

Assessment of Functional Status through Self-Reported Physical Disability and Performance-Based Functional Limitations among Elderly

Faizal Murat¹, Zuriati Ibrahim¹, Chan Yoke Mun^{1,2}, Siti Nur 'Asyura Adznam¹

¹*Department of Nutrition and Dietetics, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, Selangor, Malaysia*

²*Malaysian Research Institute on Ageing (MyAgeing), Universiti Putra Malaysia, Selangor, Malaysia*

ABSTRACT: *This cross-sectional study was conducted to assess functional status (self-reported physical disability and performance-based functional limitations) among community-dwelling elderly in Mukim Batu (Gombak), Selangor. A total of 258 subjects (males=123; females=135), aged 60 years and above were recruited. Physical disability was assessed by using a self-reported Instrumental Activities of Daily Living (IADL) instrument, whereas functional limitations were assessed through performance-based in terms of cognitive functioning, mobility status, manual dexterity and muscle strength by using Elderly Cognitive Assessment Questionnaire (ECAQ), Elderly Mobility Scale (EMS), lock and key test and handgrip strength respectively. The prevalence of self-reported physical disability was 58.1% (IADL \leq 7), with twice higher among older age group (\geq 75 years) as compared to younger age group (60-74 years) in both gender ($p<0.05$). As for performance-based, the prevalence of cognitive impairment (ECAQ \leq 5), mobility dependent (EMS \leq 13) and poor manual dexterity (lock and key test score \leq 2) was only less than 5% each. Similarly, older age group was liable to suffer from functional limitations as compared to the younger age group in both gender ($p<0.05$). Although females reported to have poorer performance-based than males, only cognitive functioning and handgrip strength were found to be significantly different between gender ($p<0.05$). In conclusion, self-reported physical disability indicated a higher prevalence of poor functional status than performance-based functional limitation. Thus, it is suggested to combine both method to give better information regarding overall functional status among elderly population.*

Keywords: *Elderly, functional status, IADL, Malaysia, physical disability*

I. INTRODUCTION

Ageing is characterised by a generalised deterioration of many organs and systems, which leads to a lower effectiveness of physiological functions accompanied by an increase in risk factors for various chronic diseases [1]. Ageing is also declared by progression loss of adaptability of an organism at later ages [2]. One of the common inadaptability among elderly population is poor functional status, with several studies reported the prevalence varies from as low as 23% [3] to almost 39% [4]. While local studies reported the prevalence ranging from 11-43% [5, 6]. The trend towards an increase of the ageing population is expected to rise and thus, it can be assumed that the proportion of older people with poor functional status will also increase concurrently.

Functional status is variously defined in the health field, by clinicians with different emphasis. In general, functional status defined as both the ability of an individual to carry out activities of daily living independently and the ability of the individual participating in life situations and society [7]. Functional status mainly comprises of two distinct aspects which are physical disability and functional limitation. Physical disability refers to unable to perform activities of daily living independently or without support, and may influenced by societal, environmental, and cultural factors [8, 9]. Physical disability usually assessed through self-reported questionnaire [i.e.: Activities of Daily Living (ADL), Instrumental Activities of Daily Living (IADL)]. In contrast, functional limitation described as limitation in the person's performance of certain action or task due to a health condition or injury. The latter may not influenced by the surrounding factors and usually assessed through performance-based (i.e.: mobility, manual dexterity, flexibility, muscle strength, psychomotor/cognitive functioning).

Currently, a gold standard method to assess functional status among elderly does not exist, while both types of assessment (self-reported and performance-based) are rarely used concomitantly in a same study. Thus, the objective of the present study is to assess self-reported physical disability and performance-based functional limitations among the community-dwelling elderly in Mukim Batu (Gombak).

