Relationship between Life Style and the Performance of Daily Activities in Elderly

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ABSTRACT

Background: *Normal age related changes result in some decline with functions for elderly persons. The rate and degree of these changes are influenced by many factors. The purpose of this study was to determine the relationship between life style and the ability for performing the daily life activities. The study focused upon determinants as muscle strength, joint range of motion, ability for performing activities of daily living (ADL) and instrumental daily activities (IADL) as ways for evaluation.*

Subjects and methods: *Eighty elderly subjects (40 males and 40 females), their age ranged between 65 and 75 years, all of them were in a good health condition. Subjects were divided into two equal groups. Group A, contains 40 subjects who's doing various aerobic and walking exercises. Group B, contains 40 subjects who's living a sedentary life without any special activities. Measurements the range of motion for the upper and lower extremities, muscle strength for selected muscle group in upper and lower extremities were evaluated. In addition two self-report scales were used to determine the ability for performing the activities of daily living.*

Results: *Significant values were measured for the experimental group regarding the ability for performing most of the activities, while the control group showed reduction in scores of performance.*

Conclusion: This study found that active life style is essential for keeping healthy life of the elderly.

Key words: *Life style, elderly, activities of daily living, instrumental activities of daily living.*

INTRODUCTION

Physical activity is a bodily movement, which includes many concepts such as fitness, exercise, training and conditioning (USDHHS 1996). Avoidance of movements over time may lead to the development of impaired muscle coordination and unconscious limitations of movement, so called "Guarded movements" which will limit performance further. Epidemiological studies clearly show a connection between physical activity and the occurrence of disabilities in old age (Nikolaus 2000). On the other hand regular physical activity has been regarded as an important component of a healthy lifestyle (Dishman, 1992).

The total amount of time spent engaging in physical activity declines with age (Caspersen and Mirritt, 1992). The quality of life in old age is intimately related to the ability to perform physical activities. The maintenance of some appropriate level of neuromuscular function into old age is critical if we expect the elderly to be able to maintain

normal daily activity and functional independence. It well established that muscular strength declines in old age (Bemben, 1998).

The idea that such impending functional losses could be reduced by early detection of system changes and by the implementation of rehabilitation or intervention programs has stimulated considerable interest for establishing potential "Biomarkers" of impaired neuromuscular and/or postural control (Williams et al., 1997).

While age-related declines in the physiological capacities and to function independently have measured separately, more work needs to be done to determine the relationship between lifestyle in elderly people and the decline in muscle strength, joint mobility and the performance of different tasks of the activities of daily living (ADL) (Posner et al., 1995).

This study is focusing mainly on elderly subjects with various activity levels and its effect on the physical function {Muscle strength & joint range of motion} and the physical performance function {Activities of daily living (ADL) & instrumental daily activities (IADL)}

SUBJECTS AND MATERIALS

Eighty elderly subjects were involved in the study (40 males and 40 females), selected randomly from nursing home residents with no history of spinal cord injury, spinal surgery, neuromuscular disorders, musculoskeletal disorders, heart or renal failure. The subjects were divided into two groups according to their lifestyle: Group (A) includes 20 males and 20 females subjects who do an aerobic exercise and in/or outdoor walking as a home program, their ages ranged from 65 and 75 years ($\bar{X}$ = 66, SD± 10. 3). Group (B) include 20 males and 20 females subjects who live a sedentary life without any activities, their age ranged from 65 to 75 years (X = 68, SD ± 6. 4).

PROCEDURE

Each participant was underwent the following steps:

1- Measurements of muscle strength were obtained by Accuforce II Hand held dynamometer incorporates a load cell and has a digital display. The dynamometer was set to read force in Newtons. One tester obtained all strength measurements. The strength was sufficient to fix the hand-held dynamometer against the forces produced by all subjects.

The isometric strengths of four upper extremity and three lower extremity muscle actions of distal, middle and proximal joints were measured twice bilaterally by a single tester. At least one minute of rest was allowed between repeated tests of the same action. All actions were tested in gravity-neutralized positions. With the exception of knee extension, which was tested with subjects sitting, this meant that all tests were performed with subjects in supine position on a padded table. Knee extension was performed with subjects sitting in a test chair with stabilizing straps or on a table with an assistance helping to stabilize. All other tests involved manual stabilization by the tester only. The hips and shoulders were tested while in neutral rotation. Further details of the test positions and dynamometer placements used are provided in table (1).

Strength was measured using isometric "make" tests. Subjects were asked to build their force to maximum over a 2-second period of time. By increasing force gradually in this manner it is easier for the tester to hold the dynamometer stationary against the subject's

exertion. Subjects were thereafter to continue with a maximum effort for another 4.0 to 5.0 seconds, at which time the tester told them to stop.

Specifics of the test position, stabilization and dynamometer placements used in this study were identical to those that have been presented in details by William et al., 1997 and Brockleurst et al., 1982, and listed in table (1).

Table (1): Test positions and dynamometer placements during testing the muscle actions.

