International Journal of Community Medicine and Public Health
Valekar SS et al. Int J Community Med Public Health. 2023 May;10(5):1705-1714
http://www.ijcmph.com
pISSN 2394-6032 | eISSN 2394-6040

DOI: https://dx.doi.org/10.18203/2394-6040.ijcmph20231267

Original Research Article

Differential of physical activities and its association with hypertension and diabetes in Myanmar

Hla Hla Win[1]*, Aye Sandar Mon[2], Win Pa Sandar[3], Martin Rusnak[4], Poppy Walton[5], Anil Khrisna[6], Khin Hnin Swe[5], Jaap J. A. R. Koot[7]

[1]Rector, University of Public Health, Yangon, Myanmar
[2]Department of Biostatistics and Medical Demography, University of Public Health, Yangon, Myanmar
[3]Consultant, The SUNISEA Project, HelpAge International Myanmar, Yangon, Myanmar
[4]Faculty of Health Care and Social Work, Trnava University, Slovak Republic
[5]HelpAge International Myanmar, Yangon, Myanmar
[6]Center for Leadership in Global Health Equity, University of Global Health Equity (UGHE), Kigali, Rawanda
[7]Global Health Unit, Department of Health Sciences, University Medical Center Groningen, University of Groningen, the Netherlands

Received: 08 March 2023
Revised: 12 April 2023
Accepted: 13 April 2023

***Correspondence:**
Dr. Hla Hla Win,
E-mail: prof.hlahlawin@gmail.com

ABSTRACT

Background: Myanmar has been facing a high and growing burden of NCDs. Since regular physical activity has been recognized as one of the effective strategies in prevention and control of NCDs, promotion of physically active lifestyle might help in combatting a number of NCDs. This study was conducted to assess the sociodemographic differentials of physical activity and to identify the association between the insufficient physical activity and occurrence of hypertension and diabetes using data extracted from Myanmar STEP-2014-data.
Methods: This study was further data analysis on 2014 STEP survey and included (5791) 40-64-year-aged participants, a subsample of STEP survey. Binary logistic regression with clustered robust standard error method was applied to estimate the effect of insufficient physical activity on occurrence of hypertension and diabetes.
Results: The findings revealed that 17.5% [95%CI: 16.5%, 18.5%] of participants had the insufficient physical activity, 41.9% [95%CI: 40.6%, 43.2%] had raised blood pressure and 16.9% [95%CI: 15.9%, 17.9%] had raised blood glucose. After adjusting other covariates, the significant association between insufficient physical activity and raised blood pressure was not found; whereas insufficient physical activity was significantly contributed to occurrence of raised blood glucose.
Conclusions: The present study highlighted the importance of physical activity in occurrence of raised blood glucose. The proportions of insufficient physical activity, raised blood pressure and raised blood glucose were observed as a rising pattern with increasing in age. Community-based health promotion program targeted at promoting physically active lifestyle should be adapted to interventions that are appropriate to different age structures.

Keywords: Insufficient physical activity, Physical inactivity, Hypertension, Diabetes, 2014 Myanmar STEP survey

INTRODUCTION

Chronic, noncommunicable diseases (NCDs), such as heart disease, stroke, cancer, diabetes and chronic lung disease, are collectively responsible for almost 70% of all deaths worldwide. They are recognized as a major global challenge in the United Nation's 2030 Agenda for sustainable development. Low- and middle-income nations account for over three-quarters of all NCD mortality, as well as 82 percent of the 16 million individuals who died prematurely, or before reaching the age of 70.[1] Hypertension, one of the major causes of premature death, accounts for approximately 1.28 billion adults aged 30-79 years worldwide. Reducing the prevalence of hypertension by 33% between 2010 and 2030 is one of the global targets for NCDs.[2]

The global prevalence of type 2 diabetes is increasing rapidly due to changes in environmental factors which interact with individual genetic susceptibility to disease.[3] Between 2000 and 2030, the number of people with diabetes worldwide is predicted to be approximately doubled. Globally, the prevalence of diabetes for all age-groups was estimated to be 2.8% in 2000 and 4.4% in 2030. The total number of people with diabetes is expected to grow from 171 million in 2000 to 366 million in 2030.[4] Myanmar has also been facing a high and growing burden of NCDs. NCDs accounted for approximately 59% of total deaths in 2014, and the burden of NCDs increased to 68% in 2018. The proportional mortality for cardiovascular disease, and diabetes were 25%, and 4% respectively.[5]

A healthy diet, regular physical activity and maintaining a normal body weight are ways to prevent hypertension and diabetes.[2,6] Regular physical activity has been shown to prevent cardiovascular diseases, type 2 diabetes, some cancers, hypertension, obesity, and depression.[7] Several studies have firmly demonstrated the benefits of regular physical activity in preventing NCDs like diabetes mellitus and hypertension.[3,8-10] The American Heart Association (AHA) recommends that adults should get at least 150 minutes per week of moderate-intensity aerobic activity or 75 minutes per week of vigorous aerobic activity, or a combination of both, preferably spread throughout the week. In addition to this, they should get moderate-to-high-intensity-strengthening activity (such as resistance or weights) on at least 2 days per week.[11] Increased levels of physical inactivity adversely affect health systems, the environment, economic development, community well-being and quality of life. Globally, 1 in 4 adults does not achieve recommended levels of physical activity. If the world's population is more active, it can prevent the deaths of up to 5 million people annually.[12] Recent epidemiological evidence shows a consistent, temporal, and dose-dependent relationship between physical activity and the development of hypertension. Experimental evidence from intervention studies continues to support the link between physical activity and hypertension, as the beneficial effects of exercise on lowering on blood pressure.[8] Similarly, the large majority of studies consistently reported an inverse association between physical activity and diabetes risk.[3]

