Original Article

Association between non-communicable diseases and physical activity level in older adults visiting primary health care centers in Jizan, Saudi Arabia

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ABSTRACT

الأهداف: لفحص العلاقة بين عدد الأمراض غير المعدية والنشاط البدني بين كبار السن الذين يراجعون مراكز الرعاية الصحية الأولية في مدينة جيزان.

المنهجية: تم إجراء دراسة مقطعية على كبار السن الذين تبلغ أعمارهم 60 عامًا أو أكثر المراجعين لمراكز الرعاية الصحية الأولية في مدينة جيزان بين يونيو وسبتمبر 2021م. حيث تم قياس عدد الأمراض الغير معديه من خلال السؤال عن 11 حالة مختلفة من الأمراض غير المعدية المبلغ عنها ذاتيًا وجمعها لإنتاج درجة واحدة، وتم حساب درجات النشاط البدني بناءً على مقياس النشاط البدني لكبار السن المبلغ عنه ذاتيًا أيضا. لفحص العلاقة بين عدد الأمراض غير المعدية والنشاط البدني لكبار السن تم استخدام نماذج الانحدار الخطي المتعدد.

النتائج: تم تضمين ما مجموعه 94 من كبار السن المشاركين في هذه الدراسة. كان هناك 62 رجلاً و32 امرأة. كان متوسط عمر عينة الدراسة 6.58 ± 67.29 سنة ومتوسط مقياس النشاط البدني لكبار السن27 ± 53.67 درجة. كما تم العثور على ارتباط سلبي ذو دلالة إحصائية بين عدد الأمراض غير المعدية والنشاط البدني لدى كبار السن.

الخلاصة: هناك ارتباط عكسي ذو دلالة إحصائية بين عدد الأمراض غير المعدية والنشاط البدني لدى كبار السن. كذلك وجدنا أن هناك ارتباط بين العمر و انخفاض النشاط البدني لدى كبار السن. نوصي بتعزيز دور النشاط البدني لكبار السن لمنع أو تقليل عدد الأمراض غير المعدية. كذلك يجب أن يركز البحث المستقبلي على دراسة ارتباط السبب والنتيجة لإثبات هذه العلاقة في مناطق عدة من المملكة العربية السعودية.

Objectives: To examine the association between the number of non-communicable diseases (NCDs) and physical activity (PA) in older adults visiting primary healthcare centers (PHCCs) in Jizan, Saudi Arabia.

Methods: This cross-sectional study was carried out on men and women aged ≥60 who visited PHCCs, Jizan City between June and September 2021. Eleven self-reported NCDs were identified and summed to produce a single score, and PA scores were calculated based on the self-reported PA Scale for the Elderly (PASE). Multiple linear regression models were used to examine the association between the number of NCDs and PA in the included population.

Results: In total, 94 participants were included in this study. Of these, 62 were men, and 32 were women. The mean age was 67.29±6.58 years, and the mean PASE score was 53.67±29.72. A significant negative association was found between the number of NCDs and PA, even after a fully adjusted analysis.

Conclusion: This study found a significant inverse association between the number of NCDs and PA in older adults. In addition, age was associated with lower PA, even among older adults. PA should be recommended to older adults to prevent or reduce the number of NCDs. Future research should focus on examining cause-and-effect associations at a national level.

Keywords: non-communicable disease, chronic disease, multimorbidity, aging, elderly, physical activity, primary health care

Saudi Med J 2023; Vol. 44 (6): 580-587
doi: 10.15537/smj.2023.44.6.20230076

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Received 31st January 2023. Accepted 11th May 2023.

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The global demographic shift towards a growing aging population is due to the increase in life expectancy and decline in fertility rates.[1] This change has led to a significant increase in people over 60 years, resulting in many challenges to the healthcare system. In Saudi Arabia, the elderly population is set to increase dramatically in the coming decades, with estimates suggesting a rise from 5.6% in 2017 to 22.9% by 2050.[2] As such, there is a need for effective healthcare systems to address the prevalence of chronic diseases and comorbidities that require continuous care, including diabetes, arthritis, cardiovascular diseases, and other aging-related conditions.[3]