Muscle Action	Extremity/joint Positions	Location of Dynamometer
Shoulder lateral rotation	Shoulder abducted 45°, elbow 90°	Just proximal to styloid processes
Shoulder abduction Elbow flexion	Shoulder abducted 45°, elbow fully extended	Just proximal to lateral epicondyle of humerus
Wrist extension	Shoulder neutral, elbow 90°,forearm supinated Shoulder neutral, elbow 90°, wrist neutral	Just proximal to styloid processes
Hip flexion	Hip flexed 90°, knee flexed, contralateral hip neutral	Just proximal to metacarpophalangeal joints
Knee extension	Hips and knees flexed 90°	Just proximal to femoral condyles
Ankle dorsiflexion	Hip and knee fully extended, ankle neutral	Just proximal to malleoli
		Just proximal to metatarsophalangeal joints

Isometric handgrip strength was measured in both dominant and non-dominant hands by Accuforce hand-held dynamometer. The dynamometer was placed in the hand with the participant's arm flexed 90° at the elbow and the forearm in neutral and parallel to the floor. The participant was instructed to squeeze the hand maximally while simultaneously lowering the arm on a 3-second count. Grip has released when the participant's arm was completely extended. One practice trial was allowed for each hand.

2- Evaluation of mobility: (I) Spinal mobility: Schober test was used for testing the thoracolumbar spine. Each subject was instructed to stand without shoes and the back pear skin. The skin overlying the thoracolumbar spine at T1 and S1 were marked. While the subject was standing the distance in cm, between the two marked points was measured by a tape measurement. Then the subject was asked to try to touch the toes by the fingers through flexion forward as much as the subject can with keeping the knee extended. The distance between the marked points was measured again and the difference between the two readings was calculated. (II) Upper and lower extremity range of motion: A universal goniometer was used for measuring the range of motion of shoulder flexion. The subject stand with the heels placed 9cm from the wall and the back against the wall; the hand was rotated 90° in pronation. The subject raised the arm upward with keeping the back to the wall. The goniometer movable arm was aligned over the lateral epicondyle, and the goniomter's fixed arm was aligned with the midline of the thorax (Norkin and White, 1985). The standard Thomas technique was used for hip flexion (Kendal and Mc Creary, 1983).

3- Measuring the activities of daily living (ADL): (Ketz Index Scale): as standardized, observer and rated instrument of subject's performance on ADL. Consisted of 6 items include bathing, dressing, continence, toileting, transfer, and feeding activities. Responses are scored on a 0/2 scale, where 0 equals completely unable to accomplish the task, 1 indicates that some assistance is required to accomplish the task and 2, indicates that the subject can complete the task

without any assistance. Total score for normal individual was 12 (Reichel et al., 1995).

4- Measuring the instrumental activities of daily living (IADL): Asking whether the subject can use the telephone, prepare meals, take medicine, travel a distance, go shopping, do house work, and handle money. Scoring of all these tasks is similar to ADL scores (Laforest et al., 1990). Total score for normal individual was 14.

Data collected from all subjects were analyzed to examine the relation between the musculoskeletal state and ADL and IADL scores. Only total values for both instruments were used in the comparative study.

RESULTS

The percentages of the participating subjects in group (A) and the frequency of the activities that they performed during the study are listed in table (2). An 81.5% of subjects in-group (A) exerted walking exercise out-door as a daily routine, while a 6.5% of the subjects performed in-door walking with aerobic exercise. Less percentage of 1.5% from the subjects participated in a physical therapy program either alone or using a Treadmill for walking inside the clinic. Only a 7% of the subjects repeated aerobic exercise as learned before but not in a regular manner.

Table (2): The percentage of the participating subjects in group (A) and frequency of the exercises.

Type of activity	Number of subjects	Percentage	Frequency/week
Walking & aerobic indoor	3	6.5%	Frequently
Walking alone outdoor	32	81.5%	7
Aerobic exercises	1	7%	1
Walking & Physical Therapy	2	1.5%	Frequently
Physical Therapy Program	2	3.5%	2
Total	40	100%	----------

The results of the study showed a diminishing in the muscle strength of the subjects in group (B). As presented in table (3) there is a diminishing in the mean values of muscle strength with subjects in group (B) more than group (A). The significant decrease was found more in the non-dominant limb of group (B) ($P< 0.005$).

In the comparison between both groups the ankle dorsi flexors were the weakest muscle group. The mean value for the muscle strength was ($\bar{X} = 235.7 \pm 73.1$) in the dominant limb of the subjects in-group (A) and ($\bar{X} = 187.1 \pm 48.2$) in-group (B). On the other hand there were more differences with the non-dominant limb ($\bar{X} = 231 \pm 57.2$) with group (A) and ($\bar{X} = 153.1 \pm 35.3$) with group (B) as it appears in table (3) and figs. (1 and 2).

Table (3): The mean muscle strength of the selected muscles of group (A) and group (B).

Muscle action	Group (A) Dominant limb (Kg)	Group (B) Dominant limb (Kg)	Group (A) Non-dominant limb (Kg)	Group (B) Non-dominant limb (Kg)
Hip flexion	102.3 ± 26.4	92.3 ± 27.4	97.6 ± 24.7	90.8 ± 28.6
Knee extension	272 ± 80.1	213 ± 43	265.4 ± 82.3	203.1 ± 43.1
Ankle dorsiflexion	235.7 ± 73.1	187.1 ± 48.2	231 ± 57.2	153.1 ± 35.3
Shoulder lateral rotation	87.3 ± 19.2	81.8 ± 10.9	86.2 ± 22	79.1 ± 16.2
Shoulder abduction	112.3 ± 25.3	101.7 ± 20	103.1 ± 16.3	95.7 ± 21.3
Elbow flexion	134.1 ± 19.1	130.2 ± 27.6	131 ± 20.4	129.7 ± 25
Wrist extension	84.2 ± 19.7	69.6 ± 8	82.2 ± 17.6	62.2 ± 17.6
P value	< 0.05	< 0.005	< 0.05	< 0.005