II. METHODS AND SUBJECT

2.1 Study Design, Sampling Method and Participants

This cross-sectional study was conducted from June till December 2013 in Gombak, Selangor. A multi-stage proportional sampling method was used for selection of the study location. Gombak district has been selected due to proportion of the elderly were among the highest compared to other eight districts in Selangor. Gombak district consist of four sub-districts, whereby Mukim Batu has been selected as the study location since the percentage of elderly population were the highest. All 16 villages under Mukim Batu were selected. Total number of subjects recruited from each village was based on the proportion of elderly from each village. Subjects then were randomly selected from each village by using a ‘Research Randomizer’ web-based application, identified from a comprehensive community list names (combination of both gender). House-to-house visits were made, and elderly who fulfilled the inclusion criteria were selected to participate in this study.

A total of 258 elderly individuals were recruited based on the inclusion and exclusion criteria. The selection criteria includes elderly people aged 60 years and above, Malaysian, have been resident in Mukim Batu for more than a year, and able to communicate effectively. Subjects were excluded if they are found mentally ill (dementia/alzheimer), terminally ill (end stage cancer/rehabilitation), bedridden, and having hearing difficulties or deaf. Informed consent for participation in the study was obtained from each subject and the study was approved by the University Research Ethics Committee of the Universiti Putra Malaysia (JKEUPM).

2.2 Socio-Demographic Characteristics

Detail socio-demographic information consists of gender, age, ethnicity, educational level, marital status, living arrangements, working status and main economic resource were obtained via face-to-face interview.

2.3 Functional Status Assessment

Self-reported Instrumental Activities of Daily Living (IADL) questionnaire were used to obtain information about physical abilities to perform eight daily activities (i.e. ability to use telephone, shopping, preparing meals, housekeeping, doing laundry, using public transport, taking medications, and handling finances) [10]. For this study, score of 7/8 is taken as the cut-off point, where a score of seven or less indicates physical disability [11].

Functional status were also assessed through performance-based, including a cognitive test [Elderly Cognitive Assessment Questionnaire (ECAQ)] [12], mobility test [Elderly Mobility Scale (EMS)] [13, 14], manual dexterity (lock and key test) [15, 16], and muscle strength (handgrip strength) [17]. An ECAQ score of five or less, EMS score of 13 or less, and lock and key test score of two or less indicates cognitive impairment, mobility dependent and poor manual dexterity respectively. The functional status assessment are summarised in Table I.

Table I: Functional Status Assessment

Self-reported physical disability	Performance-based functional limitations
Instrumental Activities of Daily Living (8-item IADL)	Cognitive test [Elderly Cognitive Assessment Questionnaire (ECAQ)]
	Mobility test [Elderly Mobility Scale (EMS)]
	Manual dexterity (lock and key test)
	Muscle strength (handgrip strength)

2.4 Data Analysis

The Statistical Package for Social Sciences (SPSS) program version 21.0 was used to analyse the data. Descriptive statistics were used for all the variables studied. Independent t-test test was used to test the significant differences ($p < 0.05$) between gender and age group with the mean of functional status for numerical data. Fisher’s Exact Test was used to assess the significant differences ($p < 0.05$) between gender and age group with functional status for categorical data.

III. RESULTS

As shown in Table II, a total of 258 subjects (male 48%, female 52%) participated in the study, with the mean age of 66 ± 6.5 years, ranging from 60 to 88 years. Almost all of the subjects (88.4%) were from the ‘younger elderly’ group (60-74 years) and only 11.6% were from the ‘older elderly’ group (≥ 75 years). Subjects mainly comprised of three main different ethnic groups in Malaysia: Malays (65.9%), Chinese (19.8%), and Indians (14.3%).

Overall, majority of the subjects (94.2%) had attained at least primary education, while only 5.8% of the subjects had no formal education. A slightly higher proportion of males (98.4%) had formal education as compared to females (90.3%). More than half of the subjects (77.9%) were married, with higher proportion of male (87.8%) compared to female (68.9%), whilst female were more likely to be widowed/divorced (30.4%) than male (7.3%). In terms of living arrangements, the majority of the subjects lived with their spouse or their

family members (96.5%) and only slightly more than three percent (3.5%) lived alone. Interestingly, about 27% of female lived alone as compared to none of the male subjects, among those aged 75years and above.