In Myanmar, there have been limited studies on physical activity and its association with hypertension and diabetes. Therefore, this study will be conducted with the aim of finding out distribution of modifiable risk factor (physical inactivity) among different population group and how much it contributes in occurrence of hypertension and diabetes among 40–64-year aged population of Myanmar. This information will be beneficial for policy intervention, establishment and implementation of suitable policy and initiatives for community-based intervention to combat NCD, specifically hypertension and diabetes.

METHODS

This study was further data analysis on 2014 STEP survey data. The 2014 Myanmar STEP survey was conducted as the national survey of diabetes and risk factors for non-communicable diseases in 2014 across the country using the survey methodology based on the WHO Step-wise approach to surveillance of noncommunicable disease (STEPS) methodology. Data were collected from September to December, 2014. The study population were persons aged 40 to 64 years of both sexes residing in both urban and rural areas of the country. This was sub-sample of the STEP survey data that included persons of 25 to 64 years of age. To get the analytical sample for this study, the sampling units were drawn from 2014 STEP survey, a population-based nationally representative survey, in which participants were selected using multistage sampling design. In the first stage, out of 330 townships, 52 were selected as primary sampling units (PSU) by probability proportionate to population size (PPS). The second stage was selection of wards and villages as secondary sampling units (SSU) by PPS resulting in 312 SSU due to six SSU drawn from each PSU. From each selected SSU, 30 households (HH) were selected by systematic random sampling. In the final stage, one eligible participant was recruited from each HH, totaling 9360 participants but the actual study included 8757 adults aged 25 to 64 years.[13] Since, in this study, age of the study units was restricted to 40 to 64 years, 5791 participants were included as analytical units.

Outcome variables

The primary outcome variable, insufficient physical activity, was treated as dichotomous variable: insufficient physical activity (not meeting WHO recommendations on physical activity for health), coded "1" and the activity meeting WHO recommendations on physical activity for health, coded "0". The two secondary outcome variables are occurrence of hypertension (raised blood pressure) and diabetes (raised blood glucose) and then both were considered dichotomous variables.

As the first objective of this study was to describe sociodemographic differentials of physical activities among 40-64-year aged population in Myanmar, the socio-economic differentials such as age, sex, marital status, education and employment status were considered independent variables for primary outcome. All were treated as categorical variables.

For occurrence of hypertension and diabetes, the insufficient physical activity was considered the main factor of interest while the socio-demographic characteristics such as age, sex, marital status, education and employment status, modifiable risk factors for NCD such as smoking, heavy alcohol drinking, inadequate fruits and vegetables consumption and central obesity were included as the covariates in the analysis. All covariates were considered the categorical variables in the analysis.

Operational definitions

The outcome variables (insufficient physical activity, hypertension and diabetes) are operationally defined based on the report on national survey of diabetes Mellitus and risk Factors for non-communicable diseases in Myanmar (2014), American Heart Association and American Diabetes Association respectively.[13-15]

Insufficient physical activity: doing less than 150 minutes of moderate physical activity per week, or equivalent (75 minutes of vigorous physical activity or an equivalent combination of moderate and vigorous physical activity achieving at least 600 MET-minutes)

MET is the ratio of a person's working metabolic rate relative to the resting metabolic rate.

Raised blood pressure or hypertension: having systolic blood pressure ≥140 mmHg and/or diastolic blood pressure ≥90 mmHg during the study, or currently on medication for raised blood pressure

Raised blood glucose or diabetes mellitus: raised fasting blood glucose (plasma-equivalent glucose value of capillary whole blood ≥7.0 mmol/L or 126 mg/dl) or raised 2-h blood glucose (plasma-equivalent glucose value of capillary whole blood ≥11.1 mmol/L or 200 mg/dl) or currently on medication for raised blood glucose

Modifiable risk factors

Smoking was considered when anyone currently smokes any tobacco products.

Heavy alcohol drinking was defined as having had more than 3 (for women) or 4 (for men) drinks in a single occasion at least one time over the past 30 days.

Inadequate consumption of fruits and vegetables was defined as is eating less than five servings of fruit and/or vegetable on average per day.

Central obesity was defined as having waist circumference (WC) >94 cm in men and >80 cm in women.