Chronic or non-communicable diseases (NCDs) are the leading causes of morbidity and mortality globally.[4] They result in prolonged, slowly progressing consequences and can cause disability or early mortality, requiring long-term healthcare.[5] In Saudi Arabia, NCDs are responsible for almost 78% of annual deaths, with cardiovascular disorders, cancers, chronic respiratory diseases, and diabetes being the most prevalent.[6] With increasing prevalence, healthcare systems have a growing challenge to address the co-occurrence of multiple chronic conditions, termed "multimorbidity," associated with disability, higher mortality, and higher healthcare costs.[7] Recent studies suggest that physical inactivity and an unhealthy lifestyle with increasing age are the main risk factors leading to the rise in the prevalence of these NCDs in Saudi Arabia.[8,9]

Physical activity is critical in preventing many diseases and has a strong relationship with major NCDs. Regular physical activity is highly recommended as a public health priority for its effectiveness in the primary and secondary prevention of NCDs.[10] The World Health Organization (WHO) recommends that older adults with chronic diseases engage in regular aerobic physical activity of at least 150 to 300 minutes (min)of moderate intensity, at least 75 to 150 min of vigorous-intensity, or a combination of moderate and vigorous-intensity activity throughout the week for substantial health benefits.[10] Despite several studies examining the association between NCDs and physical activity globally, more research has yet to be conducted among older adults in Saudi Arabia.[11,12]

The primary aim of this study is to explore the association between the number of NCDs and physical activity among older adults visiting primary healthcare centers in Jizan City. The secondary aim is to investigate the association between aging and physical activity among older adults with NCD.

Disclosure. Authors have no conflict of interests, and the work was not supported or funded by any drug company.

Methods. This cross-sectional study was carried out in 5 PHCCs in Jizan City, Saudi Arabia, between June and September 2021. These PHCCs were randomly selected from all PHCCs in Jizan City using Excel software for Windows. PHCCs are considered the frontline of the health care system responsible for preventing, screening, and managing chronic NCDs across Saudi Arabia.[13] This study followed the STROBE guidelines for cross-sectional studies.

Patients were selected using a non-probability convenient sampling method based on whether they met the eligibility criteria. The inclusion criteria were: ≥60 years of age, visitation to the selected PHCCs for routine primary care services, diagnosis of at least one NCD, and ability to walk independently or with assistive devices (such as a walking stick or cane). The exclusion criteria were: severe hearing, speaking, or vision problems, a diagnosis of Alzheimer's disease, a history of acute stroke, or a cognitive disorder.

The study was carried out in accordance with the principles outlined in the Helsinki Declaration. The study protocol was approved by the Institutional Review Board at King Saud University, Riyadh, Saudi Arabia (approval number: E-21-5948) on August 2021. The Jazan Health Ethics Committee (approval number: 2137) representing the Ministry of Health (MOH) in Jizan, Saudi Arabia, granted approval on April 28, 2021.

The sample size was estimated using G* power software version 3.1.9.4, with medium conventional effect size (f2)=0.15, statistical power (beta [β])=0.85, and the level of significance (alpha [α])=0.05, for the multiple linear regression analysis.[14] The estimated sample size was 87 participants, which was adequate to detect an association between the number of NCDs and PA. However, to compensate for a possible missing data and to obtain an equal distribution of the participants from the 5 PHCCs, 23 participants were added to the estimated sample size. Therefore, the sample size was set to 110 participants.

Before conducting this study, permission to use PA Scale for the Elderly (PASE) was obtained from the original developer through e-mail. The data were collected through either self-reported or face-to-face interviews in the selected PHCCs using a questionnaire consisting of the participants' sociodemographic characteristics, the NCDs questionnaire, and the Arabic version of the PASE questionnaire, taking precautions

against COVID-19 as recommended by WHO and MOH (such as sanitizing, wearing masks, and social distance of 2 m apart). Once the participants accepted the invitation to participate in the study, they received a brief explanation. They provided written consent and questionnaires; however, if the participant was illiterate, informed consent and questionnaires were presented orally. The participants signed a consent form, and data collection commenced.

