary constituents. Naturally, two individual have different proportion of these three primary constituents. Body composition of an individual's refers the particular proportion of the said three constituents, it changes over time during the life span of every individual. However, proportionately, fat in particular varies immensely from person to person. The main focus of body composition is the percentage of storage fat in a body versus lean body mass. Generally a healthy body has less stored fat and more lean body mass [19] Evidence suggested that being over fat is detrimental to the school aged children not only for health reasons but also due to effects of excess fat on child's ability to perform motor skills efficiently (Aahperd Health related physical Fitness Test Technical Manual, 1984) [1]. Thus body composition is treated as a good indicator of physical health. The childhood obesity is a health problem worldwide, especially in the developed countries; however, for developing nations,

it is an emerging problem where the rates of overweight and obesity are growing with the trends like developed nations (Lee *et al*., 2015) [11].

Many recent studies mostly conducted in developed countries reported that use excessive screen has great impact on body composition: Watching TV for more than two per day associated with unfavourable body composition and decreased fitness reported by Tremblay *et al*. (2011) [17] similarly Sluyter *et al*. (2013) [15] reported TV watching was positively associated with body fatness. The researcher Dumith *et al*. (2012) [5] found positive association between screen time change and skinfold thickness and leisure time physical activity and Lajous *et al*., (2009) [10] reported Screen time was positively related to triceps skinfold (TSF) and Subscapular skinfold (SSF) in males, with ≥5 hours of screen time had a greater triceps skin fold (TSF) compared with males reporting <2 hours per day.

As a result of globalization and digitalization, media culture is rapidly penetrating among children and adolescents in India. Therefore, it is very essential to understand regarding screen media culture of Indian children and impact of such screen time sedentary behaviour on children health.

2. Statement of the problem

Therefore, the aim of the study was to verify the influence of screen based sedentary time on Body composition. Thus the problem of the study stated as "Influence of Screen Based Sedentary Behaviours on Body composition of Children".

3. Materials and Methods

3.1 Study design, the subject and procedure

The present study used a cross-sectional analytical design. The study aimed to verify the influence of Screen based sedentary time (Screen time) on body composition by comparing the subjects dichotomy based on screen time (ST) recommendation and also among different groups according to the magnitude daily screen time. A total 416 boys of age of Class V-VI (Mean age 11.31 yrs.) of four Govt. aided school affiliated to West Bengal Board of Secondary Education from semi urban areas of North 24 Parganas district in West Bengal, India were included as the subject of the study.

The Screen based sedentary behaviour was measured in terms of Screen time (ST) self-reported Screen time (ST) was assessed through seven day recall Diet and Lifestyle Questionnaire of the International Study of Childhood Obesity, Lifestyle and the Environment [ISCOLE] (Katzmarzyk *et al*., 2013) [9] The Sum of skinfolds of two sites (Triceps and Subscapular) was estimated as the indicator of Body composition. The Reliability of data was ensured by establishing the instrumental reliability, tester's competency, reliability of test and the subject. Used Skinfold calliper, Stadiometer, weighing machine were manufactured by renowned companies with adequate reliability. Diet and Lifestyle Questionnaire of ISCOLE is the standardized and widely used tools for assessment Screen time (ST) of the age group. As a Body composition indicator sum of skinfolds was measured using a test item taking from AAPHERD Health Related Physical Fitness Test, 1980.

The data were collected in several dates from July 2018 to September 2018 with the help of numbers of qualified and specially trained assistants. After obtaining necessary permission from the selected school authorities. Necessary instructions and demonstration were given to the subjects before conducting of each measurement. The data from each selected school were collected in two phases. In the first phase the questionnaire part was conducted, later the Height, Weight and Skinfolds measurement were taken.

3.2 Measures

3.2.1 Personal data

Age was calculated from date of birth obtained from the school admission register. Age was considered in completed year and month. Standing Height and Weight were measured using standard procedure. Height was measured nearest to 0.5centimeter with a Stadiometer and Weight was measured nearest to 0.1 kg with a Digital weighing machine.