Data analysis

Data extraction, exploration and analysis were done by Stata 15.1. The sampling units of 40-64 years age and respective variables were extracted from STEP 1 (personal characteristics including behavioral risk), STEP 2 (physical measurements) and STEP 3 (biological measurements) files. The prevalence of outcome variables; presence of insufficient physical activity, occurrence of hypertension and diabetes, were mentioned together with 95% CI. The sociodemographic differentials of physical activity were described as frequency and percentage distribution of presence of insufficient physical activity by each level of sociodemographic characteristics. Binary logistic regression was applied to estimate the effect of insufficient physical activity on occurrence of hypertension and diabetes after adjusting other covariates. The effect estimate was presented as adjusted odds ratio (AOR) with 95% CI. Performing the binary logistic regression model, clustered robust standard error method was applied in estimation of standard error for remedial measure that compensates the biased standard error due to dependency of responses within same cluster. Moreover, assumption for multi-collinearity among independent variables was checked and there was no collinearity issue. After running the multivariable models, post logistic regression diagnostic tests; Hosmer-Lemeshow goodness of fit test for model fitness and link test for model specification error were conducted and then the analytical models passed those tests. The area under curve reflecting the prediction power of binary logistic regression model for raised blood pressure was 67% and that for raised blood glucose was 72%. All test statistics were treated as two-sided and level of significance was set at 5%.

RESULTS

In this study, the prevalence of insufficient physical activity, raised blood pressure, and raised blood glucose were mentioned for each age-sex stratum. Socio-economic differentials of insufficient physical activity were also described. The results from binary logistic regression (aOR with 95% CI) were highlighted to determine the contribution of insufficient physical activity to occurrence of raised blood pressure and raised blood glucose after adjusting other covariates.

The proportions of presence of insufficient physical activity, occurrence of raised blood pressure and occurrence of raised blood glucose according to the age-sex structure of the study participants were mentioned

together with 95% CI in Table 1. Among the study participants, 17.5% did not meet WHO recommendations on physical activity for health (i.e., insufficient physical activity), 41.9% had raised blood pressure and 16.9% had raised blood glucose. Comparing the distribution of proportions of three outcome variables by age-sex composition, those proportions were highest among 60-64-year aged men and women. The proportion of presence of insufficient physical activity among women was higher than men in every age structure. Moreover, the same pattern was observed for occurrence of raised blood pressure and raised blood glucose.

Table 1: Distribution of occurrence of insufficient physical activity, raised blood pressure and raised blood glucose according to age-sex structure.

Variables	Insufficient physical activity		Raised blood pressure		Raised blood glucose	
	N	% (95%CI)	N	% (95%CI)	N	% (95%CI)
Males						
Age groups (in years)						
40-44	400	11.3 (8.3, 14.8)	383	29.2 (24.7, 34.0)	373	11.3 (8.2, 14.9)
45-49	476	13.2 (10.3, 16.6)	452	32.5 (28.2, 37.1)	444	9.5 (6.9, 12.6)
50-54	406	13.1 (9.9, 16.7)	395	38.0 (33.2, 43.0)	389	12.1 (9.0, 15.7)
55-59	406	13.8 (10.6, 17.5)	392	40.6 (35.7, 45.6)	385	14.0 (10.7, 17.9)
60-64	339	18.0 (14.1, 22.5)	329	45.9 (40.4, 51.4)	322	19.6 (15.4, 24.3)
Females						
Age groups (in years)						
40-44	865	16.9 (14.4, 19.5)	846	35.8 (32.6, 39.2)	832	12.0 (9.9, 14.4)
45-49	828	16.2 (13.7, 18.9)	807	40.6 (37.2, 44.1)	801	15.7 (13.3, 18.4)
50-54	779	20.4 (17.6, 23.4)	760	45.3 (41.7, 48.9)	742	20.6 (17.7, 23.7)
55-59	710	20.8 (17.9, 24.0)	698	50.7 (46.9, 54.5)	687	20.8 (17.8, 24.0)
60-64	575	25.7 (22.2, 29.5)	564	54.4 (50.2, 58.6)	554	29.8 (26.0, 33.8)
Both genders						
Age groups (in years)						
40-44	1265	15.1 (13.1, 17.2)	1229	33.8 (31.1, 36.5)	1205	11.8 (10.0, 13.7)
45-49	1304	15.1 (13.2, 17.1)	1259	37.7 (35.0, 40.5)	1245	13.5 (11.6, 15.5)
50-54	1185	17.9 (15.7, 20.2)	1155	42.8 (39.9, 45.7)	1131	17.7 (15.5, 20.0)
55-59	1116	18.3 (16.1, 20.7)	1090	47.1 (44.1, 50.1)	1072	18.4 (16.1, 20.8)
60-64	914	22.9 (20.2, 25.7)	893	51.3 (48.0, 54.6)	876	26.0 (23.1, 29.1)
40-64	5784	17.5 (16.5, 18.5)	5626	41.9 (40.6, 43.2)	5529	16.9 (15.9, 17.9)

Table 2. Socio-demographic differentials of insufficient physical activity (not meeting WHO recommendations on physical activity for health) among 40-64 years aged study respondents.

