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Correlation between Health-Related Quality of Life and Hand Grip Strength among Older Adults

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ABSTRACT

Background: With advanced age, the progressive loss of muscle strength estimated by the handgrip strength (HGS) may result in a poorer health-related quality of life (HRQoL). Studying this association becomes a vital area of research for promoting aging-well. The aim of this study was to examine the correlation between HRQoL and HGS among community-dwelling older adults above 60 years old.

Methods: Participants comprised of 176 older adults (mean age: 68.15 ± 6.74). The HGS was tested with Jamar® Dynamometer, and the EuroQuol-5 Dimensions 5Levels (EQ-5D-5L) questionnaire was used to assess HRQoL.

Results: Both HGS and HRQoL were negatively correlated with age ($p < .001$). Lower values of HGS and HRQoL were recorded among older adults who had diagnosed with one or more chronic diseases ($p < .001$). Significant correlations were recorded between HGS and functioning, and subjective well-being domains of EQ-5D-5L. A relatively higher association was recorded between the functioning variables of EQ-5D-5L and HGS compared to subjective well- being variables.

Conclusion: Handgrip strength is a simple and practical measure in identifying older adults at risk of physical decline. Maintaining handgrip strength may contribute to improving HRQoL, and can add an imperative dimension to promote aging-well in older adults ≥60 years old.

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Introduction

Populations around the world are rapidly aging, by 2020; the number of people aged sixty years and older will outnumber children younger than five years (World Health Organization, 2018). With advanced age, older adults are at higher risk to develop more diseases and disability (Brown, 2015), as a result of the significant increase in life expectancy, older people may encounter further challenges in attaining a good health-related quality of life (HRQoL) (Liu, Y. et al., 2017).According to World Health Organization(World Health Organization, 2019a), communities that adapt to these changing demographics by helping older adults remain healthy and active can enable individuals to live longer, healthier and with a better quality of life(World Health Organization, 2010).

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The quality of life (QoL) is linked to the individual's perception of life in the context of culture and value systems, and it is affected by the person's physical health, psychological state, level of independence and social relations (World Health Organization, 2019b). The HRQoL becomes an important constituent of healthcare evaluation since it is a part of a multidimensional approach that considers the person's physical, mental and social aspects (Vagetti et al., 2014).

Health-related quality of life is associated with physical health and physical functioning in older adults(Fusco et al., 2012).With advancing age, older people are more likely to experience age-related declines (Brown, 2015; Perkisas, De Cock, Vandewoude, & Verhoeven, 2019). Physical health and physical functioning are adversely affected by changes in skeletal muscle and body composition(Liu et al., 2017; Steverink et al., 2006), the progressive loss of muscle strength may result in sarcopenia and poorer functional ability, both of which contribute to the impairment of HRQoL(Chen, Chang, & Lan, 2015; Dokuzlar et al., 2019; Marques, Confortin, Ono, Barbosa, & d'Orsi, 2019; Roberts et al., 2011). Muscle strength measurements may be useful as a part of the clinical assessment in identifying persons at risk of this decline (Taekema, Gussekloo, Maier, Westendorp, & de Craen, 2010). The handgrip strength (HGS) is exposed to decline with advanced age due to the age-associated loss of skeletal muscle mass and function (Cruz-Jentoft et al., 2010). HGS is a widely used measure to detect muscle strength deterioration in geriatric practice (Roberts et al., 2011), and it is an important index for diagnosing sarcopenia (Kang, Lim, & Park, 2018), a simple measure that might be applied as an indicator of HRQoL among older adults (Fusco et al., 2012; Goodpaster et al., 2006; Guede Rojas et al., 2017; Musalek, C. et al., 2017; Trombetti et al., 2016).

