Paediatrica Indonesiana

VOLUME 52 January • 2012 NUMBER 1

Original Article

Television watching time and cognitive development in young children

Anak Agung Ayu Windi Antari[1], I Gusti Ayu Trisna Windiani[1], Djauhar Ismail[2]

Abstract

Background Television viewing for children is prevalent. There have been few Indonesian studies on the association between duration of television watching and cognitive development in young children.

Objective To assess cognitive development in young children who watched < 1 hour, 1-2 hours, or > 2 hours of television daily.

Methods We conducted a cross-sectional study at 6 pre-kindergartens in Denpasar, Bali. We included 135 subjects in this study. Cognitive development was measured by the Mullen Scales of Early Learning (MSEL). Data was analyzed by one-way analysis of variance (ANOVA) test, post-hoc test, and univariate analysis of covariance (ANCOVA) with significance level of $P < 0.05$.

Results There were significant differences among composite standard score in children who watched television < 1 hour, 1-2 hours, and > 2 hours per day (P=0.035). The mean composite standard score in children who watched television 1-2 hours daily was 6.087 points higher than in those who watched television < 1 hour daily (P=0.013, 95%CI 1.29 to 10.88) and 4.213 points higher than in those who watched television > 2 hours daily (P=0.045, 95%CI 1.08 to 8.51). There was an association between television watching time and cognitive development (P=0.001).

Conclusion Television watching time was statistically associated with cognitive development in young children, where those viewing television 1-2 hours daily scoring significantly higher than those viewing < 1 hour and > 2 hours daily. **[Paediatr Indones. 2012;52:32-7]**.

Keywords: *television watching time, cognitive, playgroup, Mullen test*

The progress of science and technology has led to the considerable influence of television on child development.[1,2] The influence of television is difficult to avoid in a child's life. Nowadays, the age of children who watch television is getting younger. Busy parents do not have the time to observe, assist, and supervise children while watching television.[3-5] Television's impact on children remains debatable.[6-10] The American Academy of Pediatrics (AAP) currently suggests that pediatricians recommend parents limit children's total entertainment media time. For young children, toddlers and infants, television should be limited to only 1 or 2 hours daily, and restricted to educational programs.[11,12]

Few studies have reported on the association between television-watching time and cognitive development in children, especially in preschool-aged children. We conducted this study to assess children's television watching time at home and to look for an association between television-watching time and cognitive development of preschool-aged children who attend pre-kindergarten.

From the Department of Child Health, Udayana University Medical School, Sanglah Hospital, Denpasar[1] and Gadjah Mada University, Dr.Sardjito Hospital, Yogyakarta[2].

Reprint requests to: A.A.Ayu Windi Antari, Department of Child Health, Udayana University Medical School, Sanglah Hospital, Denpasar, Jalan Kesehatan, Denpasar 80119, Indonesia. Tel. +62-21-244038, Fax. +62-21-244038. E-mail: *windiped@yahoo.com*

Methods

We conducted a cross-sectional study from April to May 2011. Subjects were children aged 34 -52 months, attending pre-kindergarten in Denpasar, Bali. The inclusion criteria were residence in Denpasar, as well as parents providing proxy consent and able to read, write, and tell time. We excluded children with history of head injuries, birth complications, major congenital abnormalities or illness at the time of the study. The calculated minimum number of required subjects was 135, based on $\alpha=5\%$ and $\beta=20\%$. Purposive sampling was used to allocate subjects.