As for occupational status, around 31% of the subjects were still employed, with almost double the figure of male who were still employed (42.3%) than female counterpart (21.5%). Varies income resources were derived among the subjects, with males were more likely to relied on their salary or pension (63.4%), while females were more likely to depends on their children and others (76.3%).

The mean ± SD score for IADL disability of the subjects was 6.76 ± 1.37 (Table III). Although no significant difference noted between the gender, it appears that females had poorer functional status compared to males, due to a lower IADL scores. In contrast, significant difference were seen in the mean of IADL score between age group in both gender (p<0.001), where subjects from the younger elderly group had higher IADL scores compared to those from older group. Table IV reveals that more than half (58.1%) of the subjects showed presence of physical disability (IADL≤7), with almost twice higher in older elderly (male 89.5%, female 100%) as compared to younger elderly (male 47.1%, female 58.9%).

The mean scores for functional limitations assessed by using ECAQ, EMS, lock and key test, and handgrip strength were 8.46±1.43, 18.69±2.13, 2.91±0.41, and 25.08±10.07 kg respectively (Table III). Similarly to IADL disability instrument, female subjects received a lower mean score for all functional limitation assessments than male, with a significant differences noted for cognitive functioning (8.27±1.57 for female versus 8.67±1.22 for male) (p<0.05) and muscle strength (18.64±6.52 kg for female versus 32.15±8.42 kg for male) (p<0.001). There was also a trend for functional limitations to deteriorate with advancing age for both genders, while changes were most evident for cognitive functioning, mobility score and muscle strength (p<0.05). The study shows the prevalence of cognitive impairment (ECAQ≤5), mobility dependent (EMS≤13) and poor manual dexterity (lock and key test≤2) were 3.5%, 3.9% and 4.7% respectively. Except for mobility test, the prevalence of functional limitations were shown to be higher among females in contrast to males, although only cognitive functioning shows significantly different (p<0.05). As expected, subjects from the older age group were also significantly liable to suffer from functional limitation as compared to the younger elderly group in both male [mobility test (p<0.05)] and female [mobility test (p<0.001) and manual dexterity (p<0.05)].

Table II: Distribution of the Subjects According to Socio-demographic Characteristics [n (%)]

