Original Research Article

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The effect of cartoon on the immediate motor executive function of 4-6 year old children

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ABSTRACT

Background: Children's television viewing has been of concern to parents, educators and health care providers for almost as long as the television itself has been in existence. Objective of present study was to investigate the effect of cartoon viewing on the immediate motor executive function of 4-6 year old children.

Methods: 279 children, aged 4-6 year old children were administered the Seguin Form board test to confirm they were all developmentally equal. These children were then randomly assigned to watch a fast paced television cartoon, a slow paced cartoon or colour an image. Following this they were then given 3 tasks to assess motor executive function, including the colour match, 4 two piece puzzle and separating coloured beads. The time taken to complete the task was noted and the data was analyzed.

Results: Children who watched the fast-paced cartoon performed slower on the motor executive function tasks than the children in the other two groups. (p<0.001).

Conclusions: Even ten minutes of viewing a fast paced television cartoon had immediate negative effects on 4-6 year old children's motor executive function. Parents should be aware that fast paced cartoon shows could at least temporarily impair young children's motor executive function.

Keywords: Cartoon, Children, Motor executive function

INTRODUCTION

Children's television viewing has been of concern to parents, educators and health care providers for almost as long as the television itself has been in existence .Young children watch an astonishing amount of television, spending more time in front of a screen than any other single activity except sleeping.¹ The American Academy of Pediatrics recommends that children >2 years of age should have, not more than two hours of screen time per day and that children <2 be discouraged from watching. Despite growing concerns, ample evidence indicates that these recommendations are ignored.^{2,3}

Television (TV) viewing has been implicated with childhood problems of overweight, obesity, behaviour, psychosocial problems and cognition. 4.5 The media has demonstrated potentially profound effects, both positive and negative, onchildren's cognitive, social, and behavioural development, and concern about potential negative effects of TV usage is not new. Studies have also suggested a longitudinal association between entertainment television and later attention problems. 6 Recent studies have linked early TV viewing with deficits in executive function. 7-9 Executive function is increasingly recognized as key to positive social and

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cognitive functioning and is strongly associated with success in school.

In the important domain of cognitive development, studies are very few. We are not sure whether there are any short-term effects on cognitive skills. The present study is an attempt to further clarify some of these effects of television cartoon viewing. This study attempts to see the effect of cartoon (Fast paced cartoon and slow-paced cartoon) on motor executive function.

METHODS

This randomized control study was conducted at a private English medium school in Pondicherry, between April 2014 – April 2015, after obtaining permission from the Directorate of School Education and the School authorities.

Inclusion criteria

- Children of both sexes of 4-6 years of age
- Children found to be developmentally equal according to Seguin form board test.

Exclusion criteria

Children with known visual problems and uncorrected refractive errors.

All students aged 4-6 years of both sex from an English Medium School, Pondicherry were contacted in the school and informed consent formalong with the questionnaire was sent to the parents of these children to be filled and returned to the school.

Of 300 children studying in the kindergarten section of the school, a total of 279 parents gave written consent for their children to participate in the study. A total of 279 children aged between 4-6 years (belonging to Kindergarten) and developmentally equal age (screening done using Seguin form board test) were recruited into the study. These 279 children were given a pre-test (Seguin form board test) to assess if the children were developmentally equal.

Seguin form board was placed on the table and children were asked to come one by one and perform the test. While administering the test, these blocks were taken out by the examiner and stacked in front of the subject who had to put them back as quickly as he/she could. The following instructions were given to the students (in a language best understood by the student): Here are ten wooden blocks which have to be put by you in the appropriate space. Be as fast as you can. You will be allowed only three trials. Prior to starting the test, a 'ready' signal was given and at the second signal 'start', child started placing the wooden blocks. The timing with stop watch was matched with the child picking up the first block. The task was repeated 3 times. Time, in

seconds was obtained for each trial by the investigator, who was sitting beside and slightly to the back of the subject to be tested. The total time score of each subject in 3 trials, their average and the shortest time score were obtained. The students who completed the task within the time recommended as appropriate for their age group were considered developmentally equal and were included in the study. A total of 279 children, who completed the test in recommended time, were all included in the study.

These children were randomized by computer generated random number into three groups, containing of 93 children each.

First group was shown a fast paced cartoon for ten minutes, Second group was shown a slow paced cartoon and the third group was given crayons and paper and allowed to colour for ten minutes.

To quantify pacing of the cartoon, the 2 television episodes were viewed for the number of times a complete scene change occurred. For the fast-paced cartoon, "Tom and Jerry", the scene completely changed on average of every two seconds. Even within the scene characters were almost constantly moving rapidly through space. For the slow paced cartoon, Barney cartoon, the scene completely changed every 10 seconds on average.

Motor executive tasks were administered by the principal investigator of the study who was blinded to the group. Children were administered three motor executive function tasks, namely color match, two piece puzzle, separating coloured beads. Colour match task involved separating 12 blocks of 4 different colour as quickly as possible. Four piece puzzle task involved completing a four two piece puzzle as quickly as possible. Separating coloured beads task involved picking up and separating beads of four different colours. The time taken to complete the each task was noted and all data were entered in an excel sheet for documentation.

Statistical analysis

Data were analyzed using SSPS 20.0. One way ANOVA test was used to find the statistical difference in time taken to complete the task between the three groups. Turkey HSD was used to find the statistical difference in time taken to complete the task within the groups.

RESULTS

A total of 279 children, randomized into three groups (93 each) were studied. The mean age was 4.4 years in all three groups and there was no statistical difference among the three groups. There was no statistically significant difference in the distribution of males (54.4%) and females (45.6%) among the three groups (p = 0.74). The baseline characteristics of the three groups were as noted in the Table 1.