Based on its predictive validity, the HGS is considered as a vital screening measure in clinical settings (Bohannon, 2008). The average decline of right and left handgrip strength at each decade after the age of 60 years ranged between 5–6 kg in men, and 3–4 kg in women (Amaral et al., 2019; Bohannon, Wang, Yen, & Grogan, 2019). The strength of the handgrip is necessary to maintain activities of daily living (ADL), and decreased HGS is associated with ADL limitation (Liu, C.-J. et al., 2017; McGrath, Vincent, Lee, Kraemer, & Peterson, 2018; Sallinen et al., 2010; Spirduso, Francis, & MacRae, 2005). Moreover, reduced hand grip strength may negatively influence HRQoL by accelerating dependency in activities of daily living (Taekema et al., 2010), increasing risk of falls (Delbaere et al., 2006; Halaweh, H. et al., 2015), mobility limitation (Sallinen et al., 2010), and increasing disability level (Dato et al., 2012) among older adults. Accordingly, preserving muscle strength estimated by HGS can improve the HRQoL and the state of well being for older adults (Musalek & Kirchengast, 2017b), and studying this association between the handgrip strength and HRQoL becomes a vital area of research to promote the process of aging- well in different populations.

Some important contributing factors to well-being and HRQoL in older adults are prominently related to people's physical and social environments, including their homes, families, neighborhoods, and communities, as well as their personal traits such as their sex, ethnicity and socioeconomic status (World Health Organization, 2018). The variation of these environmental and personal factors may lead to different characteristics of the older population in various countries (Wiraguna et al., 2018). In the West Bank/Palestine, the number of older adults is continuously growing as life expectancy has increased about 6–8 years during the last two decades (Palestinian Central Bureau of Statistics, 2018b). The older population is one of the most vulnerable groups with a rate of poverty of 34.0%, and 71.7% suffer from one or more chronic diseases. This comprises a population age group that

requires further studying and researching (Palestinian Central Bureau of Statistics, 2018a, 2018b). Studying the association between muscle strength estimated by the handgrip strength and HRQol can add an imperative dimension to promote aging-well among the older adults in Palestine. To our knowledge, this is the first study assessing this association. Thus, the aim of this study was to examine the correlation between HRQoL and HGS among community-dwelling older adults ≥60 years old in the West Bank/Palestine.

Methods

Participants

One hundred seventy-six participants ranging in age between 60 and 91 years (mean age = 68.15 ± 6.74) were recruited in this study. The sample comprised 115 women and 61 men, all participants were community-dwelling older adults (aged ≥ 60 years), and living in the West Bank (Palestine). Exclusion criteria were older adults who were diagnosed with neurological or musculoskeletal diseases, and communication deficits that would limit the testing procedures.

Procedures

Recruitment procedure was arranged through coordination with different community and physiotherapy centers in the West Bank (Palestine). Data collection took place at the centers and at homes of the participants; enrollment took place between April 2013 and August 2014. Before data collection started, all participants were informed about the aim and methodology of the study. The participants were ensured confidentiality and informed that their participation was voluntary, and that they had the right to withdraw at any time.

The study received ethical approval from the research ethics committee of Al-Quds University, Palestine (Ref No: 1/REC/13), which complies with the Declaration of Helsinki. All participants provided written informed consent.

Measurements

At baseline, demographic clinical descriptive data on age, sex, marital status, diagnosed disease (cardiovascular, musculoskeletal, hypertension, and others), anthropometric measurements (weight and height), sensory functions (visual, hearing and speech), and using of assistive devices were registered by the researcher. In addition, The Katz Index was used to determine the independency level in performing activities of daily living (Brorsson et al., 1984).

Measure of Quality of Life

The Arabic (Jordan) EQ-5D version was used to measure health-related quality of life in this study (Aburuz, Bulatova, Twalbeh, & Gazawi, 2009). The EQ-5D-5L is a standardized, non-disease specific instrument developed for describing and valuing the health-related quality of life, and it has been described as a valid and reliable instrument to assess HRQoL in different populations (Obradovic, Lal, & Liedgens, 2013; Pattanaphesaj et al., 2015; Tidermark et al., 2007).

The EQ-5D-5L consists of a descriptive system that assesses both functioning and subjective well being domains and the EQ visual analogue scale (EQ-VAS). The descriptive system includes five dimensions (mobility, self-care, usual activities, pain/discomfort, and anxiety/depression) and each dimension includes five levels of coding: 1 = no problems; 2 = slight problems; 3 = moderate problems; 4 = severe problems; and 5 = extreme problems. In addition, respondents reported self-rated health on an EQ visual analogue scale (EQ-VAS) with endpoints labeled 100 (the best health you can imagine) and 0 (the worst health you can imagine).