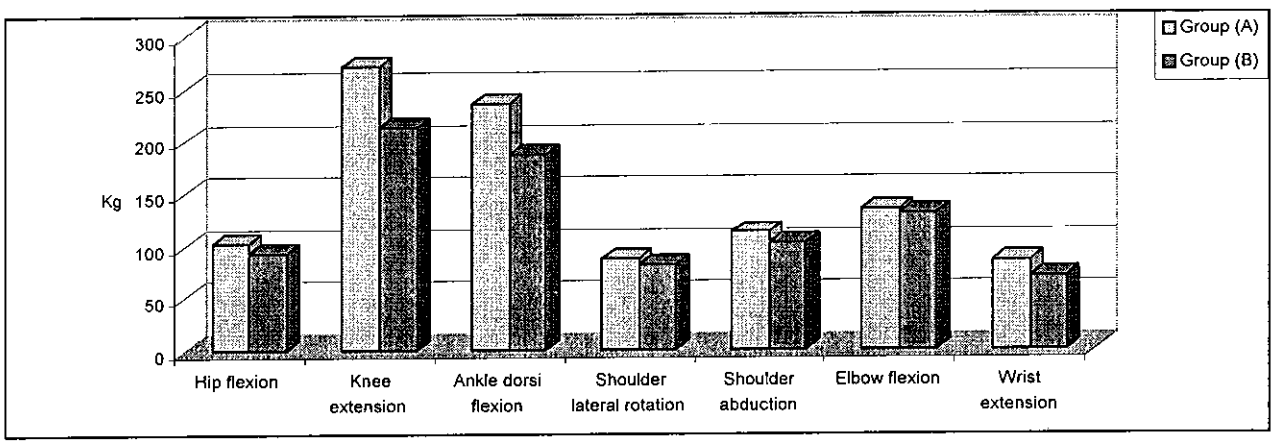

Fig. (1): Comparison between the mean values of muscle strength of the selected muscles (Dominant limb) of group (A) and group (B).

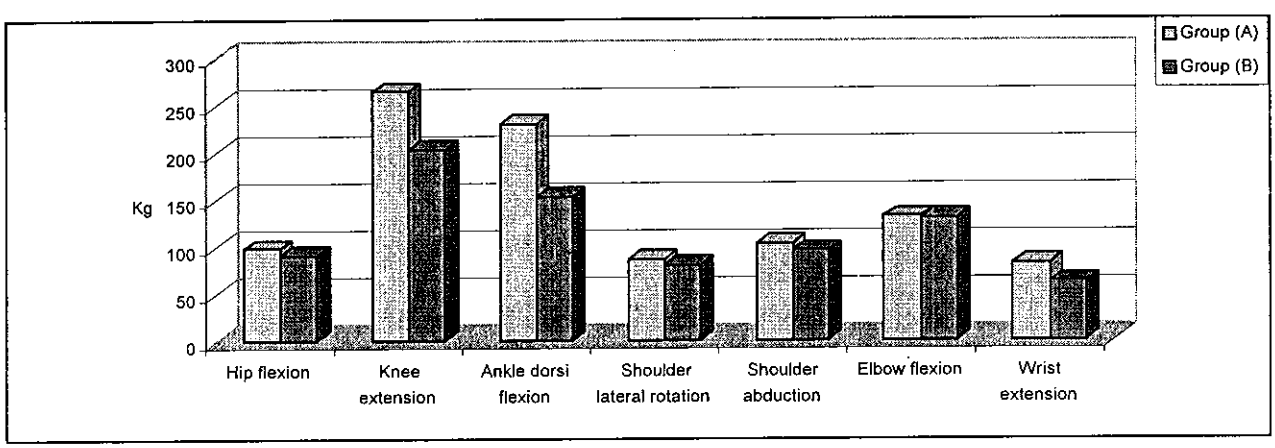

Fig. (2): Comparison between the mean values of muscle strength of the selected muscles (Non-dominant limb)of group (A) and group (B).

Handgrip strength of the non-dominant hand of the subjects in group (B) showed marked differences than group (A): (15.5 ±3.5, 20.6±4.2) respectively. The dominant handgrip strength was also less with subjects in group (B) than group (A) as it appears in table (4) and fig. (3).

Table (4): Means and standard deviations of handgrip muscles strength for subjects of group (A) and group (B).

	Group (A)		Group (B)	
	Dominant Hand	Non-dominant Hand	Dominant Hand	Non-dominant Hand
X* ± SD♦	23.7 ± 6.7	20.6 ± 4.2	19.6 ± 3.7	15.5 ± 3.5
Predicted♣ X* ± SD♦	24.6 ± 4.8	22.7 ± 4.6	24.6 ± 4.7	22.7 ± 4.6
Mean difference ±* SD♦	- 0.82	- 2.1	-4.8	-7.1
P. Value	< 0.05		< 0.005	