The PASE questionnaire is an easy and brief (5-15 min) measures self-reported PA over the preceding 7 days in older adults based on 3 domains (leisure-, household-, and work-related activities).[15] Leisure activities (walking, light sport, moderate sport, strenuous sport, and strength and endurance exercises) were scored according to the following 2 ordinal scales: i) frequency (average number of days per week) and ii)duration (average number of hours per day).[15,16] Household activities (light housework, heavy housework, home repairs, lawn care, gardening, and caring for others) and work-related activities were scored as 'yes' or 'no.' One point was awarded for every 'yes' answer to a particular activity, whereas a 'no' answer earned 0 points. Scale scores were computed from the weights and frequency values of all 12 items. The activity weight is multiplied by the activity frequency for each item. Then, the weighted time frequency was calculated for all 12 items to determine the overall PASE score. Scores ranged from 0 to 400 or more. The reliability and validity of the PASE have been determined for participants with an average age of >60 years. The Arabic version of the PASE was used because it is valid and reliable for evaluating and assessing the PA level in community-dwelling older adults in Saudi Arabia.[17] The continuous score is reported as a total of the accrued points within each of the 3 components, with a higher score indicating increased PA.

The NCDs variable was a self-reported diagnosis. Participants were asked whether a physician had ever diagnosed them or are currently treated for any of the following health conditions: heart disease, hypertension, stroke, diabetes mellitus, chronic respiratory diseases, asthma, osteoarthritis, rheumatoid arthritis, osteoporosis, chronic neurological diseases, chronic kidney diseases, or cancer. In addition, when the participants mentioned another chronic illness, it was recorded as other NCDs. The total number of NCDs was then summed to produce a single score, as performed previously by Marques et al (2018).[12]

Statistical analysis. All statistical analyses were performed using IBM Statistics version 26 for Windows (IBM Corp., Armonk, N.Y., USA). The sample was characterized by descriptive statistics (mean, standard deviation, and percentage). The PASE score was computed using its user manual to obtain a single score. However, the PASE score's upper and lower interquartile ranges (IRQ) were used to compare the participants' characteristics. The comparison between the upper and lower IQRs was tested using the chi-square test and independent-sample t-test.

Before performing the statistical analyses, the assumptions of multiple linear regression were tested, and all assumptions were met. Simple and multiple linear regression analyses (unadjusted and adjusted) examined the association between each aim's predictors and the outcome. Three models assessed the association between the number of NCDs and PA. The first model (unadjusted analysis) determined the association between PA (PASE score) as a dependent (outcome) variable and the number of NCDs as independent (predictor) variables. The second model was an adjusted analysis that included the first model, age (in years), gender (female versus [vs.] male), nationality (non-Saudi vs. Saudi), marital status (unmarried vs. married), educational level (illiterate or primary vs. high school or above), employment status (unemployed vs. retired or employed), and residence (rural or urban). The third model included variables in the second model, smoking (no vs. yes), and body mass index (body mass index [BMI]; kg/m^2).

Similarly, 3 models were also used to assess the association between aging and PA. The first model (unadjusted analysis) considered the association between PA (PASE score) as a dependent (outcome) variable and aging as an independent (predictor) variable. The second model was an adjusted analysis that included the variables in the first model, gender (female vs. male), nationality (non-Saudi vs. Saudi), marital status (unmarried vs. married), educational level (illiterate or primary vs. high school or above), employment status (unemployed vs. retired or employed), and residence (rural or urban). The third model included variables in the second model, smoking (no vs. yes), BMI (kg/m^2), and the number of NCDs.

Results. This study's participants were from 5 PHCCs in Jizan City. Their data were collected using questionnaires. Of the 110 questionnaire booklets, 16 were excluded; 6 did not meet the eligibility criteria, and 10 were rejected because there was a significant incidence of missing data (**Figure 1**).

Sociodemographic characteristics of the participants. Ninety-four older adults were included in this study. The mean age of 67.29 ± 6.58 years, two-thirds of

participants were male (n=62), the majority of whom were Saudi (86.2%), married (91.5%), and urban citizens (90.4%). The study revealed that the total sample had low physical activity, with a mean PASE score of 53.67±29.72 (IQR=32.7-78.6) and a higher mean body mass index (BMI) of 27.12±4.70 kg/m^2. Significant variations were observed between the IQR categories of PASE and age, marital status, education level, employment status, BMI, number of non-communicable diseases (NCDs), and PASE scores (p≤0.05; refer to Table 1 for details).