Hand Grip Strength (HGS)

Handgrip strength was measured with a Jamar® Hydraulic Hand Dynamometer apparatus (User Instructions, 2019). The participant was tested in a sitting position, shoulder adducted, and neutrally rotated with the elbow flexed at 90°. The forearm was placed in a neutral position. The participant was asked to squeeze the handle of the Jamar® Dynamometer as hard as possible for five seconds and then relax; the best value out of three for each hand was registered in kilograms. The hand grip strength has been described as a valid measure and good marker of physical performance among older adults (Delbaere et al., 2006; Stevens et al., 2012), and it has a high test-retest reliability (Svantesson, Norde, Svensson, & Brodin, 2009).

Statistical Analysis

Descriptive statistics were used to characterize the sample, between groups comparisons, were calculated according to sex and age; age groups were categorized into (60–69 years, 70–79 years, and ≥80 years). Welch tests and independent sample t-tests were performed on the HGS and EQ-VAS to determine differences according to sex, age categories, diagnosed diseases, living status, education level, and households' responsibility. ANOVA tests were performed to determine differences of hand grip strength and HRQoL (VAS), and Kruskal- Wallis tests were performed on the ordinal variables of the EQ-5D to compare differences between the age groups. A General Linear Model was employed to compute estimates of effect size using values of partial eta-squared (η_p^2).

Spearman's rank correlation coefficient was used to examine the correlation between HRQoL variables and hand grip strength. Statistical significance was set at $P < .05$. Data were analyzed using the Statistical Package for the Social Sciences (SPSS), version 25 (SPSS, Chicago, IL, USA).

Results

The mean age of women and men was 67.7 ± 6.5 and 69.1 ± 7.2 years, respectively. The mean BMI was 31.6 ± 5.0 kg/m^2 for women and 28.3 ± 3.8 kg/m^2 for men. A number of 88% of the women and 84% of the men recorded a diagnosed disease. Almost 50% of the participants had hypertension, and about 54% had musculoskeletal problems. A number of 109 (63%) participants used glasses, 4(2%) used hearing aids, and 24 (14%) recorded using an assistive device for walking (cane). The majority of the participants (92%) were fully independent in daily living activities (ADL), and (8%) were partially independent according to the Katz Index. Demographic and clinical characteristics of the participants are illustrated in (Table 1).

Table 1. Demographic and clinical characteristics of the participants (n = 176).

Variable	All (n = 176)	Women (n = 115)	Men (n = 61)	P Value
Mean (SD)				
Age (years)	68.2 (6.74)	67.7 (6.49)	69.1 (7.16)	.410
Body Mass Index	30.5 (4.87)	31.6 (5.00)	28.3 (3.79)	.001
Living status				
With Family	135(77)	79(69)	57(93)	.001
Alone	40(23)	36(31)	4(7)	<0.001
Education Level, N (%)				
≤ 6 years	73(42)	54 (47)	19 (31)	<0.001
Secondary Education	60 (34)	44 (38)	16 (26)	<0.001
College of higher education	8 (4)	2(2)	6 (10)	.001
University Degree	35(20)	15 (13)	20 (33)	<0.001
Co-morbidity				
Cardiovascular	39 (22)	22 (19)	17 (28)	.206
Hypertension	86 (49)	57 (50)	29 (48)	.800
Diabetes	54 (31)	36 (31)	18 (30)	.806
Musculoskeletal	95 (54)	70 (61)	25 (41)	.009
Osteoporosis	30 (17)	28 (24)	2 (3)	<0.001
Responsible for				
family members and grandchildren	75(43)	71(61)	4(7)	<0.001
Taking financial care	48(27)	2(2)	46(75)	<0.001
No Responsibility	53(30)	42(37)	11(18)	<0.001

Older adults who were diagnosed with at least one chronic disease (n = 152) recorded a lower score on EQ-VAS and lower values of HGS compared with older adults who had no chronic disease, the between-group difference in the mean value of EQ-VAS was 13.01 points (95% confidence interval (CI), 7.3 to 18.7; $P < .001$), and of the HGS was 6.9 kg (95% CI, 2.9 to 10.9; $P = .001$). (Table 2)