♣ Johanne et al., 1995 * Mean ♦ Standard deviation

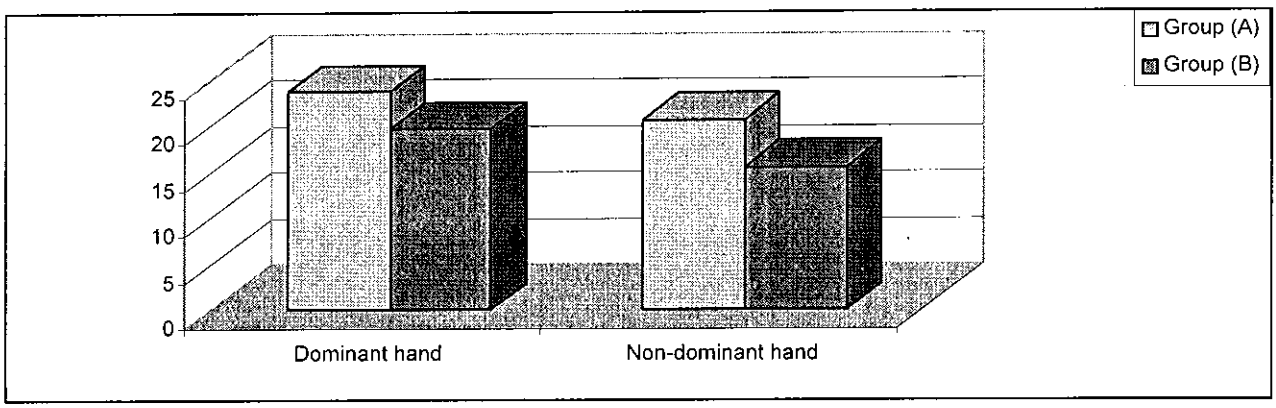

Fig. (3): Comparison between the mean values of handgrip and muscles strength for subjects of group (A) and group (B).

There was a marked difference in the range of motion of the hip flexion among the subjects of group (B) more than the normal predicted average ($P < 0.05$). The results showed also a significant reduction in the range of motion of the shoulder flexion from the normal average of 169 ± 9° to 109 ± 6°. Schober test for examining the spinal mobility revealed reduction in-subjects of group (B) more than those in-group (A) with significant deviation from normal age expected value 2.0 ± 0.24 cm, 1.6 ± 0.25 respectively as it is presented in table (5) and fig. (4).

Table (5): Mean and standard deviation for the scores of hip flexion and shoulder flexion range of motion and schober tests for subjects of group (A) and group (B).

	Hip flexion		Shoulder flexion		Schober test	
	Normal #	Mean	Normal #	Mean	Normal #	Mean
Group A	111 ± 12	105 ± 6	169 ± 9	120 ± 6	2.4 ± 0.74	2.0 ± 0.24
Group B	111 ± 12	93 ± 6	169 ± 9	109 ± 6	2.4 ± 0.74	1.6 ± 0.25

Norkin et al., 1985.

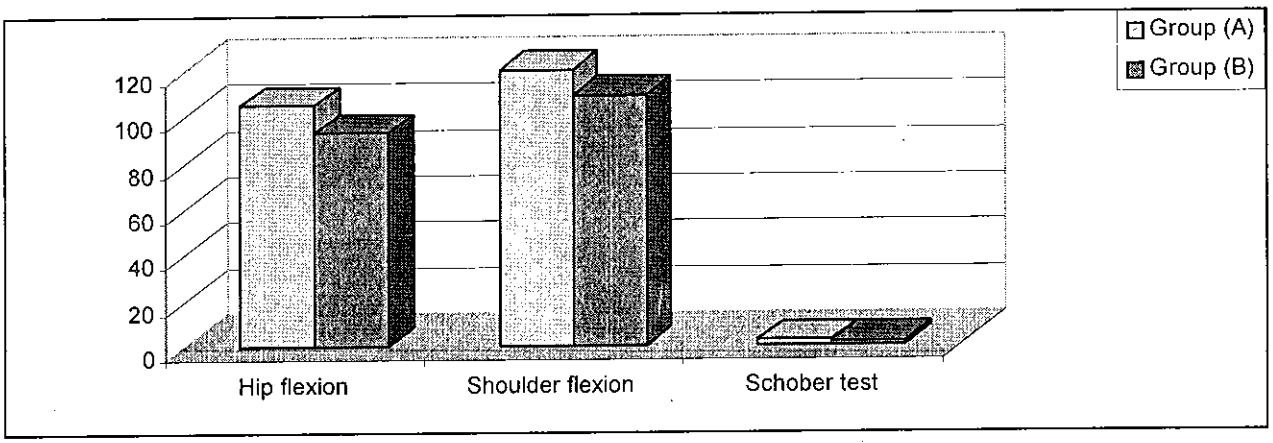

Fig. (4): Comparison between mean values of hip flexion, shoulder flexion range of motion and schober tests for subjects of group (A) and group (B).

All subjects in group (A) were independent in ADL except 3 subjects were in need for slight assistance in dressing and transfer activities. While in-group (B) there were 3 subjects completely dependent in all tasks. There were a 54.5% of subjects in group (B) in need for assistance in transfer activity while it was only a 2.5% in-group (A). The least task that was affected in group (B) was continence, which was only 6 subjects those were in need for assistance, and the remaining 34 were independent. The total score of the mean values of all the tasks that were included in the study were more significantly in group (A) 11.9 than group (B) 9.4 from the total normal scores of 12 as it presents in table (6) and figs. (5,6 and 7).

Table (6): Number and percentage of subject and their activities of group (A) and group (B) in ADL.

