strength was tested. Kellor et al. (1971) and Fullwood (1986) also tested pinch strength with the subject's forearm pronated, and only one opportunity was given to exert maximum effort. Ager et al. (1984) used the Preston pinch gauge, and one maximal force was exerted for each measurement. Fullwood and this study used the pinch gauge by B & L Engineering Co. because it has been reported to be more accurate than the Preston pinch gauge (Mathiowetz et al., 1984). For pinch strength evaluations, the ASHT recommended positioning the forearm in the neutral or midposition and recording the mean of three trials.

The purpose of this study was to establish grip and pinch strength norms for 6- to 19-year-olds and to describe the effects of age, sex, and hand dominance on hand strength.

Methods

Subjects

Subjects, 231 males and 240 females, who ranged in age from 6 to 19 years, attended schools in the seven-county Milwaukee area. All subjects were divided into seven 2-year age groups (see Table 1) and were free from disease or injury that could affect their upper extremity strength. Individuals with learning disabilities were excluded from the study.

Procedures

A brief interview preceded all testing to determine whether or not subjects met the criteria. This study was part of a larger study of hand strength and dexterity that included the Box and Block Test (Mathiowetz, Federman, & Wiemer, 1985). The hand strength testing followed the dexterity testing. Grip strength was tested first, followed by tip (2-point) pinch, key (lateral) pinch, and palmar (3-point pad) pinch. The operational definition of each type of pinch has been previously reported (Mathiowetz et al., 1984). For each test of hand strength, the subjects were seated with their shoulder adducted and neutrally rotated, elbow flexed at 90°, forearm in neutral position, and wrist between 0° and 30° dorsiflexion and between 0° and 15° of ulnar deviation (Fess & Moran, 1981; Mathiowetz et al., 1984). For each strength test, standard instructions were followed, and the scores of three successive trials were recorded for each hand (Ma-

Figure 1
A Comparison of Mean Key Pinch Strength Scores of Males and Females, Aged 6–19 Years

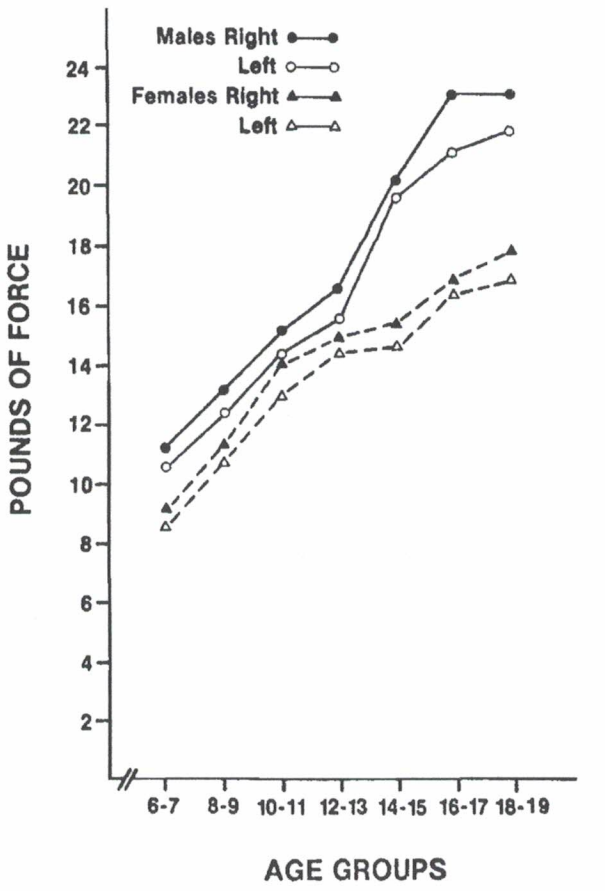

Table 3
Average Performance of Normal Subjects on Tip Pinch (lb)

		Males			Females		
Age	Hand	Mean	*SD*	Range	Mean	*SD*	Range
6–7	R	7.2	1.6	4–10	6.7	1.2	4–10
	L	7.1	1.4	5–11	6.1	1.5	3–10
8–9	R	8.6	2.2	6–17	7.6	1.4	5–10
	L	8.3	2.2	4–15	7.2	1.3	5–10
10–11	R	10.0	2.4	5–16	9.7	1.4	7–13
	L	9.5	2.3	5–16	9.4	1.7	6–12
12–13	R	10.5	2.5	5–14	10.6	2.2	6–17
	L	9.8	2.3	5–13	10.1	2.3	5–17
14–15	R	13.1	2.9	8–20	10.2	2.3	5–15
	L	12.6	3.0	6–18	9.5	2.4	4–17
16–17	R	15.0	2.7	11–21	11.9	2.3	9–19
	L	13.8	2.7	7–22	11.1	2.3	7–17
18–19	R	17.0	3.8	10–31	13.5	2.8	7–20
	L	16.1	3.8	11–29	13.4	2.9	8–20