Variables	Total freq.	N (%) for not meeting WHO recommendations	Binary Logistic Regression aOR (95% CI)
Age groups (in years)			
40-44	1265	191 (15.1)	1.00
45-49	1304	197 (15.1)	1.02 (0.84, 1.26)
50-54	1185	212 (17.9)	1.18 (0.93, 1.51)
55-59	1116	204 (18.3)	1.16 (0.92, 1.48)
60-64	914	209 (22.9)	1.45 (1.06, 1.96) *
Sex			
Male	2027	278 (13.7)	1.00
Female	3757	735 (19.6)	1.29 (1.05, 1.58) *
Marital status			
Never married	480	103 (21.5)	1.00
Currently married	4395	718 (16.3)	0.75 (0.61, 0.93) **
Others	908	192 (21.2)	0.91 (0.67, 1.23)
Education			

Continued.

Variables	Total freq.	N (%) for not meeting WHO recommendations	Binary Logistic Regression aOR (95% CI)
No formal schooling	1038	153 (14.7)	1.00
Primary education level	3415	578 (16.7)	1.21 (0.97, 1.51)
Secondary or higher level	1312	286 (21.8)	1.61 (1.15, 2.23) **
Occupation			
Non-government employed (Ref.)	318	28 (8.8)	1.00
Self employed	3372	466 (13.8)	1.62 (0.99, 2.64)
Government employed	242	55 (22.7)	2.36 (1.29, 4.32) **
Retired/Dependent/Unemployed	1851	464 (25.1)	2.91 (1.73, 4.88) ***

Table 3: Multivariable analysis for association between insufficient activity and raised blood pressure.

Variables	Total (N)	Raised blood pressure	
		Outcome %	Binary Logistic Regression (EnterMethod) aOR (95% CI)
Insufficient physical activity			
Not insufficient (Ref.)	4640	40.7	1.00
Insufficient	986	47.6	1.09 (0.93, 1.27)
Age groups			
40-44 (Ref.)	1229	33.8	1.00
45-49	1259	37.7	1.21 (1.05, 1.40) *
50-54	1155	42.8	1.44 (1.18, 1.76) ***
55-59	1090	47.1	1.80 (1.41, 2.30) ***
60-64	893	51.3	2.16 (1.78, 2.63) ***
Sex			
Male (Ref.)	1951	36.9	1.00
Female	3675	44.5	1.01 (0.89, 1.15)
Marital status			
Never married (Ref.)	467	38.5	1.00
Currently married	4271	41.6	1.13 (0.93, 1.37)
Others	887	44.6	1.11 (0.87, 1.42)
Education level			
No formal schooling (Ref.)	1009	41.0	1.00
Primary/Primary completed	3317	41.4	0.96 (0.78, 1.18)
Secondary or higher	1281	43.9	0.91 (0.71, 1.16)
Occupation			
Non-government employed (Ref.)	305	31.8	1.00
Self employed	3273	38.5	1.17 (0.84, 1.62)
Government employed	235	44.3	1.34 (0.88, 2.05)
Retired/Dependent/Unemployed	1812	49.3	1.39 (1.02, 1.89) *
Smoking and obesity (overweight & obesity)			
Non-obese & non-smoker (Ref.)	2861	35.9	1.00
Non-obese smoker	1077	30.6	0.77 (0.64, 0.92) *
Obese non-smoker	1517	59.1	2.03 (1.73, 2.39) ***
Obese smoker	147	54.4	1.56 (1.05, 2.33) *
Heavy alcohol consumption			
No (Ref.)	5418	41.7	1.00
Yes	208	46.2	1.89 (1.36, 2.64) ***
Inadequate fruits and vegetable consumption			
No (Ref.)	651	39.2	1.00
Yes	4964	42.3	1.17 (0.94, 1.46)
Central obesity			
No (Ref.)	3710	34.0	1.00
Yes	1890	56.6	1.55 (1.30, 1.86) ***

*p<0.05, ** p<0.01, *** p<0.001; Abbreviation: aOR = Adjusted odds ratio, CI = confidence interval.

Assessing soio-demographic differentials of insufficient physical activity, the distribution of proportion of Myanmar adults who did not meet WHO recommendation on physical activity for health was mentioned by age group, sex, marital status, educational level and occupational status of the respondents. The percentage of insufficient activity increased with increasing age and 22.9% of 60-64-year aged respondents had insufficient physical activity, contributing to highest proportion. Females had more percentage of insufficient physical activity compared with males. Moreover, the rising pattern of proportion of insufficient physical activity with increasing educational level was observed. Regarding the proportion of respondents who had insufficient physical activity by their occupational status, 25.1% of respondents who were in category of retired, dependent or unemployed had insufficient physical activity, accounting for the largest proportion while 8.8% of non-government employee had insufficient physical activity, resulting in smallest proportion (Table 2). The following factors: being 60-64-year-aged (reference- 40-44-year-aged), being female, currently married (reference- never married), having secondary or higher educational level (reference- no formal schooling), working in government employment and being retired/ unemployed (reference- non-government employed) were identified as the sociodemographic factors influencing occurrence of insufficient physical activity.

