

Normative Data of Handgrip Strength and Hand Dexterity of Preschool Egyptian Children Aged 3-6 Years

Amaal HM Ebrahim* Reda SM Sarhan**

*Assistant professor. Basic Science Department. Physical Therapy College. Cairo University.

**Department of Physical Therapy. Faculty of Applied Medical Sciences. King Abdul-Aziz University.

Abstract

high significant difference between right and left hand except for group A of (3years +6months) recorded no significant difference ($p>0.1388$). There is no correlation between hand grip strength and hand dexterity for right and left hands in all groups. The comparison test between all groups reported a highly significant difference ($p<0.001$) in hand grip strength and dexterity between group A and D, no significant difference showed between group B and C. These results may be revealed that with increasing age the manual skills and strength of hand developed with increasing experience and learning. **Conclusion.** We concluded that the dominant hand is significantly stronger and faster in right handed pre-school children. The data obtained from this study can be considered as a basic stone for data bank to be used in the evaluation of pre-school Egyptian children's hand function as well as for research purposes or clinical use.

Background and purpose.

Evaluation of hand grip strength and dexterity are difficult in pre-school Egyptian children because of the lack of normative data. The purposes of this study were to establish normative data of hand grip strength and hand dexterity in pre-school Egyptian children aged (3-6 years) and examine if there is a correlation between hand grip strength and dexterity of right dominant and left non-dominant hands. **Subjects.** 87 right handed healthy children (40 girls and 47 boys), divided into 4 groups according to age (group A, 3years +6months, group B, 4years \pm 6 months, group C, 5years \pm 6 months and group D, \pm 6 months). **Methods.** Hand dominance was determined, every child was asked to exert maximum grip strength by using hand held dynamometer. The hand dexterity measured by using Nine-hole Peg Board. The tests were conducted first to right hand then left hand. **Results.** The hand grip strength showed highly significant difference between right and left hand ($p<0.001$). The hand dexterity recorded a

dexterity. Pre-school children.

Key words. Normative data. Hand grip strength. Hand

for the Korean elementary school children. Semproli et al 2007⁽⁹⁾ investigate the relationship between hand grip and pinch strength values with basic body measures (body height, body mass index, BMI) and with specific hand anthropometric parameters (finger span, lengths and perimeter) in 461 pre-pubertal children ages from 6 to 10 years. They found that the relation between anthropometry and handgrip strength is stronger in boys compared with girls and low relation between hand anthropometry and tip and key pinch strength. Crosby et al 1994⁽¹⁰⁾ studied normal hand strength Deficits in motor functions in the develop and the difference between dominant and nondominant hands. The majority of right-handed subjects were 10% stronger in grip strength on the dominant side. De Smet and Vercammen 2001⁽¹¹⁾, studied the grip strength of 487 healthy children aged between 5 and 15 years. They found a clear correlation between age and grip strength up to age of 12 years. From the age of 13 years, boys developed a 25% stronger grip force than girls. The difference between the dominant and non-dominant hand grip was not significant, but was constantly

Introduction

The human hand is capable of complex and precise functions which can be divided into grasping abilities measured by the strength and manual dexterity. The hand is a receptor of much information from the environment and in everyday life all kinds of grips are of vital importance for ordinary activities of daily life. Handgrip strength is a good parameter not only in evaluation of hand as a predictor of hand function, but also to explore the status of general health^(1,2). As children grow up the hand function develops^(3,4) with contribution of the increased hand anthropometry. Many studies found a relation between increasing age, anthropometry and handgrip strength⁽³⁻⁷⁾. Grip strength testing are commonly used to evaluate hand strength for disability ratings as ; after surgery for trauma, correction of congenital anomaly or in case of impaired hand functions due to brain lesions, peripheral neuropathies or other causes. It is imperative that hand strength and dexterity be evaluated in order to determine the severity of hand dysfunction and determining the effect of treatment strategies or effects of different procedures. Yim et al ⁽⁸⁾, provide normative data of hand function including dexterity

data of hand grip strength and hand dexterity in pre-school Egyptian children aged (3-6 years) and examine if there is a correlation between hand grip strength and hand dexterity of right dominant and left non-dominant hands.