Table 1. Characteristics of subjects

	TV watching <1 hour/day n=36	TV watching 1-2 hours/day n=42	TV watching >2 hours/day n=57
Age group, n (%)			
<36 months	3(8.3)	14(33.3)	6(10.5)
37-60 months	33(91.7)	28(66.7)	51(89.5)
Gender, n (%)			
Male	15(41.7)	13(31.0)	32(56.1)
Female	21(58.3)	29(69.0)	25(43.9)
Nutritional status, n (%)			
Wasting	5(13.9)	14(33.4)	16(28.1)
Normal	27(75.0)	24(57.1)	26(45.6)
Overweight	4(11.1)	4(9.5)	15(26.3)
Paternal education level attained, n (%)			
Junior high school	0 (0)	0(0)	3(5.3)
Senior high school	11(30.6)	14(33.3)	17(29.8)
University	25(69.4)	28(66.7)	37(64.9)
Maternal education level attained, n (%)			
Junior high school	1(2.7)	1(2.4)	1(1.8)
Senior high school	20(55.6)	22(52.4)	27(47.3)
University	15(41.7)	19(45.2)	29(50.9)
Father's employment status, n (%)			
Employed	36(100.0)	41(97.6)	56(98.2)
Unemployed	0(0)	1(2.4)	1(1.8)
Mother's employment status, n (%)			
Employed	28(32.6)	22(52.4)	36(63.2)
Unemployed	8(16.3)	20(47.6)	21(36.8)
Socioeconomic level, n (%)			
Lower	7(19.4)	7(16.7)	5(8.8)
Middle	16(44.4)	16(38.1)	21(36.8)
Upper	13(36.1)	19(45.2)	31(54.4)
Number of siblings, n (%)			
<2	33(91.7)	39(92.9)	53(93.0)
>2	3(8.3)	3(7.1)	4(7.0)
Parenting, n (%)			
By parents	8(22.2)	13(31.0)	14(24.6)
Not by parents	28(77.8)	29(69.0)	43(75.4)
Number of televisions in the home, n (%)			
<2	11(30.6)	7(16.7)	15(26.3)
> 2	25(69.4)	35(83.3)	42(73.7)
TV in bedroom, n (%)			
Yes	21(58.3)	25(59.5)	36(63.2)
No	15(41.7)	17(40.5)	21(36.8)
Social interaction, n (%)			
Accompanied	33(91.7)	40(52.2)	55(96.5)
Unaccompanied	3(8.3)	2(4.8)	2(3.5)
Television programs watched, n (%)			
Cartoons	26(72.2)	34(80.9)	44(77.2)
Other than cartoons	2(5.6)	2(4.8)	0(0)
Both	8(22.2)	6(14.3)	13(22.8)
Age at onset of watching TV, n (%)			
<24 months	23(63.9)	30(71.4)	38(66.7)
>24 months	13(36.1)	12(28.6)	19(33.3)

Television-watching time was measured by diary records completed by parents/guardians. Time was measured in minutes for every 24 hour period by investigators. Diary filling was done once every 24 hours on school days and holidays. The cognitive development of subjects was measured by the Mullen Scales of Early Learning (MSEL). Data was analyzed by one-way ANOVA, post-hoc, and ANCOVA tests. A result was considered significant if the P value < 0.05. This study was approved by the Ethics Committee and Research Department of the Medical Faculty, Udayana University/Sanglah General Hospital.

Results

There were 135 subjects in our study, with ages ranging from 34 to 52 months. Subjects were allocated to one of three groups depending on the amount of time spent watching television, i.e., < 1 hour daily, 1-2 hours daily, or > 2 hours daily. The mean age of children who watched television < 1 hour daily was 45.08 months, 1-2 hours daily was 40.93 months, and > 2 hours daily was 44.29 months. The mean duration of watching television in this study for all subjects was 2.48 hours per day. Baseline characteristics for each group are shown in **Table 1**.

There were significant differences in mean Mullen composite standard scores in the 3 groups of children, with the highest score in the 1-2 hours/day of television-viewing group (P=0.035). For the individual parameters tested, we found significant differences in the mean T-scores of receptive language and expressive language, (both P=0.001) in the three groups (**Table 2**). Similar to the mean composite scores, the highest mean T-scores for receptive and expressive language were in the 1-2 hours/day TV-viewing group.

By post-hoc test, there were significant differences in mean composite standard score between children who watched television 1-2 hours and those who watched television less than 1 hour daily (P=0.013), as well as between those who watched television more than 2 hours daily (P=0.045). The mean composite standard score in children who watched television 1-2 hours per day was 6.087 points higher than in those who watched television less than 1 hour per day, and also 4.213 points higher than in those who watch television more than 2 hours per day (**Table 3**).

Further analysis of the receptive language parameter T-scores showed significant differences between children who watched television 1-2 hours and those who watched television less than 1 hour (P=0.001), as well as to children who watched

Table 2. MSEL mean scores based on duration of TV viewing

	Group			P
	<1 hour/day	hours/day	>2 hours/day	
Mean composite standard score (SD)	104.39(10.83)	110.48(9.39)	106.26(11.44)	0.035†
Mean visual reception T-score (SD)	54.36(6.63)	51.62(4.67)	51.77(7.22)	0.104†
Mean fine motor T-score (SD)	55.58(8.30)	54.64(7.17)	53.51(8.22)	0.461†
Mean receptive language T-score (SD)	50.28(7.36)	57.71(7.44)	53.35(8.11)	0.001†
Mean expressive language T-score (SD)	49.64(6.50)	56.81(7.48)	53.81(6.50)	0.001†