Table 3 revealed the results from multivariable analysis using binary logistic regression to assess the association between presence of insufficient physical activity and occurrence of raised blood pressure after adjusting other covariates. The covariates included in this model were age, sex, marital status, educational level, occupational status, smoking and obesity status, alcohol consumption, fruits and vegetable consumption and central obesity. Although the significant association between insufficient physical activity and occurrence of raised blood pressure was not observed, the proportion of raised blood pressure among participants having insufficient physical activity was higher compared with their respective counterpart (47.6% vs 40.7%). In addition, the statistically significant associations were observed between the outcome variable and age group, smoking and obesity, having habit of heavy alcohol consumption, and having central obesity. The 60-64-year aged participants had two times larger odds of occurrence of raised blood pressure than those in 40-44-year aged group. Comparing the non-obese and non-smoke participants, the odds of occurrence of raised blood pressure was significantly higher among obese non-smokers, and obese smokers but was lower in non-obese smokers. The study respondents who had habit of heavy alcohol consumption were more likely to have raised blood pressure than those without having such habit (aOR: 1.89, 95% CI: 1.36, 2.64).

Table 4: Multivariable analysis for association between insufficient activity and raised blood glucose.

Variables	Total (N)	Raised blood glucose	
		Outcome %	Binary Logistic Regression (Enter Method) aOR (95%CI)
Insufficient physical activity			
Not insufficient (Ref.)	4558	15.4	1.00
Insufficient	971	24.0	1.35 (1.10, 1.65) **
Age groups			
40-44 (Ref.)	1205	11.8	1.00
45-49	1245	13.5	1.17 (0.91, 1.49)
50-54	1131	17.7	1.51 (1.21, 1.88) ***
55-59	1072	18.4	1.57 (1.27, 1.94) ***
60-64	876	26.0	2.47 (1.92, 3.19) ***
Sex			
Male (Ref.)	1913	14.3	1.00
Female	3616	19.0	1.08 (0.85, 1.22)
Marital status			
Never married (Ref.)	997	14.4	1.00
Currently married	3258	15.8	1.17 (0.89, 1.53)
Others	1255	21.8	0.99 (0.74, 1.34)
Education level			
No formal schooling (Ref.)	460	15.2	1.00
Primary/Primary completed	4198	17.0	1.07 (0.82, 1.34)
Secondary or higher	870	17.5	1.32 (1.02, 1.71) *
Occupation			
Non-government employed (Ref.)	299	9.4	1.00
Self employed	3217	13.3	1.21 (0.77, 1.90)
Government employed	232	23.3	1.84 (1.08, 3.12) *

Continued.

Variables	Total	Raised blood glucose	
Retired/Dependent/Unemployed/	1780	23.9	1.70 (1.17, 2.47) **
Smoking and obesity (overweight & obesity)			
Non-obese & non-smoker (Ref.)	2820	14.7	1.00
Non-obese smoker	1052	7.4	0.52 (0.40, 0.67) ***
Obese non-smoker	1494	26.9	1.22 (1.03, 1.47) *
Obese smoker	145	23.5	1.04 (0.68,1.59)
Heavy alcohol consumption			
No (Ref.)	5325	16.2	1.00
Yes	204	17.0	1.70 (1.05, 2.80) *
Inadequate fruits and vegetable consumption			
No (Ref.)	633	17.2	1.00
Yes	4885	16.9	0.97 (0.71, 1.34)
Central obesity			
No (Ref.)	3645	11.3	1.00
Yes	1865	27.8	1.91 (1.55, 2.37) ***
Raised blood pressure			
No	3209	11.1	1.00
Yes	2301	24.9	1.91 (1.59, 2.29) ***

*p<0.05, ** p<0.01, *** p<0.001; Abbreviation: aOR = Adjusted odds ratio, CI = confidence interval.

The results from the binary logistic regression model which analyzed the association between insufficient physical activity and occurrence of raised blood glucose were mentioned in Table 4. After adjusting other covariates such as age, sex, marital status, educational level, occupation, smoking and obesity, habit of heavy alcohol consumption, inadequate fruit and vegetable consumption, presence of central obesity and occurrence of raised blood pressure, the participants who did not meet WHO recommendations on physical activity for health (insufficient physical activity) had higher odds of occurrence of raised blood glucose than those who met the recommendations (aOR: 1.35, 95% CI: 1.10, 1.65). The 60-64-year-aged participants had nearly three times more odds of having raised blood glucose than 40-44-year aged participants while those in 55-59-year aged group and 50-54-year aged group had nearly two times more odds of having raised blood glucose than those in 40-44-year aged group. The participants who were government employee and those who were retired/ dependent/ unemployed were more likely to have raised blood glucose than their reference group (non-government employee). Comparing non-obese and non-smoking participants, non-obese smokers were less likely to have raised blood glucose while obese non-smokers had significantly larger odds of occurrence of raised blood glucose. The participants who had habit of heavy alcohol consumption, those with central obesity, those having raised blood pressure were more likely to have raised blood glucose than their respective counterparts.