The proportion of the type of NCDs stratified by upper and lower IQRs of PASE score is presented in Table 2. Overall, among the NCDs, diabetes had the highest prevalence (73.4%), followed by hypertension (66%), osteoarthritis (14.9%), and heart disease (9.6%). The prevalence of other NCDs, such as osteoporosis, chronic respiratory disease, chronic neurological disease, chronic kidney disease, and stroke, varied from 1% to 6.4%. However, only hypertension was significantly associated with lower IQR of the PASE score.

Result of the primary aim of the study. The results of the linear regression analysis of the association between the number of NCDs and PA are presented in Table 3. Three models examined the association between the number of NCDs and PA. Model 1 was an unadjusted analysis that assessed only the PASE score as a dependent (outcome) variable and the number of NCDs as independent (predictor) variables. Model 2 was an adjusted analysis that included Model 1, age (in years), gender (female vs. male), nationality (non-Saudi vs. Saudi), marital status (unmarried vs. married), educational level (illiterate or primary vs. high school or above), employment status (unemployed vs. retired or employed), and residence (rural or urban). Model 3 included variables in Model 2 and the following health confounders: smoking (no vs. yes) and BMI (kg/m^2).

Unadjusted and adjusted analyses revealed a significant negative association between the number of NCDs and the PASE score. In Model 1, a significant inverse linear relation was observed when the PASE score was plotted with the number of NCDs (β=-12.10, standard error [SE]=3.56, p=0.00), indicating that each additional NCD may decrease the PASE score by 12.10 points. The R^2 was 0.11, indicating that the number of NCDs predicted 11% of the variance in the PASE score. This finding reveals a weak association (Cohen 1988).[18]

In Model 2, after adjusting for sociodemographic variables (age, gender, nationality, marital status, educational level, employment status, and residence area), the negative association between the PASE score and the number of NCDs decreased by 3.65 points; however, the association was still statistically significant.

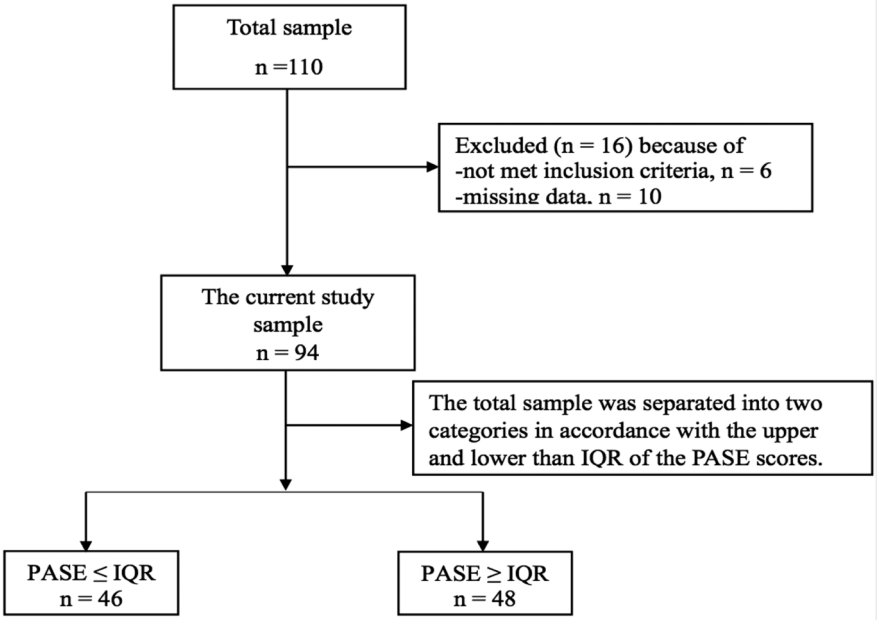

Figure 1 - The flow of the study participants. IQR: interquartile range, PASE: physical activity Scale for the Elderly

Table 1 - Participants' characteristics stratified by upper and lower interquartile ranges of the physical activity Scale for the Elderly scores