3.2.2 Sedentary screen time (ST)

Child-reported Screen Time (ST) was determined through a part of Diet and Lifestyle Questionnaire. Children were asked how many hours usually they watched TV, and how many hours they use other screen devices like video games, computer, laptop, smartphone etc. during their recreational time, on school day, and on weekend day in the last week. A Likert type scale was used, such as Responses were: 0 = I did not watch TV, 1 = 1hour of TV, 2 = 2 hours, 3 = 3 hours, 4 = 4 hours, 5 = 5 hours of TV. A weighted mean score of hours of daily Screen time was calculated as follows: [(hours of TV on school day × 5) + (hours of TV on weekend day × 2) + (hours of video games, computers and other screen media on school day × 5) + (hours of video games and computer and other screen media on weekend day ×2)]/7. Then it was considered as a continuous variable. ST was dichotomize as ST<2 hrs./day and ST≥2 hrs./day according to Screen time (ST) recommendation (AAP,2013). Participants were further subdivided in five groups according to the magnitude of Screen time, such as Group-1: ST< 2 hrs./day, Group-2: ST ≥2hrs. to <3hrs./day, Group-3:≥3hrs.to<4hrs./day, Group-4: ST ≥4hrs.to<5hrs./day, Group-5:ST:≥5hrs./day (Lajous *et al*., (2009) [10].

3.2.3 Body composition

As a predictor of body composition skinfolds of two sites (triceps and subscapular) were measured taking one item from AAHPERD Health Related Physical Fitness Test, 1980. The triceps skinfold was taken over the triceps muscle at a point halfway between the tip of the shoulder (acromial process) and the tip of the elbow (olecranon process). The thickness of skinfold (double layers of subcutaneous fat and skin) was measured with the skinfold fat calliper The subscapular skinfold was picked beneath the inferior angle of the left scapula in the direction running obliquely downwards at an angle of about 45º to the horizontal plane. Measurement of skinfold of each site was taken in three consecutive times. The median values of three measurement of skinfold of each site were recorded nearest to 0.1mm. The sum of the recorded skinfold of two sites was used for analysis purpose.

3.3 Statistical Analysis

Statistical Package for the Social Sciences (SPSS) Software (IBM, Chicago, and Version-22) was used for statistical analysis. Descriptive statistics like Mean, S.D., Range, number and Percentage were used to describe subjects' characteristics on personal data, independent and dependent variables. Independent t-test was conducted to understand the significant mean difference on body composition according for dichotomy of subjects on the basis ST recommendation (<2hrs.).One- way Analysis of Variance (ANOVA) and followed by Least Significant Difference (LSD) post-hoc test (where significant mean difference found among the ST Groups.) were also used to compare on body composition

among different groups on Screen time (ST). The level of significance was fixed at .05 level.

Results

Participants Characteristics for the entire sample are shown in the Table-1. The mean age of the subjects was 11.31 yrs. with a variation of ± 0.53 yrs., mean height of the subjects was 144.13cm with a variation of ±8.91cm, and mean body weight of the subjects was 39.02kg with a variation of ±8.91kg.

Table 1: Participants characteristics

Variable	Statistics		
	Mean	S.D	Range
Age (yrs.)	11.31	.530	10.08-12.67
Height (cm)	144.13	8.91	122 -174.5
Weight (kg)	39.02	10.67	20.30-75.90
Screen time (Hrs.)	3.172	1.506	.00 - 7.14
Body composition (Sum of skinfold)	25.69	13.353	8 – 80

It appears that mean and S.D of daily Screen time (ST) was 3.17 ±1.508hrs. and its ranges from 0 hrs. to 7.14 hrs. So, results suggested that daily Screen time status of the entire sample was high and exceeded the recommendation level (<2hrs.) (AAP, 2013). The number and percentage of subjects in respect of screen time recommendation are also shown in Fig.-1.