Material and Methods

Subjects

This study was performed after an approval from the director of El-Takwa and Dar Al-Eman kindergartens. The researchers gave the kindergarten's administration a consent letter to the parents of children containing the procedure of the experiment and its importance to the children health. The study included 87 healthy children, (40 girls and 47 boys) from El-Takwa and Dar Al-Eman kindergarten, aged from 3 to 6 years old with mean age ($4.3 \pm .8$). Children were divided according to their age into four groups, group A (3 years + 6 months) 23 children (15 boys and 8 girls), group B ($4 \text{ years} \pm 6$ months) 28 children (12 boys and 16 girls), group C ($5 \text{ years} \pm 6$ months) 23 children (13 boys and 10 girls), and group D ($6 \text{ years} \pm 6$ months) 13 children (7 boys and 6 girls). The subject characteristics, age, sex, weight and height included in table (1). All children were right handed. Handedness was identified by ask the child to draw or write any think and notice

stronger in the right hand for right-hand dominant children.

Dexterity is a motor manual skill associated with the hands requiring coordination of fine and gross movement. Babies cannot control their hands but as they develop, the dexterity increases with age as well as hand-eye coordination. With reviewing the literatures, hand dexterity of children has not been widely studied until now⁽¹²⁾. Kamieniarz et al⁽¹³⁾, used new computer tests of manual dexterity and Nine Hole Peg Tests in two groups of children aged from 7 to 15 years. They found that the hand grip strength measurement showed the highest test-retest reliability. Also the Nine-Hole Peg Test is reliable for the dominant hand but lower than the computer tests. Smith et al 2000⁽¹⁴⁾ evaluated norms for motor dexterity skills on 826 elementary school children of ages 5 through 10 utilizing the Nine-hole Peg test. Their findings supported the Nine-hole Peg Test as an effective screening tool for fine motor dexterity of school-age children.

Several studies^(5,7,8,10,12,14), report the normal values of hand grip strength and hand dexterity in different countries but these data may be not appropriate for the Egyptian children population because of the differences in physical and anthropometric characteristics according to culture and race. The purposes of this study were to establish normative

previous surgery in upper limb, and any disorder that affected upper limb performance.

the hand used and confirmed our observation by asking the teacher which hand the child used in drawing or writing. The exclusion criteria were left handedness,

Table 1. Subject characteristics: number, age, weight and height.

Age	Number	boys	Girls	Weight	Height
Group (A) 3Y + 6mo	23	15	8	16.4±3.5	91±5.4
Group (B) 4 Y ± 6mo	28	12	16	19.1±2.8	98.5±6.2
Group (C) 5 Y ± 6 mo	23	13	10	21.3±2.6	104.3±6.8
Group (D) 6 Y ± 6mo	13	7	6	24.8±3.7	113.6±8.4

a standardized position were followed; the child was seated upright on a straight-backed chair comfortably with the feet flat on the floor, shoulder adducted and neutrally rotated, elbow flexed at 90 degrees, forearm in neutral position, and the wrist between 0 and 30 degree extension and between 0 and 15 degree ulnar deviation. The arm should not be supported by the examiner or by an armrest. The handgrip dynamometer placed in child's right hand vertically and in line with the forearm to maintain the standard forearm and wrist position, and asked him/her to squeeze the dynamometer as hard as he/she can. The researchers in this study measure the hand grip strength once as used by Harkonen et al 1993a⁽¹⁶⁾ and Ashton 2004⁽¹⁷⁾ who recommended the use of single measurement as an accurate and time efficient way. The same procedure was repeated for the left hand (non dominant). The

Instruments

Hand-held dynamometer used for measuring grip strength and a Nine-hole Peg Board (Sammons Preston, USA) was used for measuring the hand dexterity. Weight and height scale putted in classroom on a flat surface with infant desk and chair of appropriate height to children. Stop watch to measure dexterity time.

Procedures

The children were tested individually by the researchers. First weighted the child and measure his/her height. A calibrated hand-held dynamometer was used to measure the grip strength of dominant and non-dominant hand. Before beginning the researcher ensured that the dynamometer was set at zero. The recommendations of the American Society of Hand Therapists (Richards & Palmiter 1996)⁽¹⁵⁾, for

right dominant and left non-dominant hands within each group. Linear regression correlation coefficient test performed to find the relation between hand grip strength and hand dexterity was done to all groups. One-way ANOVA test and Tukey-Kramer-Multiple comparison test for hand grip strength and dexterity to determine the difference between and within groups. A p value <0.05 was accepted as significant. All statistical analysis was performed using a statistical Package for the Social Sciences 16.0(SPSS) computer software, the graphs done by using Office Excel 2003.