Characteristics	TOTAL N=94	PASE ≤IQR n=46	PASE ≥IQR n=48	*P*-value
Gender, n (%)				
Female	32 (34)	16 (34.8)	16 (33.3)	0.88[a]
Male	62 (66)	30 (65.2)	32 (66.7)	
Age (years), M±SD	67.29 ± 6.58	70.0±7.28	64.7±4.5	0.00[b]
Nationality, n (%)				
Saudi	81 (86.2)	39 (84.8)	42 (87.5)	0.7[a]
Non-Saudi	13 (13.8)	7 (15.2)	6 (12.5)	
Marital status, n (%)				
Married	86 (91.5)	39 (84.8)	47 (99)	0.02[a]
Unmarried	8 (8.5)	7 (15.2)	1 (1)	
Education, n (%)				
Illiterate or primary	55 (58.5)	33 (71.7)	22 (45.8)	0.01[a]
High school or above	39 (41.5)	13 (28.3)	26 (54.2)	
Employment status, n (%)				
Retired or employed	51 (54.3)	18 (39.1)	33 (68.7)	0.00[a]
Unemployed	43 (45.7)	28 (60.9)	15 (31.3)	
Residence, n (%)				
Urban	85 (90.4)	42 (91.3)	43 (98.5)	0.77[a]
Rural	9 (9.6)	4 (8.7)	5 (1.5)	
Smoking (yes),	29 (30.9)	13 (28.3)	16 (33.3)	0.59[a]
Total number of NCDs, M±SD	1.87 ± 0.81	2.15±0.81	1.6±0.73	0.00[b]
BMI (kg/m^2), M±SD	27.12 ± 4.70	28.2±5.23	26.09±3.92	0.00[b]
Obesity, n (%)	19 (20.2)	11 (23.9)	8 (16.6)	0.38[a]
Total PASE Score, M±SD	53.67±29.72	27.9±13.36	78.37±17.44	0.02[b]
Leisure-time activity, M±SD	12.62+12.54	8.66±5.08	16.41±16.02	0.00[b]
Household Activity, M±SD	41.05+27.49	19.23±14.29	61.95±19.68	0.00[b]

M: mean, SD: standard deviation, BMI: body mass index, IQR: interquartile range, NCD: non-communicable disease, PASE: physical activity Scale for the Elderly, a: tested using Chi-Square test, b: tested using t-test

Table 2 - The proportion of the type of non-communicable diseases stratified by upper and lower interquartile ranges of the PASE scores.

Non-communicable diseases	Total N=94	PASE ≤IQR n=46	PASE ≥IQR n=48	*P*-values
Heart disease	9 (9.6)	4 (8.7)	5 (10.4)	0.77 [a]
CVA/stroke	1 (1.1)	1 (2.2)	0 (0.0)	0.30 [a]
Hypertension	62 (66)	35 (76)	27 (56)	0.04 [a]
Diabetes mellitus	69 (73.4)	36 (78.3)	33 (68.7)	0.29 [a]
Chronic respiratory	5 (5.3)	2 (4.3)	3 (6.2)	0.68 [a]
Osteoarthritis	14 (14.9)	10 (21.7)	4 (8.3)	0.06 [a]
Rheumatoid arthritis	0 (0.0)	0 (0.0)	0 (0.0)	--
Osteoporosis	6 (6.4)	3 (6.5)	3 (6.2)	0.95 [a]
Chronic neurological	3 (3.2)	2 (4.3)	1 (2.0)	0.53 [a]
Chronic kidney disease	2 (2.1)	1 (2.0)	1 (2.0)	0.97 [a]
Cancers	0 (0.0)	0 (0.0)	0 (0.0)	--
Other NCD	6 (6.4)	5 (10.8)	1 (2.0)	0.08 [a]

Values are presented as number and percentages (%). CVA: cerebrovascular accident, NCD: non-communicable diseases, IQR: interquartile range, PASE: physical activity Scale for the Elderly, a: tested using Chi-Square test

In Model 3, after adjusting for smoking, BMI, and other variables in Model 2, the significant association between the number of NCDs and the PASE score remained. In Model 3, which contained all variables, the R^2 for the PASE score was 0.32, indicating a significant association. Age was the only variable significantly associated with lower PASE scores in Models 2 and 3.

Results of secondary aims of the study. The results of the linear regression analyses of the association between age and PA are presented in Table 4. Three

Table 3 - Linear regression analysis of the association between the number of non-communicable diseases and physical activity.