	Group (A)			Group (B)		
	Dependent n. (%)♥	Assistant n. (%)♥	Independent n. (%)♥	Dependent n. (%)♥	Assistant n. (%)♥	Independent n. (%)♥
Toileting	0	0	40 (100%)	3 (7.5%)	12 (30%)	25 (62.5%)
Continence	0	0	40 (100%)	0	6 (15%)	34 (85%)
Bathing	0	0	40 (100%)	3 (7.5%)	12 (30%)	25 (62.5%)
Transfer	0	1 (2.5%)	39 (97.5%)	2 (5%)	23 (54.5%)	15 (37.5%)
Dressing	0	2 (5%)	38 (95%)	3 (7.5%)	13 (32%)	24 (60%)
Feeding	0	0	40 (100%)	2 (5%)	12 (24%)	26 (65%)
Total X*	11.92			9.4		

♥ Number (Percentage) * Mean

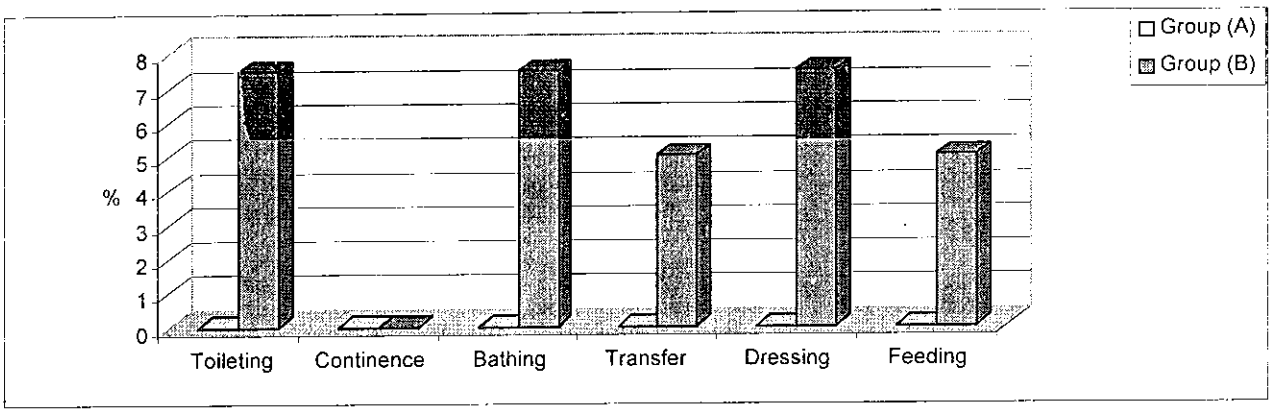

Fig. (5): Comparison between percentages of dependent subjects and their activities of** group (A) and group (B) **in ADL.

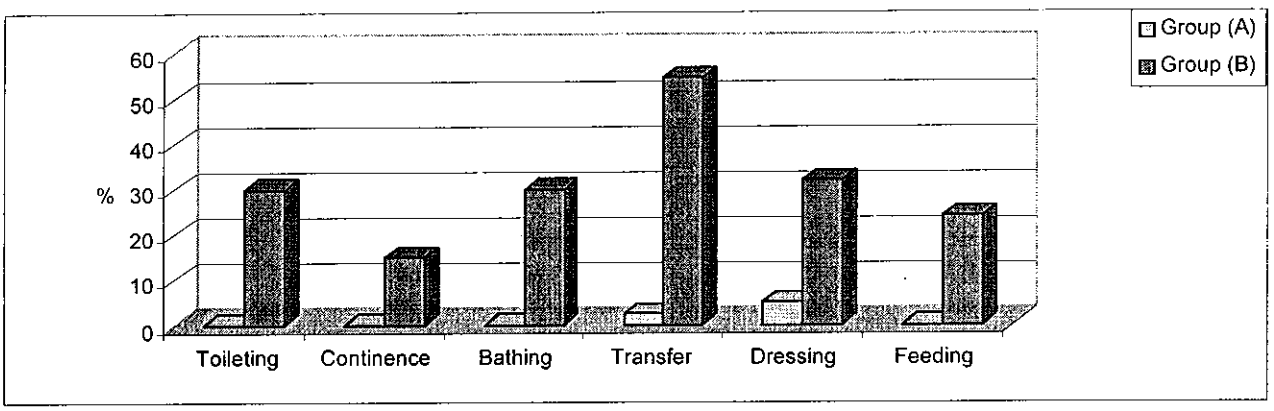

Fig. (6): Comparison between percentages of assistant subjects and their activities of** group (A) and group (B) **in ADL.

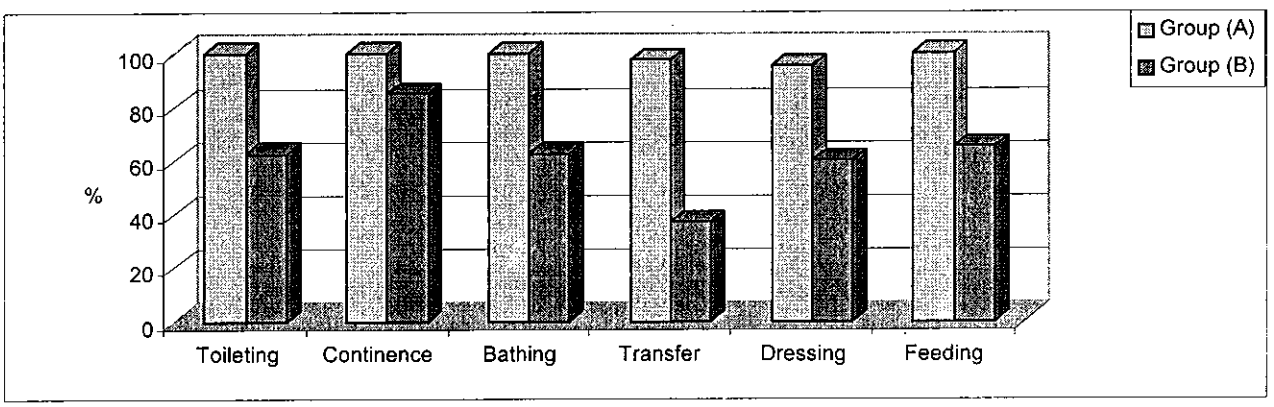

Fig. (7): Comparison between percentages of independent subjects and their activities of** group (A) and group (B) **in ADL.