Characteristics	Male			Female			Total (n=258)
	60-74 yrs (n=104)	≥75 yrs (n=19)	Subtotal (n=123)	60-74 yrs (n=124)	≥75 yrs (n=11)	Subtotal (n=135)	
Ethnicity							
Malay	64 (61.5)	18 (94.7)	82 (66.7)	78 (62.9)	10 (90.9)	88 (65.2)	170 (65.9)
Chinese	21 (20.2)	1 (5.3)	22 (17.9)	29 (23.4)	-	29 (21.5)	51 (19.8)
Indian	19 (18.3)	-	19 (15.4)	17 (13.7)	1 (9.1)	18 (13.3)	37 (14.3)
Educational Level							
No formal education	1 (1.0)	1 (5.3)	2 (1.6)	10 (8.1)	3 (27.3)	13 (9.6)	15 (5.8)
Primary education	43 (41.3)	14 (73.7)	57 (46.3)	64 (51.6)	7 (63.6)	71 (52.6)	128 (49.6)
Secondary education	47 (45.2)	4 (21.1)	51 (41.5)	44 (35.5)	1 (9.1)	45 (33.3)	96 (37.2)
Tertiary education	13 (10.6)	-	13 (10.6)	6 (4.8)	-	6 (4.4)	19 (7.4)
Marital status							
Single	6 (5.8)	-	6 (4.9)	1 (0.8)	-	1 (0.7)	7 (2.7)
Married	92 (88.5)	16 (84.2)	108 (87.8)	93 (75.0)	-	93 (68.9)	201 (77.9)
Widowed/Divorced	6 (5.8)	3 (15.8)	9 (7.3)	30 (24.2)	11 (100.0)	41 (30.4)	50 (19.4)
Living Arrangements							
Living alone	4 (3.8)	-	4 (3.3)	2 (1.6)	3 (27.3)	5 (3.7)	9 (3.5)
Living with others	100 (96.2)	19 (100)	119 (96.7)	122 (98.4)	8 (72.7)	130 (96.3)	249 (96.5)
Employment							
Unemployed	3 (2.9)	-	3 (2.4)	55 (44.4)	8 (72.7)	63 (46.6)	66 (25.6)
Retired	51 (49.0)	17 (89.5)	68 (55.3)	40 (32.3)	3 (27.3)	43 (31.9)	111 (43.0)
Employed	50 (48.1)	2 (10.5)	52 (42.3)	29 (23.4)	-	29 (21.5)	81 (31.4)
Income resources							
Pension	35 (33.7)	13 (68.4)	48 (39.0)	14 (11.3)	1 (9.1)	15 (11.1)	63 (24.4)
Salary	30 (28.8)	-	30 (24.4)	17 (13.7)	-	17 (12.6)	47 (18.2)
Children	19 (18.3)	4 (21.1)	23 (18.7)	53 (42.7)	8 (72.7)	61 (45.2)	84 (32.6)
Other (savings, social welfare)	20 (19.2)	2 (10.5)	22 (17.9)	40 (32.3)	2 (18.2)	42 (31.1)	64 (24.8)

Table III: Mean±SD for Functional Status of the Subjects by Gender and Age

Functional status	Male			Female			Total (n=258)
	60-74 yrs (n=104)	≥75 yrs (n=19)	Subtotal (n=123)	60-74 yrs (n=124)	≥75 yrs (n=11)	Subtotal (n=135)	
Self-reported physical disability							
8-item IADL score	7.14±1.15	5.47±1.50*** ^b	6.88±1.35	6.81±1.25	4.64±1.29*** ^b	6.64±1.39	6.76±1.37
Performance-based Functional limitations							
Cognitive functioning (ECAQ score)	8.80±1.14	8.00±1.49 ^b	8.67±1.22	8.40±1.45	6.73±2.05*** ^b	8.27±1.57 ^a	8.46±1.43
Mobility score (EMS score)	19.35±1.73	16.79±2.70*** ^b	18.95±2.11	18.77±1.71	14.82±3.06 ^b	18.45±2.13	18.69±2.13
Manual dexterity (Lock and key test score)	2.96±0.28	2.79±0.63	2.94±0.36	2.93±0.36	2.45±0.93	2.89±0.45	2.91±0.41
Muscle strength [Handgrip strength (kg)]	33.88±7.73	22.55±4.93*** ^b	32.15±8.42	19.21±6.43	12.16±3.39*** ^b	18.64±6.52*** ^a	25.08±10.07

*p<0.05

***p<0.001

^a, significant difference between gender (independent sample t-test)

^b, significant difference between age category within the same gender, (independent sample t-test)

Table IV: Prevalence of Functional Status of the Subjects by Gender and Age [n (%)]

Functional status	Male			Female			Total (n=258)
	60-74 yrs (n=104)	≥75 yrs (n=19)	Subtotal (n=123)	60-74 yrs (n=124)	≥75 yrs (n=11)	Subtotal (n=135)	
Self-reported physical disability							
IADL disability (IADL ≤7)	49 (47.1)	17 (89.5)** ^a	66 (53.7)	73 (58.9)	11 (100.0)** ^a	84 (62.2)	150 (58.1)
Performance-based Functional limitations							
Cognitive functioning (ECAQ ≤5)	-	1 (5.3)	1 (0.8)	6 (4.8)	2 (18.2)	8 (5.9)* ^a	9 (3.5)
Mobility test (EMS ≤13)	3 (2.4)	3 (15.8)* ^a	6 (4.9)	-	4 (36.4)** ^a	4 (3.0)	10 (3.9)
Manual Dexterity (lock and key test ≤2)	2 (1.9)	2 (10.5)	4 (3.3)	5 (4.0)	3 (27.3)* ^a	8 (5.9)	12 (4.7)