The mean time taken to complete the colour match task, two piece puzzle and separating the beads were as noted in the Table 2 and there was a statistically significant difference with respect to the three groups (p<0.001) for all the three tasks.

Table 1: Baseline characteristics of the study group.

			Study group			
Characteristics		Fast paced (n= 93)	Slow paced (n= 93)	Control (n= 93)	p value	
Age		4.4	4.4	4.4		
Gender	Male	53 (57.4%)	51 (54.8%)	48 (51.6%)	p= 0.74	
	Female	40 (42.6%)	42 (45.2%)	45 (48.4%)		
Parent's	College level	65 (69.8%)	76 (81.7%)	85 (91.3%)	p < 0.001	
education	School level	28 (30.2 %)	17 (18.3%)	8 (8.7%)		
School	Brilliant	25 (26.6%)	13 (14%)	2 (2.2%)	p <0.001	
performance	Good	68 (73.4%)	80 (86%)	91 (97.8%)		
Attention	Good	85 (91.5%)	5%) 91 (97.8%) 89 (95.7%)		0 152	
span at school	Average	8 (8.5%)	2 (2.2%)	4 (4.3%)	p= 0.153	

Table 2: Comparison of mean time taken to complete the motor executive tasks among the group.

Outcome parameters	Fast paced cartoon (n=93)	Slow paced cartoon (n=93)	P value	Fast paced cartoon (n=93)	Drawing group (n=93)	P value	Slow paced cartoon (n=93)	Drawing group (n=93)	P value
Time taken to complete colour match (in seconds	46.9±8.0	41.3±8.9	P<0.001	46.9±8.0	41.4±8.4	P<0.001	41.3±8.9	41.4±8.4	P=0.91
Time taken to complete 2 piece puzzle (in seconds)	54.1±6.0	41.8±5.2		54.1±6.0	42.1±6.2		41.8±5.2	42.1±6.2	
Time taken to separate the beads (in seconds)	81.7±9.5	73.6±4.8		81.7±9.5	73.9±5.3		73.6±4.8	73.9±5.3	

DISCUSSION

The aim of this study was to assess if television viewing had any immediate impact on the motor executive function of 4-6 year old children. The first group was shown a fast paced cartoon for ten minutes, the second group was shown a slow paced cartoon for ten minutes and the third was given crayons and paper and allowed to colour for ten minutes. Immediately after the intervention, children were asked to perform three visuomotor tasks, namely, colour match, two piece puzzle, separating coloured beads and the time taken to complete these tasks was noted and analyzed statistically.

In present study, we found that children who watched a cartoon for just ten minutes took more time to finish the motor executive task assigned to them compared to children who were a picture to color for ten minutes. Mean time taken to complete the task by the fast paced

group children, slow paced group and coloring group for the three tasks as were noted in table 2 and Children in video group scored significantly worse compared to drawing group despite being equal in development as tested by Seguin form board test. This provides an empirical evidence that watching a ten minutes cartoon video has an immediate impact on children's motor executive function.

We also found that children who performed the tasks after watching fast paced cartoon video performed slowly, compared to children who completed the task after watching a slow paced cartoon video. There was a significant statistical difference between the time taken to complete the task among the fast paced and slow paced group, and there was a significant statistical difference among the fast and drawing group. These results are consistent with the following two studies. First was the study done by Lillardet AS al, who also found that there

was an immediate impact of television viewing on 6 year old children's executive function.⁶ Second, was the study done by Anderson et al, who found that pace of the cartoon negatively impacted four year olds perseverance, organizations of behavior and impulsivity.⁸

In present study, we found that children who performed the tasks after watching slow paced cartoon video performed slowly, compared to children who completed the task after coloring for ten minutes. But statistically there was no significant difference in the time taken to complete the task between the slow paced group and the drawing group, which is contrary to the study done Cooper et al, who concluded that children who viewed slow paced programming made significantly more errors in attention tests than those who viewed fast paced programs. Researchers like Cooper et al have contradicted the deleterious effect of television pacing. It remains unclear why there remains a discrepancy on this topic.

On one side, it appears that more amounts of television exposure are detrimental to children's future behavioral performance, yet on the other side pacing seems to positively impact children attention and recall. In present study, we used only a 10 minutes video of slow paced cartoon and immediate impact on executive function was measured. We are not sure if there are long term association between slow paced carton and children's executive function or if there is any impact after watching a full one hour slow paced cartoon on children's executive function. Many children's cartoon episodes last for more than ten minutes and typically 3-4 episodes are shown in one hour programming slot. Watching a full fast paced cartoon could be more detrimental than the slow paced cartoons.

Although pacing has been investigated, the fantastical contents of the cartoon/video remains unexplored. Some researchers speculate that the on slot of specular events further exacerbate the executive function in the fast pacing. Familiar events are encoded by established neural circuitry, but there is no defined circuitry for new and unexpected events, which fantastical events often are. 8,9 A strength of our study was the use of large number of students. Previous study on effect of fast paced television on children's motor executive function, done by lillard AS, had only 60 students. 6

The limitations of this study are that, in spite of using Simple randomization we found significant differences in some baseline characteristics like educational status of parents, school performance and attention span, among the three groups, which we feel, could have been avoided by doing stratified randomization of the groups. Also, we cannot exactly tell what features of fast paced television cartoon created the effects. We have speculated that the combination of fantastical events and fast pacing are responsible, but further research systematically varying those features is needed.

CONCLUSION

Television cartoon viewing has an effect on immediate executive motor function of 4-6 year old children. This effect is more with fast paced cartoon than with the slow paced cartoon.

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Ethical approval: The study was approved by the

Institutional Ethics Committee

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