Characteristics	Model 1			Model 2			Model 3		
	Beta	SE	*P*-value	Beta	SE	*P*-value	Beta	SE	*P*-value
Constant	76.34	7.28	0.00	160.80	35.57	0.00	175.81	38.31	0.00
Number of NCDs	-12.10	3.56	0.00	-8.45	3.47	0.01	-8.08	3.64	0.02
Age (continuous)				-1.39	0.48	0.00	-1.56	0.5	0.00
Gender (female vs. male)				-11.57	6.96	0.10	-7.89	7.62	0.30
Nationality (non-Saudi vs. Saudi)				2.02	7.99	0.80	0.91	8.0	0.91
Marital status (unmarried vs. married)				4.27	10.25	0.67	5.87	10.39	0.57
Educational level (Illiterate or primary vs. high school or above)				4.10	7.35	0.57	3.3	7.44	0.65
Employment status (unemployed vs. retired or employed)				12.16	8.20	0.14	10.77	8.4	0.20
Residence (rural or urban)				-4.21	9.39	0.65	-3.7	9.57	0.69
Smoking (no vs. yes)							-7.45	6.78	0.27
BMI, (underweight-normal, overweight-obese)							-2.17	3.99	0.58
R^2			0.11			0.31			0.32

vs.: versus, SE: standard error, NCDs: non-communicable diseases, BMI: body mass index, R^2: R-squared

Table 4 - Linear Regression analysis of the association between age and physical activity.

Characteristics	Model 1			Model 2			Model 3		
	Beta	SE	*P*-value	Beta	SE	*P*-value	Beta	SE	*P*-value
Constant	192.82	28.28	0.00	151.34	36.36	0.00	175.81	38.31	0.00
Number of NCDs	-2.06	0.41	0.00	-1.60	0.49	0.00	-1.56	0.50	0.00
Age (continuous)				-12.15	7.16	0.09	-7.89	7.62	0.30
Gender (Female vs. male)				4.01	8.17	0.62	0.91	8.07	0.91
Nationality (non-Saudi vs. Saudi)				8.20	10.41	0.43	5.87	10.39	0.57
Marital status (Unmarried vs. married)				1.72	7.50	0.81	3.30	7.44	0.65
Educational level (Illiterate or primary vs. high school or above)				14.50	8.37	0.08	10.77	8.40	0.20
Employment status (Unemployed vs. retired or employed)				-0.99	9.56	0.91	-3.71	9.57	0.69
Residence (Rural or urban)							-7.45	6.78	0.27
Smoking (no vs. yes)							-8.08	3.64	0.02
BMI, (underweight-normal, overweight-obese)							-2.17	3.99	0.58
R^2			0.21			0.26			0.32

vs.: versus, SE: standard Error, NCDs: non-communicable diseases, BMI: body mass index, R^2: R-squared

models examined the association between the number of NCDs and PA.

The unadjusted and adjusted analyses revealed a significant negative association between age and the PASE score. In Model 1, a significant inverse linear relation was observed when the PASE score was plotted with age (β=-2.06, SE=0.41, *p*=0.00), indicating that each additional year may decrease the PASE score by 2.06. The R^2 was 0.21, indicating that 21% of the variance in the PASE score was predicted by age. This finding revealed a medium association.

In Model 2, after adjusting for sociodemographic variables (gender, nationality, marital status, educational level, employment status, and residence area), the negative association between age and the PASE score decreased but remained significant (β= -1.60, SE= 0.49, *p*=0.0). In Model 3, after adjusting for smoking, the number of NCDs, BMI, and other covariate variables in Model 2, the negative association between age and the PASE score also remained significant (β=-1.56, SE=0.50, *p*=0.00). In Model 3, which contained all variables, the R^2 for the PASE score was 0.32, indicating a significant association.

Discussion. This study examined the association between the number of NCDs and PA in older adults visiting PHCCs. This study found that the number of NCDs was inversely associated with the PASE score,

suggesting that the number of NCDs increased with decreasing PA. This finding is consistent with previous studies findings, supporting the well-documented negative association between the number of NCDs and PA.[12,17]

Ng et al[19] found that higher PA, measured using PASE, was significantly associated with fewer NCDs. Marques et al[12] also found that moderate and vigorous PA were negatively associated with the number of NCDs. The present study's findings were partially consistent with a recent literature review, which reported that regular moderate-to-vigorous physical activity (MVPA) is a critical factor in controlling weight and lowering the risk of obesity and related NCDs.[20] Additionally, Gomes et al[21] documented a positive association between multimorbidity and an insufficient PA only in women, suggesting gender differences. In contrast, this result was inconsistent with that of Fortin et al,[20] who found no association between PA and increased NCDs.