*p<0.05; **p<0.01; ***p<0.001

^a, significant difference (Fisher’s Exact test)

IV. DISCUSSION

This study assessed physical disability by using self-reported instrumental activities of daily living (IADL) instrument. It shows the prevalence of physical disability was 58.1% among the subjects. This finding is comparable with earlier studies which identified that 43-50% of Malaysian community-dwelling elderly had physical disability [6, 18]. Other countries also reported quite similar finding with the present study, with 48-53% of their subjects were physically disabled based on IADL instrument [19, 20]. The different ranges of prevalence for physical disability assessed by IADL instrument should be interpreted cautiously, since there is possibility of different number of IADL items used, sample size and settings of the sample studied. The IADL instrument may also influenced by societal, environmental, and cultural factors. As for Malaysian culture, it is norm for elderlies to be taken care of by their family members. Thus, higher tendency for being dependent on others or at least seek for assistance in daily activities. Physical disability among both female and older age group were reportedly to be more prevalent than male and younger elderly counterparts respectively. These findings were consistent to the previous local studies [21, 22] as well as in foreign studies [4, 23]. The gender differences in physical disability could reflected by the high percentage of illiteracy among females (9.6%), compared to males (1.6%). Since the IADL instrument assessed complex activity such as ability to use public transport (which requires the ability to manage money) and to manage own money (in other circumstances such as shopping), this could be much dependent on some educational levels which are low among females [24]. While the increasing age effect on deterioration of physical ability, it shows the normal process of ageing. The prevalence of disabilities gradually increases with advancing age, which starts to accelerate after the age of 70 and causes a growing need for help especially after the age of 80 [8].

In terms of performance-based functional limitations, the prevalence of cognitive impairment, mobility dependent and poor manual dexterity were quite low (below than five percent) for each assessment. The low prevalence of cognitive impairment in present study corresponded to other local studies, which also found that only 3-4% of the elderly had poor cognitive functioning [25, 26]. Probably, the elderly populations in present and described studies were limited by the relatively young age of subject, hence good cognitive functioning were reported. Subjects in present study also showed good mobility status, possibly due to the study areas which observed to be quite well-developed in terms of infrastructure and public transport, making the mobility tasks (i.e. shopping) for the elderly persons easier and accessible. The low prevalence of poor manual dexterity was also matched with a local study by Zuriati, where only 1.4% subjects detected unable to perform the lock and key test [27]. A possible reason for the low prevalence could be due to the common use of lock and key among this local community. In general, the relatively low prevalence of functional limitations in this study may reflect relatively good functional status in terms of performance-based measures among subjects, as they had attempted several tasks or movements. However, it is important to note that this study did not involve institutionalised elderly resident which is known to be more prone for poor functional status. Thus, the prevalence of performance-based functional limitations is therefore possibly higher than this study suggests.

Being female and older age group may increase the risk of experience functional limitations among the elderly. These findings are also consistent with a large body of work which suggests that gender and age group differs in their functional limitation in terms of cognitive functioning [5, 28], mobility status [25], manual dexterity [29] and muscle strength [30, 31].

V. CONCLUSION

In a nutshell, self-reported physical disability indicated a higher prevalence of poor functional status than performance-based functional limitations among the elderly population under study. Similar trends toward gender- and age-related functional decline with other studies were also observed in this study. Thus, it is suggested to combine both method (self-reported and performance-based) to give better information regarding

overall functional status among elderly population. Prevention of functional decline among elderly people does need priority, and such effort need to be at early stage by recognizing gender- and age-specific risk and protective factors.