Results

The paired t-test for hand grip strength of all groups showed a highly significant difference in strength between right (dominant) and left hand (non-dominant) $p < 0.000$, the means of hand grip strength for group A were 4.63 ± 1.166 & 2.63 ± 0.646 for right and left hand respectively and increase through all groups to be 6.6 ± 0.828 for right hand and 4 ± 0.67 for left hand (for the D group). In dexterity test, group A (age from 3 +6 months) recorded no significant difference between right and left hand dexterity ($p > 0.1388$), the other three groups (B, C, and D) reported

measurement recorded for each child as right dominant hand and left non-dominant hand score.

To test the hand dexterity, the nine-hole peg board was used to measure the time the child took to place nine headless pegs in holes on a 5-inch square peg board using one hand only. The Nine-hole Peg Board was centered in front of the child with the container side on the same side as the hand being tested. The right dominant hand was tested first. The child completed one practice trial followed by the actual timed test for each hand. The child was told that the holes might be filled in any order, and he/she must pick up one peg at a time, using one hand only, and to put them in the holes until all nine holes were filled. The child should take the pegs out again from the holes one by one⁽⁸⁾. The child completed one practice trial followed by the actual timed test for each hand. The performance of each child was recorded in seconds, and the test was performed once with each hand.

Statistical Analysis

The mean and standard deviation to age height, weight, and grip strength and dexterity time for both dominant and non-dominant hand were calculated. The paired-sample t-test was used to compare differences between

very significant differences between right and left hand dexterity ($p < 0.0019$, < 0.0057 , 0.0036) respectively (table 2, figure 2,3).

Table 2. The paired t-test of hand grip strength and hand dexterity of all groups.

Measurement		Hand grip strength (Kg)				Hand dexterity (sec)			
group	Hand	X $\bar{}$ ±SD	SEM	t	P value	X $\bar{}$ ±SD	SEM	t	P value
(A) 3Y+6mo	RT	4.63±1.166	0.243	8.756	<0.0001	43.61±13.85	2.887	1.508	>0.1388
	LT	2.63±0.646	0.135			49.87±14	2.985		
(B) 4Y±6mo	RT	5.1±0.828	0.169	5.457	<0.0001	37.62±5.57	1.036	3.261	<0.0019
	LT	3.6±1.14	0.215			42.66±6.17	1.145		
(C) 5Y ±6mo	RT	5.42±1.163	0.242	5.635	<0.0001	33.52±5.98	1.246	2.904	<0.0057
	LT	3.8±0.70	0.146			39.35±7.54	1.573		
6 Y+6mo	RT	6.6±0.828	0.230	8.395	<0.0001	29.62±4.5	1.248	3.231	<0.0036
	LT	4±0.676	0.190			35.69±5.07	1.407		

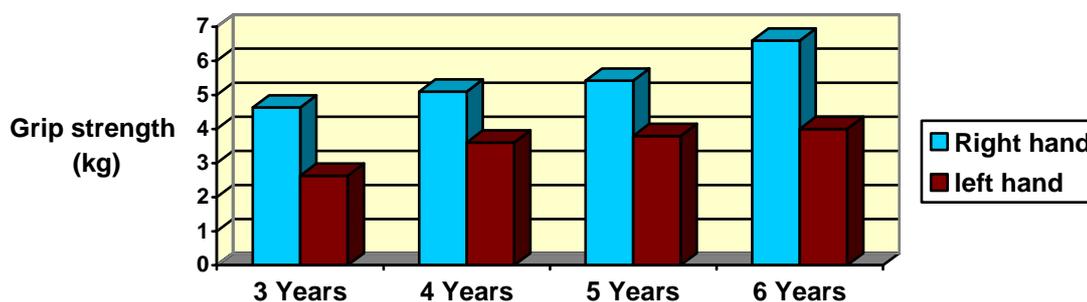


Figure.2 The mean of hand grip strength (Kg) of right (RT) and left (LT) hand for 3, 4, 5, and 6 years children