† One-way ANOVA test

Table 3. Comparison of the mean difference composite standard score based on television watching time

	TV Watching (hrs/day)	Mean difference	Std. error	P	95% confidence interval	
					Lower limit	Upper limit
<1hour	1-2hrs	-6.087	2.425	0.013¶	-10.88	-1.29
	>2hrs	-1.874	2.273	0.411¶	-4.71	5.45
1-2hours	<1hr	6.087	2.425	0.013¶	1.29	10.88
	>2hrs	4.213	2.171	0.045¶	1.08	8.51
>2hours	<1hr	1.874	2.273	0.411¶	-2. 62	6.37
	1-2hrs	-4.213	2.171	0.045¶	-8.51	-1.08

Table 4. Comparison of receptive language T-Score and expressive language T-Score across TV watching time groups

	TV watching time (hrs/day)	TV watching time (hr/day)	Mean difference	Std. Error	P	95% Confidence interval	
						Lower limit	Upper limit
Receptive language T-score	<1hr	1-2 hrs	-7.437	1.751	0.001¶	-10.90	-3.97
		>2 hrs	-3.073	1.641	0.063¶	-6.32	0.17
	1-2hrs	<1 hr	7.437	1.751	0.001¶	3.97	10.90
		>2 hrs	4.363	1.567	0.001¶	1.26	7.46
	>2hrs	<1 hr	3.073	1.641	0.063¶	-0.17	6.32
		1-2 hrs	-4.363	1.567	0.006¶	-7.46	-1.26
Expressive language T-score	<1hr	1-2 hrs	-7.171	1.549	0.001¶	-10.23	-4.11
		>2 hrs	-4.168	1.451	0.005¶	-7.04	-1.30
	1-2hrs	<1 hr	7.171	1.549	0.001¶	4.11	10.23
		>2 hrs	3.003	1.386	0.032¶	0.26	5.75
	>2hrs	<1 hr	4.168	1.451	0.005¶	1.30	7.04
		1-2 hrs	-3.003	1.386	0.032¶	-5.75	-0.26

¶ Post-hoc test

television more than 2 hours per day (P=0.001). There were also significant differences in the expressive language T-scores between children who watched television 1-2 hours and those who watched television less than 1 hour (P=0.001), as well as to children who watched television more than 2 hours per day (P=0.032) (**Table 4**).

ANCOVA analysis revealed a significant association between television watching time and cognitive development (P=0.001). There were no significant associations between cognitive development of children to age, gender, level of parental education, parental employment status, socioeconomic status, parenting form, type of television programs viewed, number of siblings, nutritional status, social interaction, number of televisions in the home, age at onset of watching television, and the presence of a television in bedroom (P>0.05).

Discussion

The mean television watching time of children attending playgroup was 2.48 hours per day, less than that of a previous study that reported children aged 3 to 5 years to view TV about 3.3 hours per day.[2]

There has been little research on the influence of television on cognitive development in Indonesian children.[3,13] An overseas study assessed cognitive development with the Peabody Individual Achievement Test Reading Recognition Scale and found positive effects of television watching in children aged 3 to 5 years. They reported that each hour of television watched was associated with an increase of 0.51 points in the reading recognition scale score, but not significantly associated with memory capabilities. Reading skills assessed included the ability to pronounce words and enrich the vocabulary.[2]

We used the Mullen scale to assess cognitive development in children who attended playgroup, and we observed results different from other studies that used other criteria and cognitive assessment tools.[14-17] However, we had similar results to a study by Lineberger, who found that watching children's television programs (Dora the Explorer, Blue's Clues, Arthur, Clifford or Dragon Tales) increased the value of expressive language and vocabulary in children who watched at the age of 30 months.[18]

The American Academy of Pediatrics recommends that pediatricians advise parents to reduce the negative impact of television on children. Pediatricians are expected to answer the parents' questions about educational television programs, when children should watch television and limiting television watching time. The American Academic of Pediatrics recommends that children aged less than 2 years not watch television, while those over 2 years of age should be limited to only 1 to 2 hours, as well as restricting TV to educational programs and not viewing displays of violence.[11,12]

Television watching by children has been shown to increase their vocabulary, especially for words

that are rarely used by children in daily life.[3,18-20] Other studies concluded that television can develop cognitive function through looking at the pictures and hearing words.[21-23]

A limitation of our study was the lack of direct observation of television watching time. Because of the limited number of researchers, we also did not examine the quality of stimulation and learning processes gained by children .