The subjects in group (A) regarding the IADL showed independence in almost all tasks. The maximum amount of independence was present with medication, telephone and traveling (97.5%, 85% and 75%) respectively. Preparing meals and housework were considered the most dependent tasks as shown in table (7) and figs. (8,9 and 10). On the other hand the subjects in group (B) showed the most dependence level in almost all tasks. Shopping, preparing meals and housework were considered the most affected tasks (47.5%, 32.5% and 27.5%) respectively. While medication and telephone were considered the most independent tasks (47.5% and 32.5%) respectively listed in table (7) and figs. (8,9 and 10).

Table (7): Number and percentage of subjects and their activities of group (A) and group (B) in IADL.

	Group A			Group B		
	Dependent n. (%)♥	Assistant n. (%)♥	Independent n. (%)♥	Dependent n. (%)♥	Assistant n. (%)♥	Independent n. (%)♥
Medication	0	1 (2.5%)	39 (97.5%)	3 (7.5%)	12 (30%)	25 (62.5%)
Preparing meals	3 (7.5%)	23 (57.5%)	14 (35%)	11 (27.5%)	26 (65%)	3 (7.5%)
Telephone	2 (5%)	4 (10%)	34 (85%)	7 (17.5%)	14 (35%)	19 (47.5%)
Housework	3 (7.5%)	23 (57.5%)	14 (35%)	19 (47.5%)	20 (50%)	1 (2.5%)
Money	0	23 (57.5%)	17 (44%)	6 (15%)	33 (82.5%)	1 (2.5%)
Shopping	2 (5%)	12 (40%)	26 (65%)	13 (32.5%)	23 (57.5%)	4 (10%)
Traveling	1 (2.5%)	9 (22.5%)	30 (75%)	5 (12.5%)	31 (77.5%)	4 (10%)
Total $\bar{X}$*	11.3			8.4		

♥ Number (Percentage) * Mean

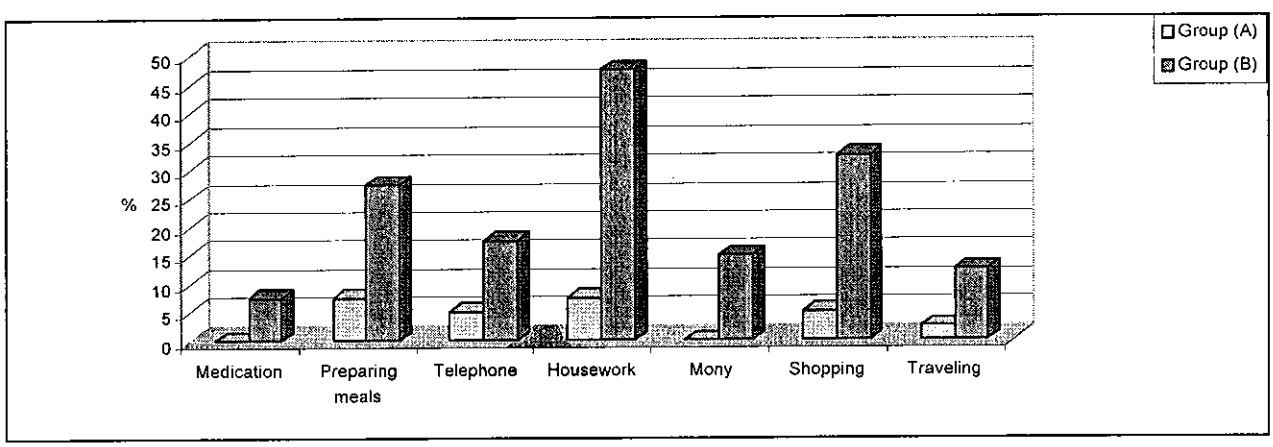

Fig. (8): Comparison between percentages of dependent subjects and their activities of group (A) and group (B) in IADL.

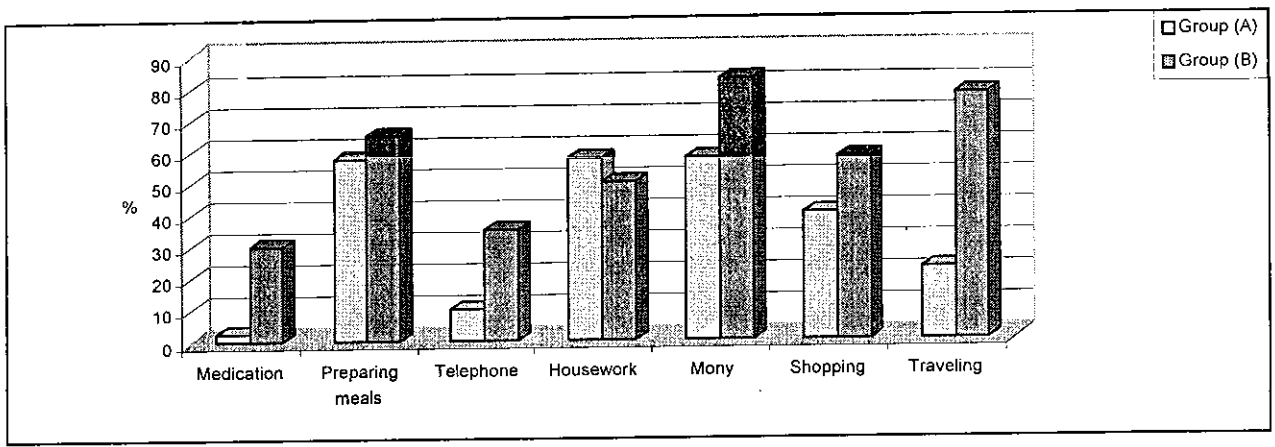

Fig. (9): Comparison between percentages of assistant subjects and their activities of group (A) and group (B) in IADL.

