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PHYSICAL ACTIVITY STATUS AND ITS ASSOCIATION WITH NON-COMMUNICABLE DISEASES AMONG ADULT POPULATION OF SOUTH PUNJAB

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ABSTRACT

Despite well-appreciated benefits of physical activity (PA), a huge number of people do not indulge in sufficient PA, which is a well-known risk factor of the leading non-communicable diseases (NCDs) such as hypertension, diabetes, hypertension, cardiovascular disease and cancer. The study aimed to assess PA status and its association with NCDs among adult population of south Punjab. The cross-sectional analytical study was conducted. A total of 385 adults of both genders, and residents of South Punjab were enrolled by cluster random sampling. The total of 385 participants, majority of the cases were very young (18 – 25) years and the median age was 24.0 years. The frequency of males was three times higher than females (77.1 % vs. 22.9 %). HTN was found in 4.9 % participants, DM in 7.5 %, hypercholesterolemia in 6.0 %, and CVD in 3.1 %. The frequency of individuals reporting work related PA of vigorous intensity was 22.9 %, work related PA of moderate intensity was 51.9 %, leisure time PA of vigorous-intensity was 21.6 %, leisure time PA of moderate intensity was 46.5 %, and travel related PA was 70.9 %. Gender male, urban residence, being married, no formal education, and being employed were significantly related with HTN. Similarly, being married, occupation homemaker, and travelling through personal car were significantly related with DM. Differently gender male, rural residence, being married, higher education, occupation homemaker, and smoking were significantly related with hypercholesterolemia. Furthermore, being married, occupation homemaker, and travelling through personal bike were significantly related with CVD. It was concluded that those having any kind of PA at work or during sports or even using bicycle or walk as activity had minimum chances of any NCDs like HTN, DM, CVD or hypercholesterolemia and being physically active also causes to avoid obesity, which is base for many NCDs.

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Key Words: Physical Activity, Non-Communicable Diseases (NCDs), Adult, HTN, DM, CVD

INTRODUCTION

Physical activity (PA) is defined as any movement of body by the skeletal muscles that results in energy expenditure, one of the important requisites to appreciate good health and quality of life (QoL) (Sinha, 2020). One of the best things a person can do for their health is PA. It is essential for good ageing, can lighten the load of chronic illnesses, and can delay the onset of early mortality. The World Health Organization (WHO) recommends PA for adults > 150 minutes of activity of moderate-intensity or > 75 minutes of activity of vigorous-intensity or an equivalent combination of activity of moderate-to-vigorous intensity aerobic PA all over the week. This recommended minimum time of PA can be distributed into thirty minutes a day and five days a week (Sinha, 2020). Some examples of PA are as follows: housework, walking, running, cycling, swimming, outdoor games and dancing. All these types of PA are beneficial to health if performed regularly with adequate duration and intensity (PHE, 2016).

Based on absolute rates of energy expenditure, the intensity of PA is classified into light, moderate or vigorous. Energy expenditure of activity is stated by multiples of the metabolic equivalent of task (MET). The rate of energy expenditure while sitting at rest equals to one MET (Piercy et al., 2018). The MET value ranges between 3 and 5.9 for PA of moderate-intensity. The MET value of 6 or more for PA of vigorous intensity (Wellman et al., 2020). The examples of aerobic PA of moderate-intensity include brisk walking, jogging, cycling, swimming, and dancing (PHE, 2016). Any PA of vigorous-intensity involves higher amount of energy so the individual would not be able talk without getting out of breath. The examples of aerobic PA of vigorous-intensity include jogging, running, rope jumping, hiking, fast swimming, aerobic dancing, and heavy yard work (MacIntosh et al., 2021). Older adults should perform PA three or more days a week to increase balance and to prevent falls (Sinha, 2020).