REFERENCES

- [1]. D. Sharma, S.R. Mazta, and A. Parashar, Morbidity pattern and health-seeking behavior of aged population residing in Shimla Hills of North India: a cross-sectional study, *Journal of Family Medicine and Primary Care*, 2(2), 2013, 188-193.
- [2]. M.R. Rose, Adaptation, aging, and genomic information. *Aging*, 1(5), 2009, 444-450.
- [3]. I. Abdulraheem, A. Oladipo, and M. Amodu, Prevalence and correlates of physical disability and functional limitation among elderly rural population in Nigeria. *Journal of Aging Research*. Doi:10.4061/2011/369894
- [4]. M.C. Dolai, and F. Chakrabarty, Functional status of the elderly Santal people. *International Journal of Humanities and Social Science Invention*, 27(4), 2013, 610-620.
- [5]. A. Rashid, A. Azizah, and S. Rohana, Cognitive impairment among the elderly Malays living in rural Malaysia. *Medical Journal of Malaysia*, 67(2), 2012, 187.
- [6]. S. Suzana, P. Boon, P. Chan, and C. Normah, Malnutrition risk and its association with appetite, functional and psychosocial status among elderly Malays in an agricultural settlement. *Malaysian Journal of Nutrition*, 19(1), 2013, 65-75.
- [7]. National Committee on Vital and Health Statistics (NCVHS). (2001). *Classifying and reporting functional health status*. Washington, DC: Department of Health and Human Services.
- [8]. Heikkinen, E., *What are the main risk factors for disability in old age and how can disability be prevented?* WHO Regional Office for Europe (Health Evidence Network: Copenhagen. (2003).
- [9]. S.Z. Nagi, An epidemiology of disability among adults in the United States. *Milbank Memorial Fund Quarterly* 54, 1976, 439-67.
- [10]. M.P. Lawton and E.M. Brody, Assessment of older people: self-maintaining and instrumental activities of daily living. *Gerontologist*, 9(3), 1969, 179-186.
- [11]. J.C. Millán-Calenti, J. Tubío, S. Pita-Fernández, S. Rochette, T. Lorenzo, A. Maseda, Cognitive impairment as predictor of functional dependence in an elderly sample. *Archives of Gerontology and Geriatrics*, 54(1), 2012, 197-201.
- [12]. E.H. Kua and S.M. Ko, A questionnaire to screen for cognitive impairment among elderly people in developing countries. *Acta Psychiatrica Scandinavica*, 85, 1992, 119-122.
- [13]. M.E. Tinetti, and S.F. Grinter, Identifying mobility dysfunctions in elderly patients. *Journal of American Medical Association*, 259, 1988, 228-236.
- [14]. R. Smith, Validation and reliability of the Elderly Mobility Scale. *Physiotherapy*, 80(11), 1994, 744-747.
- [15]. M.C. Manandhar, Functional ability and nutritional status of free living elderly people. *Proceedings of the Nutrition Society*, 54, 1995, 677-691.
- [16]. National Health and Nutrition Examination Survey III (NHANES III). *Physical Function Examination Manual*; Westat, Inc; Rockville, 1993.
- [17]. T.E. Hillman, Q.M. Nunes, S.T. Hornby, Z. Stanga, K.R. Neal, B.J. Rowlands, S.P. Allison, and D.N. Lobo, A practical posture for handgrip dynamometry in the clinical setting. *Clinical Nutrition*, 24, 2005, 224-228.
- [18]. A. Siti Nur 'Asyura, S. Shahar, S. Rahman, N. Yusof, F. Arshad, Z. Yassin, M. Salleh, A.A. Samah, and N.I.M. Sakian, An action research on promotion of healthy ageing and risk reduction of chronic disease: A need assessment study among rural elderly Malays, care givers and health professionals. *The Journal of Nutrition, Health & Aging*, 13(10), 2009, 925-930.
