

WHEN IS THE BACKWARD WALK STARTING AGE FOR CHILDREN?

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The purpose of this study was to investigate a characteristic of kindergartners' backward walk (BW) and when the stable BW starting age is for children. Thirty-three kindergartner of the age 3 – 6 years old participated in BW test of this study. They were asked to walk backward with the different three paces along a walkway of 10m long. In fast pace, the boys of oldest group showed greater BW speed and step length than the boys of youngest group. There was no child older than 70 months after birth, which made an unstable BW in this study. It is possible to suggest that children who participated in this study understood the instruction to do BW, because there are significant differences among each BW speed. In this study, children learn stable BW around 70 months after the baby's birth.

KEY WORDS: growth, kindergartner, step length

INTRODUCTION: The average time for children to start forward walking (FW) is between year one and year two. The walk has an important meaning in a process of the growth. Backward walking (BW) is also important movement, and it is seen in a labour scene of the agriculture and fishery, for example a rice planting or seine. Furthermore, BW has been used for rehabilitation, because BW needs physical strength and dynamic postural control (Robert et al., 1998). No studies, however, have investigated when BW start at and how it develops. The purpose of this study was to investigate a characteristic of kindergartners' BW and when the stable BW starting age is for children.

METHODS: Thirty-three kindergartner of the age 3 – 6 years old the Preschool Affiliated to School of Teacher Education, College of Human and Social Sciences, Kanazawa Univ. participated in BW test of this study. Children are divided into 3 age groups; Group1 is the age group between 44 and 55 months, Group2 is the age group between 56 and 67 months, Group3 is the age group between 68 and 79 months. Table1 show the physical characteristics of the children. They were asked to walk backward with the three different paces (slow, normal, fast), along a walkway was 10m long. Two digital video cameras operating at a rate of 30 fields per second were used. Parameters as number of BW steps, times, speed, step length and step frequency was calculated.

Table 1
Physical Characteristics of Subjects

Group	N		Height (cm)		Weight(kg)		Leg Length(cm)		
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	
Group 1	17	13	M	100.6	102.7	15.3	16.8	46.2	46.8
			SD	(5.1)	(4.8)	(2.4)	(2.8)	(2.4)	(3.0)
Group 2	13	23	M	106.9	106.9	18.1	16.8	48.0	48.7
			SD	(5.8)	(3.7)	(4.2)	(2.0)	(2.9)	(2.1)
Group 3	31	24	M	114.0	111.8	19.9	18.5	52.0	50.9
			SD	(4.4)	(5.5)	(2.5)	(2.7)	(2.4)	(2.9)

M = mean; SD = standard deviation (in parentheses).

RESULTS: Table 2 and 3 summarise the mean value for the variables measured in the three age groups of boys and girls respectively. In fast pace, the boys of group 3 showed greater BW speed and step length than the boys of group 1. As for the stability of BW, the number of children who were not able to perform stable BW made the back slide walking or fell to the ground is shown in Table 4, and also the appearance of those children is shown Photo 1 – 3. There is no child over the 70 months after the baby’s birth who preformed unstable BW in this study.

Table 2
Self-paced walking test (boys)

Group	N		PACE								
			SLOW			NORMAL			FAST		
			SPEED (m/sec)	STEP LENGTH (m)	STEP FREQUENCY (steps/min)	SPEED (m/sec)	STEP LENGTH (m)	STEP FREQUENCY (steps/min)	SPEED (m/sec)	STEP LENGTH (m)	STEP FREQUENCY (steps/min)
Group 1	17	M	0.61	0.28	129.3	0.80	0.31	156.1	1.06	0.30	212.6
		SD	(0.16)	(0.05)	(20.1)	(0.19)	(0.06)	(30.0)	(0.27)	(0.07)	(29.6)
Group 2	13	M	0.75	0.32	140.9	0.73	0.35	125.4	1.22	0.34	225.8
		SD	(0.19)*	(0.04)	(31.3)	(0.16)	(0.07)	(14.4)	(0.29)	(0.07)	(66.9)
Group 3	31	M	0.58	0.30	116.7	0.79	0.33	143.4	1.41	0.37	227.7
		SD	(0.19)	(0.06)	(28.1)	(0.23)	(0.05)	(40.1)	(0.40)	(0.07)	(52.9)

M = mean; SD = standard deviation (in parentheses).

* : significant at p<0.05
 ** : significant at p<0.01

Table 3
Self-paced walking test (girls)

Group	N		PACE								
			SLOW			NORMAL			FAST		
			SPEED (m/sec)	STEP LENGTH (m)	STEP FREQUENCY (steps/min)	SPEED (m/sec)	STEP LENGTH (m)	STEP FREQUENCY (steps/min)	SPEED (m/sec)	STEP LENGTH (m)	STEP FREQUENCY (steps/min)
Group 1	13	M	0.55	0.30	111.6	0.73	0.32	139.9	0.99	0.32	190.8
		SD	(0.16)	(0.06)	(16.7)	(0.17)	(0.07)	(28.8)	(0.17)	(0.06)	(28.4)
Group 2	23	M	0.62	0.32	114.5	0.72	0.32	133.3	1.14	0.32	212.8
		SD	(0.24)	(0.06)	(33.0)	(0.16)	(0.05)	(29.1)	(0.21)	(0.06)	(31.8)
Group 3	24	M	0.57	0.30	114.2	0.73	0.34	129.4	1.13	0.36	193.2
		SD	(0.18)	(0.08)	(21.3)	(0.19)	(0.07)	(19.5)	(0.32)	(0.07)	(47.2)

M = mean; SD = standard deviation (in parentheses).

* : significant at p<0.05
 ** : significant at p<0.01

Table 4
Number of Subjects who performed unsteady or incomplete BW

Group	N	Boys	%	Girls	%	Sum	%
Group 1	30	9	52.9	4	30.8	13	43.3
Group 2	36	7	53.8	7	30.4	14	38.9
Group 3	55	2	6.5	2	8.3	4	7.3

DISCUSSION: It is possible to suggest that children participated in this study understood the instruction to do BW, because there are significant differences among each BW speed. In this study, children learn stable BW around 70 months after the birth. It is more difficult to move backward as an unnatural direction to walk than forward, because BW needs body stability and taking risk of falling. It seems that the children get to accept the fear of stumbling at this age. It is suggest that BW is the development indicator for children, because physical and mental adaptations are required to BW rather than FW.



Figure 1: Unstable BW (side walk).



Figure 2: Unstable BW (back slide walk).



Figure 3: Unstable BW (pike style walk).

CONCLUSION: It is concluded that stable BW starting age for children is 70 months in this study. In addition, the increase in BW speed can most likely be explained by increasing step length.

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