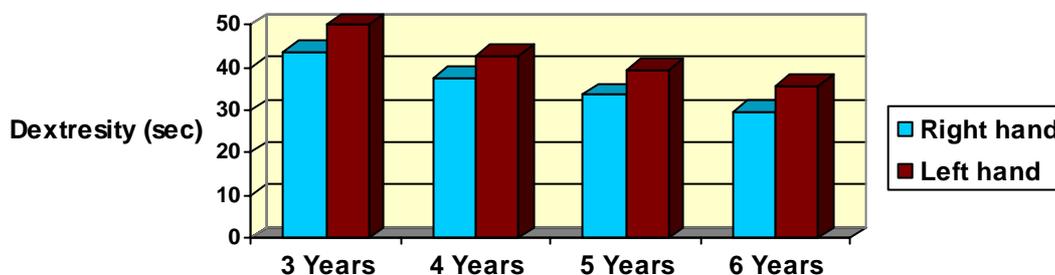


Figure 3. The mean hand dexterity (sec) of right (RT) and left (LT) hand for 3, 4, 5, and 6 years children

for group A, B, C, and D were showed no significant results as the p value were 0.1566, 0.3526, 0.0983, and 0.6881, and the correlation coefficient were 0.3053, 0.1791, 0.3531, and 0.1234 respectively. (table 3)

The linear regression correlation coefficient showed no significant results between right hand grip strength and right hand dexterity as correlation coefficient were -0.1767, 0.121, 0.131, and 0.345 for group A, B, C, and D. The left hand grip strength and dexterity

Table 3. The correlation coefficient between hand grip strength and dexterity for all children.

Correlation coefficient between right (RT) hand grip strength and dexterity for all groups				
	3 Years	4 Years	5 Years	6 Years
Rt hand grip strength (Kg)	4.63±1.166	5.1±0.828	5.42±1.163	6.6±0.828
RT hand dexterity (sec)	43.61±13.85	37.62±5.57	33.52±5.98	29.62±4.5
Correlation coefficient (r)	-0.1767	0.121	0.131	0.345
f	0.6766	0.403	0.379	1.481
P value	0.42	0.53	0.58	0.25
Correlation coefficient between right (LT) hand grip strength and dexterity for all groups				
Lt hand grip strength (Kg)	2.63±647	3.6±1.139	3.8±0.702	4±0.675
LT hand dexterity (sec)	49.87±14.0	42.66±6.17	39.35±7.54	35.69±5.07
Correlation coefficient (r)	0.3053	0.1791	0.3531	0.1234
f	2.159	0.8947	2.992	0.170
P value	0.1566	0.3526	0.0983	0.6881

hand grip strength and dexterity recorded between group A and D. No significant results reported between group B and C for hand grip strength and hand dexterity either for right hand or left hand. An extremely significant difference ($P < 0.001$) in right hand grip strength and significant difference in right hand dexterity showed between group B and D. The comparison between group C and D recorded a very significant difference ($P < 0.01$) in right hand grip strength only.

The results in table 4 describe the ANOVA and Tukey-Kramer – multiple comparison test between all groups. The hand grip strength showed a very significant difference ($p < 0.001$) in left hand and significant difference ($p < 0.05$) for hand dexterity between group A and B. the comparison between group A and C reported a highly significant difference ($P < 0.001$) for left hand grip strength and very significant difference ($P < 0.01$) for right and left hand dexterity. A highly significant difference ($P < 0.001$) in

Table 4. One-way ANOVA test and Tukey-Kramer-Multiple comparison test for hand grip strength and dexterity.

Comparison	Measurement	Hand grip strength (Kg)		Hand dexterity (sec)	
		RT	LT	RT	LT
A (3Y +6mo) vs B (4Y±6mo)	Mean difference Q p	-0.4739 2.306 p>0.05	-1.416 8.264 P<0.001***	5.988 3.554 p>0.05	7.214 3.965 P<0.05*
A (3Y +6mo) vs C (5Y±6mo)	Mean difference Q p	-0.4739 3.647 p>0.05	-1.630 9.012 P<0.001***	10.087 5.669 P<0.01**	10.525 5.476 P<0.01**
A (3Y +6mo) vs D (6Y±6mo)	Mean difference Q p	-1.974 7.730 P<0.001***	-1.884 8.622 P<0.001***	13.993 6.683 P<0.001***	14.177 6.270 P<0.001***
B (4Y±6mo) vs C (5Y±6mo)	Mean difference Q p	-0.3174 1.545 p>0.05	-0.2148 1.245 p>0.05	4.099 2.433 p>0.05	3.307 1.818 p>0.05
B (4Y±6mo) vs D (6Y±6mo)	Mean difference Q p	-1.500 6.107 P<0.001***	-0.4681 2.223 p>0.05	8.005 3.975 P<0.05*	6.963 3.201 p>0.05
C (5Y±6mo) vs D (6Y±6mo)	Mean difference Q p	-1.183 4.631 P<0.01**	-0.2533 1.159 p>0.05	3.906 1.866 p>0.05	3.656 1.617 p>0.05