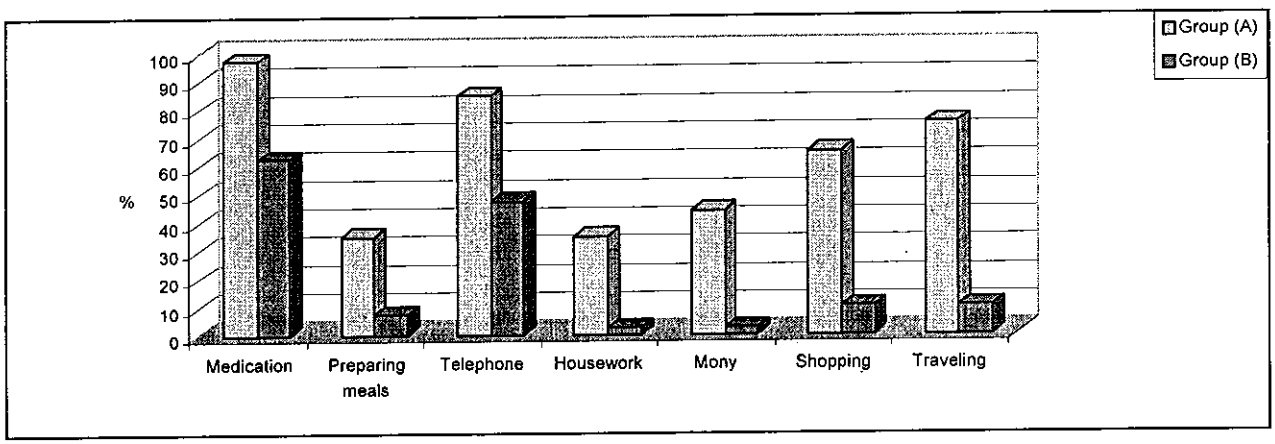

Fig. (10): Comparison between percentages of independent subjects and their activities of group (A) and group (B) in IADL.

There was a marked decrease in the total scores of ADL and IADL of subjects in group (B) (78% and 60%) respectively than that in group (A) (90% and 80%) respectively as it is presented in table (8) and fig. (11).

Table (8): Comparison between means of total scores from ADL & IADL of group (A) and group (B).

	Group A		Group B		P Value
ADL × * ± SD♦	11.9 ± 0.015	90%	9.3 ± 0.053	78%	0.05
IADL × * ± SD♦	11.4 ± 0.202	80%	8.4 ± 0.164	60%	0.005

* Mean ♦ Standard deviation

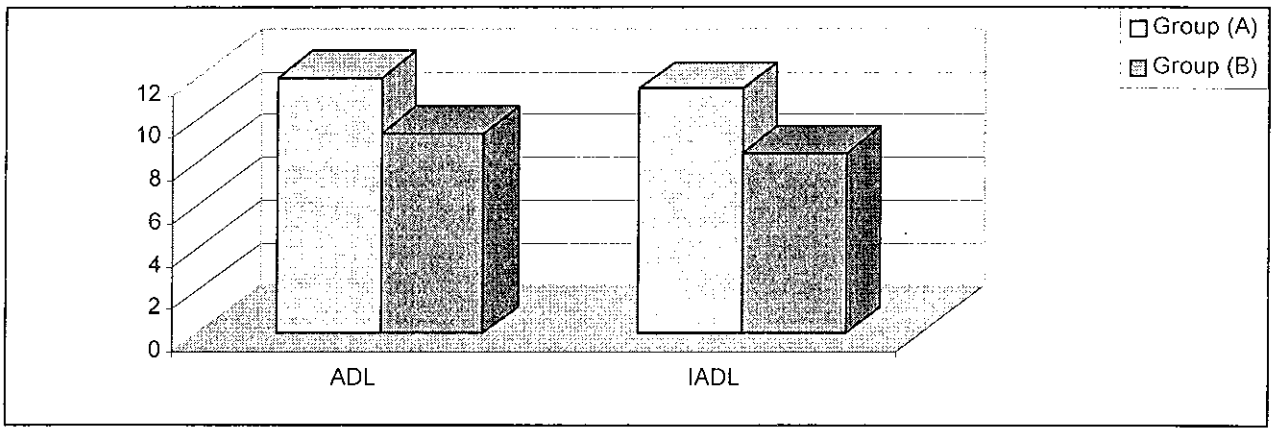

Fig. (11): Comparison between mean values of total scores from ADL and IADL of group (A) and group (B).

DISCUSSION

The major purpose of this study was to correlate the relationship between lifestyle and a variety of functional outcome measures in elderly subjects. This study had three major biomarkers among elderly subjects: the muscle strength of selected muscles from upper and lower extremities, the changes in spinal mobility, and the accumulative effects upon ADL and IADL.