DISCUSSION

Physical active lifestyle has been globally recognized as one of the promising strategies in prevention and control of a number of NCDs and their metabolic risk factors such as obesity and increased blood cholesterol level. This study was conducted to assess the sociodemographic differentials of physical activity and to identify the association between the insufficient physical activity and occurrence of hypertension and diabetes using data extracted from Myanmar STEP-2014-data. In the current study, 17.5% of participants did not meet WHO recommendations on physical activity for health. This prevalence was similar to that of WHO estimate which mentioned the prevalence of physical inactivity among adults ranging from 11% to 24% across the world.[16]

However, the prevalence of physical inactivity among Nepalese residents was lower than that of the current study. These discrepancies may occur due to the difference in age composition of study participants. The age of participants in this study ranged from 40 to 64 years while age of participants in Nepal national survey varied from 15 to 69 years. The study findings revealed that higher prevalence of insufficient physical activity was significantly associated with older age (60 years and above), being a female, never been married, higher level of education, working in government employment and being retired/ unpaid work compared with their respective reference group. These findings were consistent with those of other international studies, exhibiting variations in presence of insufficient physical activity across the different sociodemographic strata. Myanmar adults aged 60 years and above were more likely to exhibit insufficient physical activity than the younger age groups; which is supported by the evidence from studies conducted in Sri Lanka and Nepal in which older adults were less likely to physically active compared with their younger counterparts.[17-19] It was observed that female participants had higher proportion of insufficient physical activity than males in every age group. A systematic review supported this result.[20] Health promotion

strategies targeted at promoting physically active lifestyle should be modified and adapted to account the physical activity differentials depending on different age-sex structures.

Educational level and occupational status, indicators for individual's socioeconomic status, were identified as the significant determinants for presence of insufficient physical activity. Similarly, in studies conducted in Sri Lanka and Nepal, people with higher educational level did not meet WHO recommendations on physical activity for health.[17-19] The possible explanation for this finding is people with higher educational level seems to be more involved in sedentary work leading to less work-related physical activity. The persons from retired, unemployed, dependent category were significantly higher prevalence of insufficient physical activity. This obviously indicated those persons had substantially low duration for work-related and transport-related physical activities. Therefore, health promotion packages targeted at people in age of retirement should include strategies for engaging in sufficient level of leisure-time physical activity.

In the present study, 41.9% and 16.9% of participants had raised blood pressure and blood glucose respectively. Comparing results from STEP survey conducting in Haryana, north India, the prevalence of hypertension was slightly higher (39.1% in Haryana) but that of diabetes was lower (21.3% in Haryana).[21] High prevalence of hypertension is alarming and calls for immediate and intensive public health action. Assessing the factors related to occurrence of hypertension and diabetes, the interaction effect of smoking and BMI was taken account into the multivariable models since that interaction effect has been well established in other studies.[22,23] In this study, significant association was not observed between insufficient physical activity and occurrence of hypertension although the prevalence of hypertension was higher in persons having practice of insufficient physical activity than their respective counterpart. Similarly, the findings from baseline assessment of CRONCAS cohort study reported there was no significant association between physical activity and hypertension.[24] However, the participants having insufficient physical activity had significantly larger odds of occurrence of raised blood glucose than those with sufficient physical activity. Physical activity favors lowering the risk of diabetes which has been well documented in other studies.[25,26] Reducing levels of physical activity resulting in increased prevalence of obesity leads to a rising trend of diabetes occurrence and hence community engagement in physical activity should be prioritized.

Regarding sociodemographic characteristics, age, education and occupation status were identified as the significant determinants for occurrence of diabetes; whereas only age was significantly associated with occurrence of hypertension. The current study expressed the increasing pattern of prevalence of hypertension and diabetes with aging in males and females as well as in overall study population. The 60-64-year-aged participants had the largest odds of hypertension and diabetes compared with younger age groups. The consistent findings were evident in studies conducted in Bangladesh, India, China and Peru.[21,24,26-28] Our study observed that unemployed or retired persons were more likely to have diabetes than currently working individuals. Moreover, the odds of developing diabetes was significantly higher among the person with higher educational level than those without formal schooling. These results were similar to those previously reported in developing countries such as Nepal and Bangladesh.[26,29] In the study conducted in Nepal, the comorbidity of hypertension and diabetes was substantively higher among more educated persons and in Bangladesh DHS survey, the chance of diabetes among individuals higher educational level became doubling compared with those having no formal schooling. The possible explanation might be the fact that higher educated individuals seem to fit in sedentary lifestyle resulting from physically inactive working environment, easy access to transportation leading to lesser walking activity and then risk of developing NCDs also rises.

Congruent with previous studies, the modifiable risk factors such as heavy alcohol consumption, smoking and obesity were observed as the significant factors associated with occurrence of hypertension and diabetes. In this study, heavy alcohol drinkers were determined as those with higher risk than non-heavy-drinkers with respect to likelihood of hypertension and diabetes. Moreover, compared with non-obese non-smokers, obese smokers as well as obese non-smokers had significantly larger odds of developing hypertension; whereas only obese non-smokers expressed significantly larger effect estimate for risk of developing diabetes. Unfortunately, non-obese smokers had lower risk of developing hypertension and diabetes than non-obese non-smokers. This result might occur due to the explanation that only daily current smokers were considered smoking in this study and hence might mask the effect of former smokers. A population-based study conducted in Germany reported that obese former smokers were more likely to have hypertension than normal-weight current smokers but likelihood of hypertension among normal-weight never smokers did not differ from normal-weight current smokers.[23] In addition, individuals having central obesity were more likely to develop hypertension as well as diabetes compared with those who did not have. Likewise, a study conducted in rural Uganda presented the significant positive association between central obesity and elevated plasma glucose.[30] These findings consistently indicate the important role of overweight/ obesity in occurrence of hypertension and diabetes and then call for the greater attention and extended action of the concerned organizations in prevention and control of NCDs for older people through lifestyle modification. Elevated blood pressure is one of the independent risk factors for DM, and many epidemiological studies have suggested that

hypertensive individuals had higher risk of developing diabetes than normotensive persons.[28,31,32] In the current study, hypertension was observed as an independent risk determinant for diabetes and the risk of developing diabetes was nearly twice among hypertensive individuals compared with normotensive persons. According to this finding, the suggestive actions are maintaining normal blood pressure among normotensive individuals through adoption of healthy lifestyle behaviors and controlling blood pressure in acceptable range among hypertensive patients through lifestyle modification as well as taking appropriate and regular treatment.