Certain methodological differences make it difficult to compare these studies, including the participants' characteristics (stratified by gender and age groups), number and type of chronic diseases, categorization of multimorbidity, and measures of PA. The association between the number of NCDs and PA can be bidirectional. Therefore, older adults with higher NCDs may be less physically active because of poor health. However, worse health conditions resulting from NCDs may restrict PA participation and lead to insufficient PA.[23]

The present study also revealed that age was inversely associated with PA in older adults with NCDs. This finding supports that individuals may spend less time engaging in PA as they grow older. is consistent with most previous studies. For example, a recent survey by Suryadinata et al[24] revealed that the geriatric group tended to have a poor PA level. In contrast, the younger adult group tended to have a high PA level.

This study has several strengths. First, this is the first study conducted to examine the association between the number of NCDs and PA in older adults visiting PHCCs in Jizan City. Second, using the PASE to measure PA in older adults is recommended as the best-suited self-report PA tool for older adults with multiple chronic diseases.[25] The Arabic-translated PASE questionnaire has been validated for assessing the Saudi population.[17] Therefore, the PASE was used in the present study to assess PA rather than an internationally standard measure, such as the International Physical Activity Questionnaire, which has limitations associated with its self-report format (people tend to overestimate their positions on the items). Third, this study followed the STROPE guidelines, mainly recommended for observational studies. Finally, when the number of NCDs was assessed, 11 defined types were included in the questionnaire to cover the most prevalent NCDs.

Study limitations. This study has several limitations that should be considered when interpreting the results. Firstly, the cross-sectional study design cannot establish causality, and therefore further research utilizing different study designs is required to confirm the relationship between the number of NCDs and the PA variables. Secondly, the PA and number of NCDs questionnaires were self-reported by the participants, which may have led to overestimation or underestimation due to recall bias. Objective measures of PA, such as accelerometers, would provide more accurate data. Thirdly, although the PASE has many strengths, it has some limitations regarding Minimally Clinically Important Differences and cut-off scores. Furthermore, PASE scores alone cannot predict healthy physical measures, and therefore other objective measures should be used to complement self-reported data.[17]

Based on the results of this study, we recommend that future research should include a larger sample of older adults from multiple healthcare institutions. Furthermore, longitudinal studies are needed to investigate the association between NCDs and PA further, considering the known benefits of PA. Experimental study designs should be utilized to implement interventional PA programs aimed at protecting and reducing the number of NCDs in older adults.

Our findings also indicate that older adults with higher NCDs visiting PHCCs had very low levels of PA. This observation serves as a call to action for policymakers and the Ministry of Health (MOH) in Saudi Arabia to integrate and enhance the role of physiotherapy in PHCCs, with a particular emphasis on promoting lifestyle changes that include regular PA.[26] By doing so, physiotherapists can play a significant and cost-effective role in the prevention, control, and management of NCDs. As a healthcare profession with a vital role in PA promotion, physiotherapists can prescribe structured exercises as part of a treatment or intervention program.

In conclusion, the results of this study demonstrate a strong inverse association between PA levels and the prevalence of NCDs in older adults visiting primary health care centers in Jizan City. Specifically, older adults who engaged in regular PA were found to have lower rates of NCDs than their less active peers. Furthermore, the findings suggest that advancing age is associated with decreased PA levels, particularly among

older adults. Given these results, it is recommended that healthcare professionals promote and prescribe PA as a preventative measure against NCDs in older adults. By doing so, the incidence and burden of NCDs in later life may be reduced. Additionally, further research is needed to explore the causal relationship between PA and NCD prevalence. Overall, the findings of this study provide valuable insights for healthcare providers seeking to improve the health outcomes of older adults in Jizan City and beyond.

Acknowledgment. *The authors gratefully acknowledge the King Salman Center for Disability Research for funding this work through Research Group no KSRG-2023-317. The authors also thank the Investigators Support Unit at Prince Naif Health Research Center (https://isuapp.ksu.edu.sa/) for the English language editing.*

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