- [19]. J.C. Millán-Calenti, J. Tubío, S. Pita-Fernández, I. González-Abraldes, T. Lorenzo, T. Fernández-Arruty, and A. Maseda, Prevalence of functional disability in activities of daily living (ADL), instrumental activities of daily living (IADL) and associated factors, as predictors of morbidity and mortality. *Archives of Gerontology and Geriatrics*, 50(3), 2010, 306-310.
- [20]. H. Hsu and L.-J. Jhan, Risk factors of falling among the elderly in Taiwan: a longitudinal study. *Taiwan Geriatrics Gerontology*, 3(2), 2008, 141-154.
- [21]. H.A. Mohamad, S. Suzana, I.M. Noor, and S. Norshafarina, Relationship between appetite, food intake and body composition among elderly Malays from an urban residential area in Kuala Lumpur, Malaysia. *Malaysian Journal of Nutrition*, 16(3), 2010, 339-348.
- [22]. S. Suzana and H. Siti Saifa, Validation of nutritional screening tools against anthropometric and functional assessments among elderly people in Selangor. *Malaysian Journal of Nutrition*, 13(1), 2007, 29-44.
- [23]. A.Z. Al Hazzouri, A.M. Sibai, M. Chaaya, Z. Mahfoud, and K.M. Yount, Gender differences in physical disability among older adults in underprivileged communities in Lebanon. *Journal of Aging and Health*, 23(2), 2011, 367-382.
- [24]. S. Suzana, J. Earland, and A.R. Suriah, Social and health profiles of rural elderly Malays. *Singapore Medical Journal*, 42(5), 2001, 208-213.
- [25]. N.N. Hairi, A. Bulgiba, R.G. Cumming, V. Naganathan, and I. Mudla, Prevalence and correlates of physical disability and functional limitation among community dwelling older people in rural Malaysia, a middle income country. *BioMed Central Public Health*, 10, 2010, 492.
- [26]. S.Y. Sharifah Zaniyah, M. Gunasegaran, M.Z. Muhammad Hanif, N. Nuramalina, H.C. Seow, and V. Bharathi, Prevalence of cognitive impairment among the members of the national council of senior citizens' Malaysia in day care centres within the Klang valley. *Malaysian Journal of Public Health Medicine*, 11(2), 2011, 43-48.
- [27]. I. Zuriati, Profil Keupayaan Fungsi, in S. Suzana, I. Zuriati, A.R. Suriah & A. Siti Nur 'Asyura (Ed.), *Pemakanan dan Penilaian Kesihatan Warga Tua*, (Malaysia: Penerbit Universiti Kebangsaan Malaysia, 2007) 63-69.
- [28]. Y. Zhou, J.H. Flaherty, C.-Q. Huang, Z.-C. Lu, and B.-R. Dong, Association between body mass index and cognitive function among Chinese nonagenarians/centenarians. *Dementia and Geriatric Cognitive Disorders*, 30(6), 2011, 517-524.
- [29]. J.V Annemieke, B. Anita, N.V.S. Ivo, D.V. Marianne, and N. Frans, Manual dexterity in hereditary motor and sensory neuropathy type 1A: severity of limitations and feasibility and reliability of two assessment instruments. *Journal of Rehabilitation Medicine*, 40, 2008, 132-136.
- [30]. P.C. Dhara, P. Sengupta and S. De, Hand grip strength of older persons in relation to body dimensions and nutritional status. *Journal of the Indian Academy of Geriatrics*, 7, 2011, 143-149.
- [31]. F. Moy, E. Chang, and K. Kee, Predictors of handgrip strength among the free living elderly in rural Pahang, Malaysia. *Iranian Journal of Public Health*, 40(4), 2011, 44.