Strength and limitation

Highlighting the importance of physical activity in prevalence of hypertension and diabetes among 40-year and above aged Myanmar adults using the national representative data is the greatest strength of this study.

Nonetheless, the present study has some limitations. The cross-sectional nature restricts the ability to draw cause-effect relationships between the explanatory and outcome variables. Since the participants self-reported practice of behavioral risk factors including type and duration of physical activity, they may have elicited information bias. Moreover, the present study used the data from 2014 STEP survey, the prevalence of insufficient physical activity, hypertension and diabetes might be changed during these years. However, the factors related to presence of insufficient physical activity, occurrence of hypertension and diabetes might be the same.

CONCLUSION

The present study highlighted high prevalence of raised blood pressure. The proportions of insufficient physical activity, raised blood pressure and raised blood glucose were observed as a rising pattern with increasing in age. The proportion of insufficient physical activity among women was higher than men in every age structure. Moreover, the same pattern was observed for occurrence of raised blood pressure and raised blood glucose. After adjusting other covariates, the significant association between insufficient physical activity and raised blood pressure was not found; whereas insufficient physical activity was significantly contributed to occurrence of raised blood glucose. Community-based health promotion program targeted at promoting physically active lifestyle should be modified and adapted to account the physical activity differentials depending on different age-sex structures. Moreover, health promotion packages focusing people in age of retirement should include strategies for engaging in leisure-time physical activity such as physical exercise appropriate for that age group. Effective interventions for prevention and control of NCDs have to be well established for older people. Those interventions should emphasize on maintaining normal body weight via health promotion activities especially adoption of physically active lifestyle. Further nation-wide study assessing occurrence of raised blood pressure, raised blood glucose and their correlates should be conducted.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: Ethical approval was obtained from the Institutional Review Board of University of Public Health, Yangon, Myanmar

REFERENCES

1. World Health Organization (WHO). Noncommunicable diseases. Available at: https://www.who.int/health-topics/noncommunicable-diseases. Accessed on 6th March 2022.
2. World Health Organization (WHO). Hypertension Available at: https://www.who.int/news-room/fact-sheets/detail/hypertension. Accessed on 14 March 2022.
3. Gill JM, Cooper AR. Physical activity and prevention of type 2 diabetes mellitus. Sports Medicine. 2008;38(10):807-24.
4. Wild S, Roglic G, Green A, Sicree R, King H. Global prevalence of diabetes: estimates for the year 2000 and projections for 2030. Diabetes Care. 2004;27(5):1047-53.
5. World Health Organization (WHO). Noncommunicable diseases Myanmar 2018. Available at: https://www.who.int/nmh/countries/mmr_en.pdf. Accessed on 6 March 2022.
6. World Health Organization (WHO). Diabetes. Available at: https://www.who.int/news-room/fact-sheets/detail/diabetes. Accessed on 14th March 2022.
7. Sahebkar M, Heidarian Miri H, Noormohammadpour P, Tiyuri A, Pakzad R, Mansournia N, et al. Geographical Patterning of Physical Activity Prevalence in Iran: Spatial Analysis of 4 Pooled National Health Surveys Among 119,560 Adults. J Phys Act Health. 2019;16(12):1071-7.
8. Diaz KM, Shimbo D. Physical activity and the prevention of hypertension. Current hypertension reports. 2013;15(6):659-68.
9. Sternfeld B, Gabriel KP, Jiang S-F, Whitaker KM, Jacobs Jr DR, Quesenberry Jr CP, et al. Risk estimates for diabetes and hypertension with different physical activity methods. Medicine and science in sports and exercise. 2019;51(12):2498.
10. Zucatti ATN, de Paula TP, Viana LV, DallAgnol R, Cureau FV, Azevedo MJ, et al. Low Levels of Usual Physical Activity Are Associated with Higher 24 h Blood Pressure in Type 2 Diabetes Mellitus in a Cross-Sectional Study. J Diabetes Res. 2017;2017:6232674.
11. American Heart Association. Recommendations for Physical Activity in Adults and Kids. Available at: https://www.heart.org/en/healthy-living/fitness/fitness-basics/aha-recs-for-physical-activity-in-adults. Accessed on 13 March 2022.