Participants who had ≥ 7 years of education (n = 103) recorded higher mean values on EQ-VAS compared with their peers who had ≤ 6 years of education (n = 73), (77.4 ± 12.4 and 66.0 ± 13.8, ($p < .001$), with a partial eta-squared (η_p^2) = 0.06, and HGS (26.0 ± 9.8, 20.2 ± 7.4, $p = .001$, $\eta_p^2 = 0.07$). For women, the mean value of the hand grip was higher among those with ≥7 years of education (n = 61) compared with women who had ≤ 6 years of education (n = 54), (21.0 ± 5.1 and 18.0 ± 4.9). Both EQ-VAS and HGS were higher in participants who lived within family compared to participants living alone ($\eta_p^2 = 0.04$ for EQ-VAS and 0.08 for HGS), with a significant difference in EQ-VAS among women ($p = .004$). Additionally, participants who were involved in their households' responsibility recorded higher values compared to their counterparts who had no responsibility on both EQ-VAS (74.0 ± 13.2, 68.6 ± 14.9, $p = .01$, $\eta_p^2 = 0.03$), and HGS (26.0 ± 9.8, 20.2 ± 7.4, $p = .001$, $\eta_p^2 = 0.08$).

The mean values of HGS (Kg) for right and left hands were 32.6 ± 9.6 and 31.5 ± 7.9 for the men, and for the women the values were 19.7 ± 5.7 and 18.3 ± 5.5, with a significant

Table 2. Handgrip strength and EQ-VAS according to co -morbidity (n = 176).

	Hand Grip Strength (Kg)			EQ – VAS		
Diagnosed Disease	*Yes- Mean(SD)*	*No- Mean(SD)*	*P*	*Yes- Mean(SD)*	*No- Mean(SD)*	*P*
Hypertension	23.0(9.5)	25.3(9.5)	0.11	69.3(14.9)	75.2(12.3)	.005
Diabetes	23.4(8.1)	24.6(10.1)	0.44	69.8(13.8)	73.7(13.70	.047
Cardiovascular	23.8(9.7)	24.3(9.5)	0.77	74.1(12.7)	66.2(16.4)	0.002
Musculoskeletal	21.3(7.9)	27.7(10.2)	<0.001	67.4(13.2)	78.2(12.5)	<0.001
Respiratory	22.0(7.8)	24.5(9.8)	0.25	63.7(12.7)	73.5(13.7)	.002
Osteoporosis	16.5(5.8)	25.8(9.4)	<0.001	61.2(15.2)	74.6(12.5)	<0.001
One or more diagnosed disease	23.2(8.9)	30.2(11.5)	0.001	70.5(13.60	83.5(10.9)	<0.001

Table 3. Values of handgrip strength according to age and sex categories (n = 176).

	60–69 years		70–79 years		≥80 years		
Hand Grip Strength (kg)	n	*Mean (SD)*	n	*Mean (SD)*	n	Mean (SD)	P
Right hand	110	25.8 (9.8)	51	22.8 (8.4)	15	17.5 (7.8)	.002
Women	74	21.4 (5.5)	32	18.0 (4.3)	9	12.4(4.3)	<0.001
Men	36	34.8 (10.5)	19	30.7(7.6)	6	25.0(4.9)	.007
Left hand	110	24.4(8.9)	51	21.5(8.6)	15	16.6(8.3)	.004
Women	74	19.8 (5.0)	32	16.8 (4.8)	9	11.6 (5.6)	.001
Men	36	33.8(7.5)	19	29.5(7.6)	6	24.3(5.1)	.004

Table 4. Values of HRQoL according to age categories (n = 176).

Variable	60–69 years (n = 110)	70–79 years (n = 51)	≥80 years (n = 15)	P
HRQoL-Functioning				
(Median-range)				
Mobility	2.00 (3)	2.00 (3)	3.00 (3)	<0.001
Self-care	1.00 (3)	1.00 (4)	3.00 (3)	<0.001
Usual activities	2.00(4)	2.00 (4)	3.00 (4)	0.013
HRQoL- Subjective Well Being				
Pain/Discomfort	2.00 (4)	2.00 (3)	2.00 (4)	0.806
Anxiety/Depression	2.00 (4)	2.00 (3)	2.00 (3)	0.747
EQ- VAS (Mean (SD))	75.2 (13)	70.4 (14)	57.67 (13.2)	<0.001

Table 5. Correlation between HRQoL variables and handgrip strength (n = 176).