hands with age were similar to that in previous studies from Australia^(7,18), Korea⁽⁸⁾, Sweden⁽¹⁹⁾ and the USA⁽¹²⁾, although different instruments were used. The extremely significant difference between right and left hand among all groups reported in this study was in agreement with results found by Yim et al 2003⁽⁸⁾, Ager 1984⁽⁵⁾, Häger-Ross and Rösblad 2002⁽²⁰⁾. Similarly a study conducted by Armstrong and Oldham 1999⁽²¹⁾, compared dominant and non-dominant hand strength in both right and left-handed participant, they observed

Discussion

In this study normative data are presented for hand grip strength and dexterity in pre-school Egyptian children aged 3 to 6 years using hand held dynamometer and Nine-Hole Peg board. The superior performance of the right dominant hand over the left non-dominant hand in most tasks has been documented extensively. In particular, the right dominant hand is faster and more accurate than left non-dominant hand. As shown in this study the development of hand strength and difference between

than with their non-dominant hand

No correlation was found between hand grip strength and hand dexterity for any age group. Yim et al 2003⁽⁸⁾, reported no significant difference in three kinds of pinch strength and dexterity between elementary school boys and girls.

In addition, the within- and between groups comparison (One-way ANOVA test and Tukey-Kramer-Multiple comparison test) of hand grip strength test showed a highly significant difference for right hand between group A and D and between group B and C ($p < 0.001$) and very significant difference between group C and D ($p < 0.01$), but no significant difference between group A and B or group A and C. this results can be explained as the hand grip strength is increased as the child grow up and use it in many activities of daily living. The left hand grip strength showed a highly significant difference between group A and B, C, and D ($p < 0.001$). No significant difference in left hand strength between other groups. The comparison between group A and B, group B and C and group C and D, for right hand dexterity showed no significant difference ($p > 0.05$). A high significant difference reported between group A and group C and D ($p < 0.01$ and 0.001 respectively)

small but significant differences between the dominant and non-dominant hands in the right handed group. Also Incel et al 2002⁽⁴⁾ and Özcan et al 2004⁽²²⁾, documented significantly more grip strength in dominant hands than in non-dominant hands for right-handed people.

The right hand and left hand dexterity showed no significant difference between right and left hand for group A (3years +6months), this insignificance may be due to the young age as the result suggest that the cognitive development of the children of this age may enable them to perform the test fast. The rest of the groups showed a high significant difference between right and left hand dexterity. These results were confirmed by Poole et al 2005⁽²³⁾, who measured dexterity in 406 children aged 4-19 years using the Nine-hole Peg Test, and concluded that the speed of dexterity improved with age and performed faster with dominant hand than non-dominant hand. Other studies have shown that dexterity continues to improve during adolescence^(24,25), and it has been suggested that adolescents do not have similar dexterity to adults. Similarly, Özcan et al 2004⁽²²⁾, concluded that the right-handers significantly faster in dexterity test with their dominant hand

The hand grip strength and hand dexterity showed a high significant difference between right and left hand. The age group of 3years +6months recorded no significant difference in hand dexterity. There is no correlation between hand grip strength and hand dexterity for any age group. These results may be revealed that with increasing age the manual skills and strength of hand developed with increasing experience and learning and the dominant hand is significantly stronger and faster in right handed pre-school children. The data obtained from this study can be considered as a basic stone of data bank to be used in the evaluation of pre-school Egyptian children's hand function as well as for research purposes or clinical use.

and between group B and D ($p<0.05$). The left hand dexterity recorded significant difference between group A and B ($p<0.05$), very significant difference between group A and C ($p<0.01$) and a highly significant difference between group A and D ($p<0.001$). This results may be due to the development of manual skills and increasing the coordination of fine and gross movements developed through learning and experience.

In the future, this study should be repeated with avoidance of some methodological limitations as the sample group from Egyptian children was small and was not represent the most population of pre-school children. More studies should be conducted to examine if there are differences of hand grip strength and hand dexterity between boys and girls. Further studies with larger sample size and more age variability to compare the sequences of hand grip strength and hand dexterity development through pre-school age, pre-pubertal age and adolescents of Egyptian population could be better to represent the normative data and permit generalization.

