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## Age and Sex Differences in Performance in Motility and Strength Tests

By R. N. KJERLAND

### THE PROBLEM

Ream (7) defines motility as the fundamental capacity for speed in a simple repeated movement. As a measure of motility the tapping test has several advantages. The test is simple, objective and easily given and quickly learned. It has the advantage of motivating the observer to do his best.

In a review of earlier studies, Wells (10) concludes that the performance of boys is faster than girls and that sex differences increase with age. He predicts a consistent superiority of men over women in speed of movement as so measured.

Bryan (3) in a study of voluntary motor ability concludes that "The maximum rate of rhythmically repeated voluntary movements is probably a test of the power of voluntary arrest and reversal."

Lauer (4) found correlations of .24 and .63 for men and women respectively between tapping performance and coordination as measured by specially devised apparatus simulating certain functions of automobile driving.

Another measure of motor ability often used is the strength of grip test. Strength is defined as the inherent capacity to manifest energy, to endure, and to resist some type of counter-tension. This study is concerned with the strength of grip of the right and left hands taken separately.

Lauer (5) found a slight relationship between motility and strength of grip in both men and women. Correlations of .33 and .19 were obtained for men and women respectively. Other studies have shown a positive relationship between motility and strength of an individual. While the differences in strength for the two sexes are obvious it was considered of interest to determine the magnitude of this difference.

These two psychometric tests are assumed to be of interest to those in certain fields of skill such as driver education and selection. The strength of grip test being an indication of endurance and the motility test a measure of general activity and facility in certain types of performance. The purpose of this study is to determine age and sex differences in both the motility and strength tests under standard conditions.

Since age and sex differences in the two tests have been reported in the literature without statistical evaluation the following null hypotheses were set up for experimental evaluation.

1. There is no significant differences in the performance between men and women on motility or strength.
2. There is no significant difference in performance among age groups used on motility or strength.

#### METHOD AND PROCEDURE

The method was essentially that of giving the motility and strength tests to a sufficient number of subjects, of both sexes, under standard conditions to obtain statistically substantial results. One hundred subjects 66 men and 34 women, ranging in age from 17 to 77 were used in this study. A variety of vocations were represented in the sample. Among these were college instructors, research workers, tradesmen, professional workers, driver training instructors and students. The subjects were arbitrarily grouped according to age and sex as follows: (a) 12-21, (b) 22-26, (c) 27-31, and (d) 32-77. The youngest and oldest groups had greater range because of smallness of numbers.

Each subject was given four trials of ten seconds each on the motility test at evenly spaced intervals. The total number of contacts for each trial was recorded. The strength test consisted of four trials, two for the right hand and two for left hand using the Smedley hand dynamometer. The order of trials was taken as follows: right, left, right, left. Standard instructions were used for both tests. All subjects were motivated to do their best at every trial.

#### THE APPARATUS

The motility test consisted of a series electrical circuit including a telegraph key, 6-volt rectifier for batteries and Stoelting counter. A ten-second G.E. interval timer was provided to close the circuit for a standard time interval for each trial to give precise timing. The Stoelting counter was used to record the number of key contacts during each interval. This insures accuracy up to 20-25 counts a second. The subject was seated during the test with the key placed on a table at a comfortable height from the floor. Two practice trials were given for motility only.

The Smedley hand dynamometer used in the strength of grip tests was calibrated in kilograms. All subjects took this test while in a standing position.

#### RESULTS OBTAINED

The mean scores and standard deviations of all subjects have

been computed and the mean differences subjected to analysis for significance between age and sex groups. The results of statistical analysis are given in Tables 1 through 4.

**Table 1**  
Comparison of Age and Sex (Motility)

Age Groups	Measures	Men	Women	Sexes Combined
12-21	Mean	70.06	70.28	70.13
	S.D.	7.00	4.69	6.40
	N	17	7	24
22-26	Mean	74.95	67.67	72.61
	S.D.	8.94	6.93	9.00
	N	19	9	28
27-31	Mean	77.15	68.17	73.48
	S.D.	5.29	3.87	6.48
	N	13	9	22
32-77	Mean	70.91	64.00	68.52
	S.D.	6.40	8.00	7.68
	N	17	9	26
Group Comparisons	Mean	73.08	67.37	71.14
	S.D.	7.75	6.56	7.81
	N	66	34	100

Table 1 indicates that as age progresses, a poorer performance is shown for women with less variability. The performance of men is progressively better through age 31. There is a wide difference in the mean scores of sexes favoring men. Men are more variable than women.

**Table 2**  
Double Classification for Analysis of Variance Using Four Age Groups (Motility)

Source	d.f.	s.s.	m.s.	F
Sex	1	732	732.00	18.8164**
Age Groups	3	383	127.67	3.2817*
Interaction	3	1417	472.33	12.1416**
Error	92	3579	38.90	
Total	99	6111		

\*Significant at the 5% level of confidence.

\*\*Significant at the 1% level of confidence.

The results presented in Table 2 indicate that there is significant differences between age groups, sex groups and interaction of these groups in their performance of the motility test under conditions of this study.

#### SUMMARY AND CONCLUSIONS

Within the limitations of the number of subjects used and other conditions of this study, the following conclusions may be tentatively stated:

1. Significant differences at the one per cent level of confidence

**Table 3**  
Comparison of Age and Sex (Strength)

Age Groups	Measures	Men	Women	Sexes Combined
12-21	Mean	43.88	28.29	39.33
	S. D.	9.98	6.13	11.48
	N	17	7	24
22-26	Mean	51.63	32.44	45.46
	S. D.	7.32	4.17	11.06
	N	19	9	28
27-31	Mean	57.08	26.44	44.55
	S.D.	11.23	4.62	17.61
	N	13	9	22
32-77	Mean	48.53	30.11	42.15
	S.D.	8.77	3.21	11.43
	N	17	9	26
Group Comparisons	Mean	49.91	29.38	42.93
	S.D.	10.32	5.09	13.18
	N	66	34	100

Table 2 indicates that the performance of men improves through age 31. There is a wide difference in the mean scores of the sexes favoring the men. Men are more variable than women.

**Table 4**  
Double Classification for Analysis of Variance Using Special Age Groups (Strength)

Source	d.f.	s.s.	m.s.	F
Sex	1	9,455.03	9,455.03	136.63**
Groups	3	563.39	187.80	2.71*
Interaction	3	985.99	328.80	4.75**
Error	92	6,366.10	69.20	
Total	99	17,370.51		

\*Significant at the 5% level of confidence.

\*\*Significant at the 1% level of confidence.

The results presented in Table 4 show significant differences at the five per cent level for age groups and significance at the one per cent level of confidence for sex groups and interaction.

were found between the performance of men and women on both the motility and strength tests. Hypothesis one is rejected.

2. The performance of men and women among age groups used show significant differences at the five per cent level of confidence. Hypothesis two is also rejected.

3. Women's performance on the motility test decreases with age.

4. Men's performance on both tests increases up to the age 31 and decreases beyond this point.

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