	HGS Women (n: 115)		HGS Men (n: 61)	
HRQoL Variables	r_s	P value	r_s	P value
Functioning				
Mobility	−.501	<0.001**	−.503	<0.001**
Self-care	-.454	<0.001**	-.544	<0.001**
Usual activities	-.379	<0.001**	-.441	<0.001**
Subjective Well Being				
Pain/Discomfort	-.224	.016*	-.269	.036*
Anxiety/Depression	-.149	.111	-.422	.001**
EQ Visual analogue scale	.650	<0.001**	.698	<0.001**

**Correlation is significant at the 0.01 level, *Correlation is significant at the <0.05 level

difference between the two sexes ($p < .001$). Significant differences($p < .05$) were recorded for the hand grip strength values between the three age category groups, where participants in the age group 60–69 years recorded higher values than the other age groups (Table 3).

As seen in Table 4, values of EQ-VAS were negatively correlated with age ($p < .001$, $\eta_p^2 = 0.23$). Also, the younger age groups recorded higher values on EQ-5D-5L variables (mobility, self-care, and usual activities, and EQ-VAS) ($p < .01$). No significant differences were recorded on EQ-5D-5L variables (pain/discomfort, and anxiety/depression) relative to age categories (Table 4).

As seen in Table 5, a significant correlation was recorded between HGS and the EQ-VAS ($p < .001$). Relatively higher correlations were recorded between the functioning variables of EQ-5D-5L (mobility, self-care, and usual activities)and HGS($p < .001$),compared to subjective well- being variables of the EQ-5D-5L (pain/discomfort, and anxiety/depression) among the two genders, and no significant correlation was recorded among

women between the hand grip strength and the anxiety/depression variable of the EQ-5D-5L. (Table 4)

Discussion

In this study, results indicated that older adults who had been diagnosed with at least one chronic disease recorded lower values of HGS and lower scores on EQ-VAS compared with older adults who had no chronic diseases. This might be attributed that the co-morbidity has a negative impact on the hand grip strength, findings that are consistent with similar studies considering the HGS as a vital physical functioning measure to be included in geriatric care (Dudzinska-Griszek, Szuster, & Szewieczek, 2017; Kim, Jeon, & Jeong, 2019).Also, corresponding with our findings; a systematic review (Salive, 2013) has shown that co-morbidity is associated with elevated disability, poor functional status, and poor quality of life. Musculoskeletal disorders including arthritis and osteoporosis seem to have a great adverse influence on the quality of life among older adults (Park et al., 2018), compared to our findings, the participants who were diagnosed with musculoskeletal disorders recorded significantly lower values on HRQoL variables. The majority of the participants who were diagnosed with osteoporosis in this study were women (24%) compared to (2%) of men, results that are in accordance with another study reporting 30% of the women in Europe and the United states above the age of 50 years old had osteoporosis(Sözen, Özışık, & Başaran, 2017), and in Jordan about 30% of women were identified as having osteoporosis (Shilbayeh, 2003). In Palestine, women ≥64 years had a higher risk of developing osteoporosis (Kharroubi, Saba, Ghannam, & Darwish, 2017), findings that require further attention to improve muscle strength and physical functioning to prevent falls and falls' consequences in both sexes with a special focus in women, as women have a higher risk of falls (Halaweh et al., 2015; Kusljic, Perera, & Manias, 2018),and osteoporosis was described as one of the major quality of life threatening diseases for women (Elayeh et al., 2014).

Our results showed that participants who received more education scored higher scores in EQ-VAS and HGS compared to their counterparts who received less education. Evidence suggests that older adults with more education age more slowly than their less-educated peer (Sanderson et al., 2014). This may involve various contributing factors, including age, occupation, socioeconomic status, and level of physical performance. However, a low level of education may result in reduced physical performance including the HGS. Welmer et.al found that higher education was associated with higher hand grip among 60 years and older Swedish population; where persons with higher education had 4% better grip strength compared to persons with lower education (Welmer, Kareholt, Rydwik, Angleman, & Wang, 2013), comparable results were also found among a Korean older population, which indicated that older women who had been educated for ≥7years had lower risk of low HGS than those who had been educated for ≤ 6 years (OR, 0.57; 95% CI, 0.34–0.94 for 7–9 years and OR, 0.32; 95% CI, 0.17–0.61 for 10–12 years).(Kim et al., 2019).A high percentage of women 47% and men 31% in this study had ≤ 6 years of education, a finding that needs to be considered by health care providers in developing appropriate health promotion program addressing age-related declines for less-educated older adults.