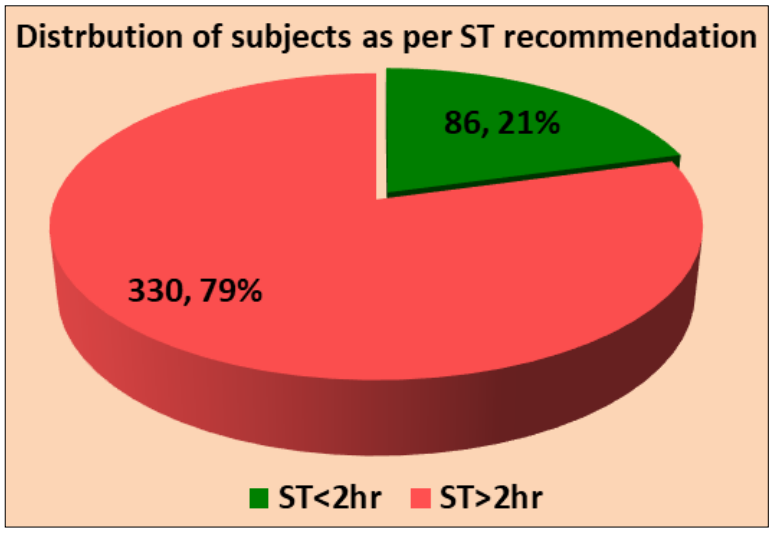


Fig 1: Distribution as per Screen time (ST) recommendation (AAP, 2013)

It is appears from the Fig.-1 the majority of the subjects 79.33% (330) among 416 were crossed the recommendation Screen time (<2hrs.). However, only 20.67% (86) subject's Screen time were remained within the recommendation level.

Mean and S.D. of Sum of skinfolds scores was 25.69±13.35mm and their ranges were 8-80mm. Therefore, the status of the subjects in respect of sum of skinfolds was much higher than normal level (14mm) with reference to the criterion referenced standard mentioned in by AAHPERED Health Related Physical Fitness Test Technical Manual, 1984 [1].

The participants were compared on Body composition according to the ST dichotomization. Independent t-tests analysis was conducted.

Table 3: Results of Independent t-tests on Body Composition indicators according to ST dichotomization (ST<2hrs vs. ST≥2hrs.category)

Variables	ST Groups	Statistics					
		Mean	S.D	Mean Diff.	S.E.D	t-value	p-value (Sig.)
Body composition (Sum of skinfold) [mm]	ST<2hrs.	18.638	8.713	-8.883	1.558	-5.699	.000
	ST≥2hrs.	27.521	13.745				

It is appears from the table that, the mean value of the variables Sum of skinfold of ST<2hrs. Category was found lower than the ST≥2hrs. Category. The mean differences on Sum of skinfold were also statistically significant at 0.05 level. Therefore, the Independent t-test result suggested that ST<2hrs. Category was better in respect of Body composition (Lower score in Sum of skinfolds indicates better in Body composition).

However for better understanding regarding the influence of Screen time (ST) on the Body composition indicator, the entire sample were further categorized in five Screen time groups stated earlier. Then, one-way ANOVA followed by LSD post-hoc test (Where significant difference found) was conducted to compare the means on the dependent variables of five Screen time groups. The results of ANOVA followed by LSD post-hoc test have been presented below.

Table 4: Results of ANOVA on Body Composition indicator among five ST groups.

Variable	Source of Variance	Sum of Squares	Df	Mean Square	F-ratio	Sig.
Body composition (Sum of skin fold)	Between Groups	12573.553	4	3143.388	21.032*	.000
	Within Groups	61426.134	411	149.455		
	Total	73999.688	415			

*Significant at 0.05 level

$F_{.05}(4,411)$

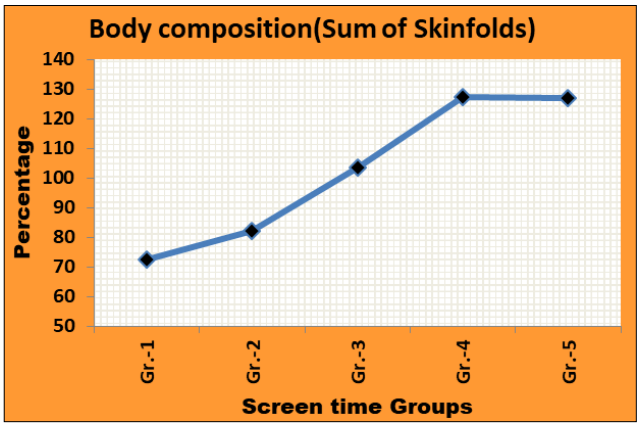
The ANOVA results suggested that, the mean difference on Body Composition i.e Sum of skinfold among various ST groups was statistically significant at 0.05 level ($p<0.05$) Thus, LSD post -hoc test was conducted to obtain the direction and significance difference on Body composition.