The results supported the hypothesis that the increased the life style activities of an elderly person the less the amount of diminishes in the musculoskeletal and postural changes. Comparing the dominant and nondominant handgrip strength for each group separately, a great significant difference in the same group was found. The finding that older subjects have lower hand grip strength scores than the younger ones was expected and agreed with numerous studies (Bassey and Harries 1993). Muscle changes and atrophy seem to be accelerated after the age of 70, adding to the less activities and movement the elderly used to have, so they less likely to attain maximum tension level, due to the less use of type II muscle fibers (Johanne et al., 1995).

The finding of this study showed that subjects in group (A) were consistently stronger than those in-group (B), which may be due to the physical activity and the usage of hands in many tasks during daily activities. Regarding to the lower limb strength for the selected muscles, there was a significant difference in the values between both groups ($P<0.05$ - 0.005), which is associated with improvement of their abilities, gait, transfer, balance, and IADL. These results agreed with that of (Chandler et al., 1998), who found that the lower extremities muscle strength of the elderly persons can be accomplished using low technology, in-home progressive resistive exercise program supervised by a therapist or care givers. This strength gain is reflected on chair-rise ability and in mobility task such as gait, shopping and stair climbing. Chandler et al., (1988) recommended also that higher intensity or longer duration strength exercises might be needed to improve balance and endurance in elderly person.

The observed reduction in hip flexor strength and contructure in-group (B) is

associated with an overall increase in anterior pelvic tilt with subsequent increase in lumbar Lordosis. The Schober test showed a decrease in the spinal mobility of subjects in group (B) than those in-group (A), which might be explained by the strength gains of the spinal muscles during ADL, good circulation and oxygenation of these parts and maintaining of good posture and balance.

Functional independence is necessary to assess a person's strength. The ability to function in the world is predicted on the ability to perform certain activity (Hanks & lichtenberg 1996). One of the aims of this study was to compare ADL scores in both groups. The findings of the study showed more independence with subjects in-group (A) ranged from 95% to100% in all tasks of ADL. This could be due to their challenging environment, which increases their muscle strength, fitness and physical performance. In support of this explanation, Buchner and De Latew (1991) studied the relationship between muscle strength and function in men and women aged 60-90 years. They found the more the active the person; the more power he had in the extremities muscles. Additionally daily activities are necessary for living in modern society, using telephone, shopping for food and preparing meals, and managing money, are ADLs but not in the same sense as personal care tasks as bathing or dressing. IADLs also include managing the medications, which reflects the mental status changes (Reichel et al., 1995).

The IADLs finding in this study showed a higher independent level among the subjects of group (A), with scores ranged between 35%-97.5%. On the other hand there were an 82.5% of the subjects in group (B) in need for assistance in managing money that may be due to low educational level in elderly women rather than mental or neuromuscular changes. Subjects in- group (B) showed more dependent level, as they need the nursing stuff for all ADL and IADL.

In this study the impact of the psychological variables was not considered. These variables could have the potential to influence the relationship between physiological variables and the ability to function independently, especially with subjects in group (B), which could be considered as a limitation. However, we use several tests to evaluate physiological capacity of elderly in order to compensate this limitation.

CONCLUSION

In summary, a significant relationship was found between physiological parameters especially extremity strength, handgrip and the ability of elderly subjects to perform certain activities needed for independent daily living.

There is need for further researches to determine the relationship between the physiological indicators and functional ability, which will help in the development of goal-directed training programs as a base for improving and maintaining independent elderly people.

Health organizations and educational institutions must communicate to the public about the amounts and types of physical activity that are needed to prevent disease and promote health. There is need for implementing effective strategies that promote the adoption of physically active lifestyles. An active lifestyle does not require a regimented, vigorous exercise program. Instead, small changes that increase daily physical activity will enable individuals to reduce their risk of chronic disease and may contribute to enhanced quality of life.

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الملخص العربي

العلاقة بين أسلوب المعيشة وأداء الأنشطة اليومية عند كبار السن

التغيـــيرات المصاحبة لتقدم العمر تؤدي إلى بعض الهبوط لوظائف الأشخاص المسنين . بتأثر معدل ودرجة هذه التغييرات بعديد مـــن العوامـــل . ســـعت هـــذه الدراسة لتحديد العلاقة بين أسلوب المعيشة والقدرة على أداء نشاط الحياة اليومية . وركزت الدراسة على مؤشرات كفوة العضلات ، مدى تحرك المفاصل ، والقدرة على أداء نشاطات المعيشة اليومية .. سواء العادية أو التي تعتمد على استخدام الأجهزة كوسائل للتقييم . شارك في الدراسة ثمانون مسن (٤٠ ذكور ، ٤٠ إناث) أعمارهم تتراوح بين ٦٥ إلى ٧٥ سنة ، ولا يعانون من مشـــاكل صـــحية . قسمت مجموعة المسنين المشاركة بالدراسة إلى مجموعتين متساويتين كلا منها ٤٠ فرد . مجموعة (أ) يؤدي أفرادها التماريـــن الهوائية والمشي أما المجموعة (ب) فتعيش الحياة العادية الرتيبة بدون أي أنشطة حركية خاصة . تم قياس مدى حركة مفاصل وقوة عضلات مختارة من الأطراف العليا والسفلية من الجسم ، إضافة إلى ذلك تم قياس القدرة على أداء نشاطات المعيشة اليومية . سجلت أرقام مجموعة المسنين التجريبية (أ) معدلات عالية بخصوص القدرة على أداء أغلب الأنشطة بينما لوحظ تدني معدلات مجموعة المسنين القياسية (ب) . أوضحت الدراسة أن أسلوب المعيشة النشيط ضروري لاستمرار المسنين للحياة بصحة جيدة .