Living alone was found as a significant risk factor for higher risk of diseases and disability with advanced age (Lund, Nilsson, & Avlund, 2010). Growing evidence suggests that loneliness is adversely associated with physical and mental illness and different aspects of functional status

in later life (Ong, Uchino, & Wethington, 2016; Shankar, McMunn, Demakakos, Hamer, & Steptoe, 2017). In contrast, social connections particularly between close relatives have been described as a vital contributing factor to better health-related quality of life and subjective well-being during old age(Chui, 2018). With higher life expectancy, women are more likely to spend the later stage of their lives alone(Guralnik, Balfour, & Volpato, 2000; Le, Ren, Shen, Li, & Zhang, 2015), the majority of the participants who lived alone in the present study were women, this might be related that about one third of elderly females in the West Bank are widows (Palestinian Central Bureau of Statistics, 2018b), both EQ-VAS and HGS were higher among participants who lived within family compared to participants living alone; findings that correspond with a similar study indicating that older women reported better physical health when they were living with family (Imam, 2010).Additionally, this might be attributed that participants who were involved in their households' responsibility within a family recorded higher values on HRQoL and HGS, as active participation in familial and social activities may positively contribute to better HRQol and well-being among older adults(Adams et al., 2011).

The hand grip strength was used in this study as a recognized indicator of the hand and the upper extremity strength, a vital measure that has been described as a good marker of physical performance among older adults (Bellace, Healy, Besser, Byron, & Hohman, 2000; Delbaere et al., 2006; Kozakai, 2017; Liu et al., 2017; Stevens et al., 2012). The applied HGS test using the Jamar dynamometer was found as a practical feasible measure to be administered in home- settings, and the tests were appropriate for evaluating the physical performance of the participants; findings that support the evidence regarding HGS test simplicity and validity in geriatric care as an efficient tool to predict future outcomes in aging adults(Bohannon, 2008; Fusco et al., 2012; Goodpaster et al., 2006; Guede Rojas et al., 2017; Musalek & Kirchengast, 2017b; Trombetti et al., 2016).

The hand grip strength is expected to decline with advanced age due to the loss of skeletal muscle mass and function (Cruz-Jentoft et al., 2010; Halaweh, H. et al., 2017), which may adversely reflect on HRQoL among older adults (Chan, van Houwelingen, Gussekloo, Blom, & den Elzen, 2014). In this study, older age groups recorded lower HGS and EQ-VAS values ($p < .01$), this might be attributed to advanced age, older adults are at higher risk to develop more diseases and disability (Brown, 2015), and may encounter more challenges in pursuing good health-related quality of life (HRQoL) (Liu et al., 2017; Spirduso et al., 2005; Steverink & Lindenberg, 2006). This suggests that preserving the strength of the hand grip may promote a better quality of life and enhance the possibility of aging-well as people grow older. Findings that are consistent with WHO recommendations are that it is fundamental to reconsider measures to help older adults remain healthy and active in order to maximize health, functioning, and enhanced quality of life for older adults (World Health Organization, 2010).

Factors related to demographic and clinical characteristics including age, health status, culture, and language of the studied population have been considered important to HRQoL in this study. Therefore, the Arabic (Jordan) version of the EQ-5D-5L was used as a relevant, valid and reliable measure, Cohen's kappa coefficient (κ) values for EQ-5D mobility, self-care, usual activities, pain/discomfort and anxiety/depression items were 0.66, 1.0, 0.48, 0.66, and 0.48 respectively ($P \leq .001$ for all dimensions), and the Interclass correlation coefficient for the EQ-VAS was 0.78. (Aburuz et al., 2009). The EQ-5D-5L was found as a practical and simple tool to assess HRQoL among older adults, results that are consistent with similar studies (Pattanaphesaj & Thavorncharoensap, 2015; Tidermark & Bergström, 2007). Functioning and

subjective well being were the major domains of interest for studying HRQoL. The functioning domain was addressed by studying mobility, self-care, and usual activities dimensions of the EQ-5D-5L, and for studying subjective well-being domain, dimensions of pain/discomfort and anxiety/depression were addressed.