Table 5: Inter-group comparison (Post-hoc LSD test) on body composition according to screen time (ST)

Variable	ST Groups					Mean Diff.	S.E.	Sig.
	Group-1	Group-2	Group-3	Group-4	Group-5			
	ST<2h	ST≥2-<3h	ST≥3-<4h	ST≥4-<5h	ST ≥5h			
Body composition (Sum of Skin folds)	18.638	21.067				-2.428	1.853	.191
	18.638		26.600			-7.961*	1.756	.000
	18.638			32.674		-14.035*	1.911	.000
	18.638				32.584	-13.946*	2.134	.000
		21.067	26.600			-5.532*	1.744	.002
		21.067		32.674		-11.607*	1.901	.000
		21.067			32.584	-11.517*	2.125	.000
			26.600	32.674		-6.074*	1.806	.001
			26.600		32.584	-5.984*	2.041	.004
				32.674	32.584	.089	2.176	.967

*Significant at 0.05 level

It is appears from the table that, the significant differences found between Group-1 vs. Group-3, Group-4 and Group-5, Group-2 vs.Group-3, Group-4 and Group-5 and also between Group-3 vs. Group-4 and Group-3 vs. Group-5. However, the difference on Body composition (Sum of skinfolds) were not significant between: Group-1(ST<2h) vs. Group-2(ST≥ 2 to <3h) and Group-4(ST≥4to <5h) vs.Group5 (ST≥5h)



Note: Scores are presented in percentage. Lower score indicates better in Body composition

Fig 3: Body composition (Sum of Skinfolds) score according to ST groups

The results indicate that almost all pair group differences were significant, except between two extreme pair ST groups (Group-1 vs. 2 and Group-4 vs. 5).However, Lower ST groups were almost always better in respect of Body composition (Sum of Skinfolds) except between ST Group-4 and 5, where Group-5 was slightly better. Thus the results indicate that Body composition was negatively influenced by Screen time.

Discussion

The result of the present study revealed that body composition of children was negatively influenced by Screen based sedentary behaviours. A study conducted by Dumith *et al.* (2012) [5] found positive associations between screen-time change and skinfold thickness, and body composition affected by increasing Screen time. A study conducted with Mexican adolescents (Lajous *et al*., (2009) [10] reported that Screen time was positively related to triceps skinfold and subscapular skinfold in males, with ≥5 hours of screen time had a greater triceps skin fold (TSF) compared with males reporting <2 hours per day. Similarly males with ≥5 hours of screen time had a 0.73 mm greater subscapular skinfold (SSF) compared with males with < 2 hour of screen time. Investigator Tremblay *et al*. (2011) [17] found TV viewing for more than 2hrs. per day associated with unfavourable body composition and decreased fitness, similarly Sluyter *et al*. (2013) [15] reported TV watching was positively associated with body fatness. However, the researchers Xue *et al*., (2016) [18] found no relationship between screen time and body fat percentage. So, the finding of the present study is consistent with the finding of the several study conducted elsewhere.

Evidence suggested that body composition is significantly related to physical activity and energy intake. Lack of physical activity and exercise are the primary cause of obesity in all age groups (Fox & Mathews, 1981) [12] However, several recent studies suggested that a Physical activity and dietary habits significantly affected by excessive screen time. The researchers Melkevik *et al*. (2010) [13] reported that more than 2 hrs. of daily total screen-time was negatively associated with Moderate to vigorous intensity physical activity for both boys and girls. The researchers Hardy *et al*. (2018) [7] found Screen time was associated with a lower likelihood to achieve healthy zones of physical activity attributes. A study conducted by Dumith *et al*. (2012) [5] found positive associations between screen-time change, and leisure-time physical activity among children.Negative associations between screen time and physical activity/fitness were identified by Costigan *et al*. (2013) [4]. A Longitudinal study (Fletcher *et al*. 2017) [6] conducted with Australian

adolescents showed that total screen time also positively associated with unhealthy dietary habit. Similarly the investigators Borghese *et al*., (2014) [2] found TV viewing was positively associated with the frequency of consumption of unhealthy diet. So these may be the cause of such negative influence of Screen based sedentary behaviours on Body composition.

Conclusion

Majority of the subjects were crossed the recommended Screen time (<2hrs). Body composition was negatively influenced by Screen based sedentary behaviours whether it may be directly or indirectly by influencing other associated factors like Physical activity, Dietary habit etc. However, further study is needed to establish the causal relationship with Screen time sedentary behaviours and Body composition.

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