The cognitive development in children attending playgroup who watched television 1-2 hours per day was higher than in those who watched television for less than 1 hour or more than 2 hours per day. In conclusion, television watching time was statistically associated with cognitive development of children who attended playgroup.

Pediatricians are expected to educate the parents about managing TV-watching time, in order to prevent negative impacts of television on cognitive development. Television watching time for preschool children should be limited to 1-2 hours daily, and restricted to educational programs.

Acknowledgments

Our highest gratitude to I Gde Raka Widiana, MD, for his help in constructing methodology and statistical analysis in this study.

References

1. Christakis DA. The hidden and potent effect of television advertising. JAMA. 2006;295:1698-9.
2. Zimmerman FJ, Christakis DA. Children's television viewing and outcomes. Arch Pediatr Adolesc Med. 2005;159:619-25.
3. Chen M. Mendampingi anak menonton televisi. Jakarta: PT Gramedia Pustaka Utama; 2005.
4. Vandewater EA, Bickham DS, Lee JH. Time will spent? Relating television use to children's free-time activities. Pediatrics. 2005;117:181-91.
5. Hancox RJ, Milne BJ, Poulton R. Association of television viewing during childhood with poor educational achievement. Arch Pediatr Adolesc Med. 2005;159:614-8.
6. Zimmerman FJ, Christakis DA, Meltzoff AN. Association between media viewing and language development in children under age 2 years. J Pediatr. 2005;151:364-8.
7. Zimmerman FJ, Glew GM, Christakis DA, Katon W. Early cognitive stimulation, emotional support, and television watching as predictors of subsequent bullying among grade-school children. Arch Pediatr Adolesc Med. 2005;159:384-8.
8. Vandewater EA, Rideout VJ, Wartella EA, Huang X, Lee JH, Shim M. Digital childhood: electronic media and technology use among infants, toddlers, and preschoolers. Pediatrics. 2007;119:1006-15.
9. Vandewater EA, Lee SJ. Measuring children's media use in the digital age: issues and challenges. Am Behav Sci. 2009;52:1152-76.
10. Johnson JG, Cohen P, Kasen S, Brook JS. Extensive television viewing and the development of attention and learning difficulties during adolescence. Arch Pediatr Adolesc Med. 2007;161:480-6.
11. American Academy of Pediatrics. Media education. Pediatrics. 1999;104:341-3.
12. American Academy of Pediatrics. Children, adolescents, and television. Pediatrics. 2001;107:423-6.
13. Tarigan T, Ervani N, Lubis S. Pola menonton televisi dan pengaruhnya terhadap anak. Sari Pediatri. 2007;9:44-7.
14. Akshoomoff N. Use of the Mullen scales of early learning for the assessment of young children with autism spectrum disorder. Child Neuropsychology. 2006;12:269-77.
15. Ozmert E, Toyran M, Yurdakok K. Behavioral correlates of television viewing in primary school children evaluated by the child behavior checklist. Arch Pediatr Adolesc Med. 2002;156:910-4.
16. Stone WL, McMahon CR, Yoder PJ, Walden TA. Early social-communicative and cognitive development of younger siblings of children with autism spectrum disorders. Arch Pediatr Adolesc Med. 2007;161:384-90.
17. Dawson G, Rogers S, Munson J, Smith M, Winter J, Greenson J, et al. Randomized controlled trial of an intervention for toddlers with autism: the early start Denver model. Pediatrics. 2010;125:17-23.
18. Linebarger DL, Kosanic AZ, Greenwood CR, Doku NS. Effect of watching the television program *Between the Lions* on the emergent literacy skill of young children. J Educ Psychol. 2004;96:297-308.
19. Koolstra CM, Van der Voort THA, Van der Kamp LJT. Television's impact on children's reading comprehension and decoding skills: a 3-year panel study. Read Res Q. 1997;32:128-52.
20. Wright JC, Huston AC, Murphy KC, Peters M, Pinon M, Scantlin R, et al. The relations of early television watching to school readiness and vocabulary of children from low-

income families: the early window project. Child Devel. 2001;72:1347-66.

21. Polakovich IDA, Lorch EP, Milich R, Ashby RD. Disentangling the relation between television watching and cognitive processes in children with attention-deficit/hyperactivity disorder and comparison children. Arch Pediatr Adolesc Med. 2006;160:354-60.
22. Thompson DA, Christakis DA. The association between television watching and irregular sleep schedules among children less than 3 years of age. Pediatrics. 2004: 116:851-6.
23. Sharif I, Sargent JD. Association between television, movie, and video game exposure and school performance. Pediatrics. 2005;118:1061-70.