Conclusion

In conclusion, this study provided normative data of hand grip strength and hand dexterity of right handed pre-school Egyptian children aged 3-6 years.

- years old. *Am J Occup Ther* 1984;38:107-113.
6. Bowman O, Katz B. Hand strength and prone extension in right dominant 6 to 9 years. *Am J Occup Ther*. 1984;38:367-376.
 7. Newman DG, Peam J, Bames A, Young CM, Kehoe M, Newman J. Norms for handgrip strength. *Arch Dis Chil*. 1984;59:453-459.
 8. Yim SY, Cho JR, Lee Y. Normative data and developmental characteristics of hand function for elementary school children in Suwon area of Korea: Grip, pinch and dexterity study. *J Korean Med Sci*. 2003; 18:552-558.
 9. Semproli S, Brasili P, Toselli S, Ventrella AR, Jürimäe J, Jürimäe T. The influence of anthropometric characteristics to the handgrip and pinch strength in 6-10-year old children. *Anthropol Anz*. 2007;65(3):293-302. MIDLINE.

References

1. Secker DJ, Jeejeebbog KN. Subjective global nutritional assessment for children. *Am J Clin Nutr*. 2007;85:1083-1089. Downloaded from www.ajcn.org
2. Kenjle K, Limaye S, Ghugre PS, Udipi SA. Grip strength as an index for assessment of nutritional. *J Nutr Sci Vita*. 2005;51(2):87-92. MIDLINE
3. Haward BM, Griffin MJ. Repeatability of grip strength and dexterity tests and the effect of age and gender. *Int Arch Occup Environ Health*. 2002;75(1-2):111-119. Midline
4. Incel NA, Ceceli E, Durukan PB, Erdem HR, Yorgancioglu ZR. Grip strength: effect of hand dominance. *Singapore Med J*. 2002;43(5):234-237. MIDLINE
5. Ager C, Olivett B, Johnson C. Grasp and pinch strength in children 5 to 12

- and clinical utility. Critical Review in physical and a rehabilitation Medicine.1996;46:87-109
16. Harkonen R., Harju R. Alaranta H. Accuracy of the Jamar dynamometer. J Hand Ther. 1993a;6:259-262.
 17. Ashton LA., Myers S. Serial grip strength testing- its role in assessment of wrist and hand disability. Int J Surg. 2004;5(2). The Internet Journal of Surgery TMISSN :1528-8242, <http://www.ispub.com/ostia/index.php?xmlFilePath=journals/ijsvol5n2/strength.xml>
 18. Grice OK., Vogel KA, Le V, Mitchell A, Muniz S, Vollmer MA. Adult norms for a commercially available Nine Hole Peg Test For finger dexterity. Am J Occup Ther. 2003;57(5):570-573. Midline
 19. Fllwood D. Australian norms for hand and finger strength of boys and girls aged 5-12 years. Aust
 10. Crosby CA., Wehb MA., Mawr B. Hand strength: Normative values. J hand Surg. 1994;46A:665-670. MIDLINE
 11. De Smet L, Vercammen A. Grip strength in children. J Pedia Orthop. 2001; 10: 352-354
 12. Mathiowetz V, Wiemer DM, Federman SM. Grip and Pinch: norms for 6- to 19-yr-olds. Am J Occup Ther 1986;40:705-711
 13. Kamieniarz M, Stryla W, Haglauer P, Kamieniarz G. Standardized Computer tests for assessment of children manual dexterity. Computational Methods in Science and Technology. 1999;5:25-38
 14. Smith YA, Hong E, Presson C. Normative and validation studies of the Nine-Hole Peg Test with children. Percept Mot Skills. 2000; 90:823-843. Midline
 15. Richard L, Palmiter-Thomas P. Grip strength measurement: A critical review of tools, methods,