12. World Health Organization (WHO). Physical activity. Available at: https://www.who.int/news-room/fact-sheets/detail/physical-activity. Accessed on 13 March 2022.
13. Latt TS, Zaw KK, Ko K. Report on National survey of diabetes mellitus and risk factors for non-communicable diseases in Myanmar. 2014. Available at: https://www.who.int/ncds/surveillance/steps/Myanmar_2014_STEPS_Report.pdf Accessed on 20 March 2022.
14. American Heart Association. High Blood Pressure. Available at: https://www.heart.org/en/health-topics/high-blood-pressure. Accessed on 20 March 2022.
15. American Diabetes Association. Diabetes: Understanding A1C: Diagnosis. Available at: https://www.diabetes.org/diabetes/a1c/diagnosis Accessed on 20 March 2022.
16. Frantz JM, Ngambare R. Physical activity and health promotion strategies among physiotherapists in Rwanda. African Health Sciences. 2013;13(1):17-23.
17. Karunanayake AL, Senaratne CD, Stathi A. A descriptive cross sectional study comparing barriers and determinants of physical activity of Sri Lankan middle aged and older adults. PloS One. 2020;15(5):e0232956.
18. Pedisic, Z, Shrestha N, Loprinzi PD, Mehata S, Mishra SR. Prevalence, patterns, and correlates of physical activity in Nepal: findings from a nationally representative study using the Global Physical Activity Questionnaire (GPAQ). BMC Public Health. 2019;19(1):864.
19. Wickramarachchi BI, Siop SJ, Perera B. Personal determinants for physical activity behavior of urban-dwelling older adults in Sri Lanka. Gerontology Geriatric Medicine. 2019;7:23337214211023684.
20. Koeneman MA, Verheijden MW, Chinapaw MJ, Hopman-Rock M. Determinants of physical activity and exercise in healthy older adults: a systematic review. The International Journal Behavioral Nutrition and Physical Activity. 2021;8:142.
21. Thakur JS, Jeet G, Nangia R, Singh D, Grover S, Lyngdoh T, et al. Non-communicable diseases risk factors and their determinants: A cross-sectional state-wide STEPS survey, Haryana, North India. PloS One. 2019;14(11):e0208872.
22. John U, Meyer C, Hanke M, Völzke H, Schumann A. Smoking status, obesity and hypertension in a general population sample: a cross-sectional study. QJM: Monthly Journal of the Association of Physicians. 2006;99(6):407-15.
23. Primatesta P, Falaschetti E, Gupta S, Marmot MG, Poulter NR. Association between smoking and blood pressure: evidence from the health survey for England. Hypertension (Dallas, Tex.: 1979). 2001;37(2):187-93.
24. Bernabé-Ortiz A, Carrillo-Larco RM, Gilman RH, Checkley W, Smeeth L, Miranda JJ. Cohort Study Group. Contribution of modifiable risk factors for hypertension and type-2 diabetes in Peruvian resource-limited settings. Journal of Epidemiology and Community Health. 2016;70(1):49-55.
25. Brugnara L, Murillo S, Novials A, Rojo-Martínez G, Soriguer F, Goday A, et al. Low Physical Activity and Its Association with Diabetes and Other Cardiovascular Risk Factors: A Nationwide, Population-Based Study. PloS One. 2016;11(8):e0160959.
26. Ali N, Akram R, Sheikh N, Sarker AR, Sultana M. Sex-specific prevalence, inequality and associated predictors of hypertension, diabetes, and comorbidity among Bangladeshi adults: results from a nationwide cross-sectional demographic and health survey. BMJ Open. 2019;9(9):e029364.
27. Mistry SK, Hossain MB, Parvez M, Gupta RD, Arora A. Prevalence and determinants of hypertension among urban slum dwellers in Bangladesh. BMC Public Health. 2022;22(1):2063.
28. Zhang H, Ni J, Yu C, Wu Y, Li J, Liu J, et al. Sex-based differences in diabetes prevalence and risk factors: a population-based cross-sectional study among low-income adults in China. Frontiers in Endocrinology. 2019; 10: 658.
29. Pandey AR, Karki KB, Mehata S, Aryal KK, Thapa P, Pandit A, et al. Prevalence and determinants of comorbid diabetes and hypertension in nepal: evidence from non communicable disease risk factors STEPS Survey Nepal 2013. Journal of Nepal Health Research Council. 2015;13(29):20-5.
30. Maher D, Waswa L, Baisley K, Karabarinde A, Unwin N, Grosskurth H. Distribution of hyperglycaemia and related cardiovascular disease risk factors in low-income countries: a cross-sectional population-based survey in rural Uganda. International Journal of Epidemiology. 2011;40(1):160-71.
31. Talukder A, Hossain MZ. Prevalence of Diabetes Mellitus and Its Associated Factors in Bangladesh: Application of Two-level Logistic Regression Model. Sci Rep. 2020;10:10237.
32. Endris T, Worede A, Asmelash D. Prevalence of Diabetes Mellitus, Prediabetes and Its Associated Factors in Dessie Town, Northeast Ethiopia: A Community-Based Study. Diabetes, metabolic syndrome and obesity: targets and therapy. 2019;12:2799-809.

Cite this article as: Win HH, Mon As, Sandar WP, Rusnak M, Walton P, Khrisna A, Differential of physical activities and its association with hypertension and diabetes in Myanmar. Int J Community Med Public Health 2023;10:1705-14.