Hand grip strength tests permit the use of normative data for understanding age and sex differences, where results may differ significantly between women and men (User Instructions, 2019). In accordance with our results, men recorded relatively higher hand grip strength values. For this reason, the correlation between the hand grip strength (HGS) and HRQoL was computed for each sex separately. Recent studies (Amaral et al., 2019; Bohannon et al., 2019) have established handgrip strength reference values, and indicated that handgrip strength is expected to decrease with advanced age; the average decline of right and left HGS among men at each decade after the age of 60 years ranged between 5–6 kg; whereas in women ≥60 years, the average reduction of hand strength per decade ranged between 3–4 kg. Comparable to our results the average reduction of HGS per decade was 4–5 kg among men, and 3–6 kg among women.A study in Brazil (Amaral et al., 2019) indicated that the mean handgrip strength for men ≥ 60 ranged between 36.2 ± 8.1, and 25.7 ± 5.8 kg, and in women the mean value of the maximum hand grip ranged between 23 ± 5.5 and 17.1 ± 4.9 kg, convergent results were also found among the United States residents(Bohannon et al., 2019), findings that are a little higher than this study results.

Significant correlations were recorded in this study between the handgrip strength and HRQoL ($p < .05$), results which are in accordance with other studies (Chan et al., 2014; Fusco et al., 2012; Musalek, Christina et al., 2017), indicating that poor HGS has been shown to associate with several adverse health outcomes among older adults including functional impairment and HRQoL. Our results showed that relatively higher associations ranged between (r_s _.379 to −.503; $p < .001$) were recorded among women and men between the functioning variables of EQ-5D-5L and HGS compared to subjective-well being variables of the EQ-5D-5L(r_s _.224 to −.422; $p < .05$). Comparable results have been shown in similar studies indicating that the reduction in HRQoL is considerable in the physical functioning domain (Chung, Zhao, Liu, & Quach, 2017; Samuel, Rowe, Hood, & Nicol, 2012).This might be interpreted that self-care in terms of washing and dressing independently and the older person's ability to maintain usual activities *(e.g. work, housework, family or leisure activities*), are major dimensions of the functioning domain of EQ-5D-5L that might be influenced by the HGS. And the weakness of the HGS may cause activity restriction and reduced quality of life in older adults (Liu et al., 2017; McGrath et al., 2018; Sallinen et al., 2010).

Recent studies indicated that increased handgrip strength was associated with lower odds of depression, anxiety and hopelessness in older adults with correlations ranging from moderate to strong (Ashdown-Franks et al., 2019; Gordon, McDowell, Lyons, & Herring, 2019), a meta-analysis by Chang et.al found that sarcopenia was independently associated with depression (Chang, Hsu, Wu, Huang, & Han, 2017).Similar to this study's results, men recorded a significant correlation between the HGS and pain/discomfort, anxiety/depression dimensions of HRQoL (r_s _.269; $p = .036$ and r_s _.422; $p < .001$), and women recorded significant correlation between the HGS and pain/discomfort dimension (r_s _.224; $p = .016$). Further investigations are needed to address the subjective well-being

domain in term of mental health, financial resources, and other environmental and social aspects.

Limitations

The cross-sectional design of this study does not enable a true causal association to be ascertained. Though handgrip strength may affect HRQoL, it is also possible that reduced HRQoL may lead to lower handgrip strength. Further prospective and intervention studies are required to help the cause and effect relationship to be determined.

A possible limitation of this study could be that the participants were mostly independent, functioning, and community-dwelling older with a relatively young old mean age of sixty-eight years. Further studies are needed to address this association among older age cohorts and older adults living in institutions with a lower level of functioning and independence.

Conclusion

Handgrip strength is a simple and practical measure in identifying older adults at risk of physical decline. Preserving muscle strength estimated by the handgrip strength may contribute to better HRQoL among older adults. HRQoL was significantly associated with handgrip strength among women and men; a relatively higher association was recorded between the functioning variables of EQ-5D-5L and handgrip strength compared to subjective well-being variables. Further studies are needed to address the causal effect of this association.

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Declaration of interest statement

The author reports no conflicts of interest.

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