23. Gardner RA, Broman M. The Purdue Pegboard: normative data on 1334 school children. *J Clin Child Psychol.* 1979;1:157-159.
24. Lee-Valkov PM, Aaron DH, Eladoumikachi F, Thornby J, Netscher DT. Measuring normal hand dexterity values in normal 3,4,and 5-year-old children and their relationship with grip and pinch strength. *J Hand Ther.* 2003;16(1):22-28. Midline
- Occup Ther J 1986;33:26-36
20. Häger-Ross C & Rösblad B. Norms for grip strength in children aged 4-16 years. *Acta Paediatr* 2002;91:617-625
21. Özcan A, Tulum Z, Pinar L, Başkurt. Comparison of pressure pain thr-878eshold, grip strength, dexterity and touch pressureof dominant and non-dominant hands within and between right and left handed subjects. *J Korean Med Sci.* 2004;19:874
22. Poole JL, Burtner PA, Torres TA, et al. Measuring dexterity in children using the Nine-hole Peg Test. *J hand Ther.* 2005;18:348-351

الملخص العربى

البيانات المعيارية الطبيعية لقوة قبضة اليد والمهارات اليدوية للأطفال المصريين قبل سن لمدرسة من عمر ٣ الى ٦ سنوات

د. أمال حسن محمد إبراهيم* د. رضا سيد محمد سرحان**
*أستاذ مساعد. قسم العلوم الأساسية. كلية العلاج الطبيعى. جامعة القاهرة
** قسم العلاج الطبيعى. كلية العلوم الطبية التطبيقية. جامعة الملك عبد العزيز

المجموعات. أوضح اختبار المقارنة بين كل المجموعات أن هناك إختلاف ذو دلالة هامة ($p < 0.001$) فى قوة قبضة اليد والمهارة بين المجموعة أ والمجموعة د وتفاوتت فى النتائج بالنسبة لباقي المجموعات. هذه النتائج يمكن أن توضح أنه مع زيادة السن فإن المهارات اليدوية وقوة قبضة اليد تتطور مع زيادة الخبرة والتعليم. الخلاصة: أنضح من هذه الدراسة أن اليد السائدة هى أكثر قوة وسرعة فى الأطفال المصريين قبل سن المدرسة المستخدمين اليد اليمنى. البيانات التى حصل عليها من هذه الدراسة يمكن أن تعتبر كحجر أساس لبنك بيانات يمكن أن يستخدم لتقييم وظائف يد الأطفال المصريين قبل سن المدرسة وكذلك إستخدامها لأغراض البحث والعلاج. الكلمات الدالة: البيانات المعيارية الطبيعية. قوة قبضة اليد. المهارات اليدوية. أطفال ما قبل سن المدرسة.

الخلفية والغرض. من الصعب تقييم قوة قبضة اليد ومهاراتها لدى الأطفال المصريين قبل سن المدرسة بسبب نقص البيانات المعيارية الطبيعية. كان الغرض من هذه الدراسة هو الحصول على البيانات المعيارية الطبيعية لقوة قبضة اليد والمهارات اليدوية عند الأطفال المصريين قبل سن المدرسة والبالغين من العمر ٦-٣ سنوات واختبار العلاقة الترابطية بين قوة قبضة اليد والمهارة فى اليد اليمنى (السائدة) واليد اليسرى (غير سائدة). **الأشخاص.** ٨٧ من الأطفال الأصحاء (٤٠ بنت و ٤٧ ولد) يستخمون اليد اليمنى قسموا إلى أربع مجموعات حسب السن (مجموعة أ من ٣ سنوات + ٦ شهور، مجموعة ب من ٤ سنوات ± ٦ شهور، مجموعة ج من ٥ سنوات ± ٦ شهور، مجموعة د ٦ سنوات ± ٦ شهور). **الطريقة.** حددت اليد السائدة، ثم طلب من كل طفل القيام بأقصى قوة لقبضة اليد باستخدام جهاز الديناموميتر اليدوى المعايير. قيست المهارات اليدوية باستخدام لوحة تسعة فتحات خنزير (Nine-hole Peg Board). الأختبارات بدأت باليد اليمنى ثم اليد اليسرى. **النتائج.** أظهرت نتائج قوة قبضة اليد إختلاف ذو دلالة هامة بين اليد اليمنى واليسرى ($p < 0.001$). وسجلت مهارات اليد إختلاف ذو دلالة هامة بين اليد اليمنى واليد اليسرى فى كل المجموعات ما عدا مجموعة أ (٣ سنوات ± ٦ شهور) فلم تسجل أى إختلاف إحصائى ($p > 0.1388$). لم توجد أى علاقة ترابطية بين قوة قبضة اليد والمهارة اليدوية لأى من اليد اليمنى أو اليسرى بالنسبة لكل