The WHO has developed a number of surveillance systems and PA surveillance to support countries with the routine collection of NCD risk factor data among both adults and youth. The surveillance of PA in populations using a standard procedure is an essential part of a public health response addressing sedentary lifestyle in many populations. Objective measurement techniques and questionnaires are utilized for PA surveillance. However, questionnaires being relatively cheap and easy to administer are used more frequently than objective measurement techniques for PA surveillance. Where needed and available, objective PA measurement is advised (WHO, 2022). PA has demonstrated the health benefits and physical inactivity has shown the negative effects on health. For these reasons, PA has emerged as an intervention tool. However, research employing a valid and reliable measure; and effectively satisfying the research question are some challenges. The doubly labeled water (DLW) is the gold standard method to assess total energy expenditure. However, it is not frequently used in research because it is an expensive and time-intensive method that cannot cover qualitative data (Sylvia et al., 2014).

A number of methods including self-report questionnaires and devices such as accelerometers and pedometers are used for the assessment of PA. Self-report

questionnaires are the most frequently used for PA measurements and rely on recall ability of the participants. These questionnaires vary in terms of measure (mode, duration or frequency), data type (activity score, time or calories), data quality (intensity measures, distinguishing between habitual and merely recent activity) and data assessment (printed or computerized proforma).

In 2002, the WHO developed the GPAQ for PA surveillance. Since its development, the GPAQ has gone through a research programme demonstrating that the GPAQ is a valid, reliable and adaptable tool for PA surveillance. The GPAQ, mainly through the WHO STEPS, has been used in more than one hundred countries. The GPAQ evaluates three PA domains including occupational PA, transport-related PA and leisure time PA. Show cards for each PA domain including vigorous and moderate PA at work, vigorous and moderate activity during leisure time and sitting, and transport activity are developed to help the respondents when the GPAQ is administered (WHO, 2022). The GPAQ comprises of 16 questions grouped to evaluate three PA domains including occupational PA, transport-related PA and leisure time PA.

The urbanization, industrialization, modern transportation, sedentary jobs, air pollution, and lack of spaces are common reasons for insufficient PA (Habib et al., 2022). Insufficient PA or being physically inactive is a well-known risk factor of the leading NCDs such as depression, DM, HTN, CVD and cancer (Liu et al., 2022). The reduction in premature deaths from NCDs is an important SDG target to be attained by 2030 (Thakur et al., 2021). The GPAQ developed for the surveillance of PA has been used in many countries. However, the review of literature revealed that the utilization of the GPAQ is very low in studies from Pakistan. Most of the available studies assessed PA level in students, labourers or patients. The evidence was still lacking in general population of Pakistan particularly of South Punjab. Therefore, the study aimed to assess PA status and its association with NCDs among adult population of south Punjab in order to prevent or delay the incidence of NCDs and to improve the physical as well as mental health of local population. The aim of this study is to determine the PA status among adult population of South Punjab and also to find the association between physical activity status and NCDs among adult population of South Punjab.

MATERIALS AND METHODS

METHODS

In this chapter, I will describe the method used in each study. I will discuss the questionnaires used for gathered the information from the participants. The pilot study, study participants, sample size calculation, study measures, study procedure, and data analysis.

STUDY DESIGN

I used a cross-sectional research design to measure the relationship between PA and Non-communicable Diseases (NCDs) among adults population of South Punjab. Prior to data collection the Advance Studies Review Board (ASRB) of the Islamia University of Bahawalpur approved the study.

In this study, all participants were recruited through Cluster random sampling. Adults

aged between 18 to 80 years who took part in various PA were invited to participate in the study. Participants consisted of those who took part in various sports and non-competitive PA. They were recruited from sports clubs, fitness centres, and recreational parks and Dring stadium of Bahawalpur in South Punjab. The personal information of the participants was and will only be used for the study analysis, and no identification was collected.

STUDY POPULATION

A total of 385 Pakistani adults (77.1 % males, and 22.9 females) participated in the study. They were aged between 18 to 80 years and took part in various PA including sports and non-competitive PA such as gym exercise, swimming, jogging, walking, and exercise. They were recruited from various sports clubs and recreational parks in South Punjab.

INCLUSION CRITERIA OF THE PARTICIPANTS

- Adults of age 18 to 80 years
- Both male and female subjects
- Permanent residents of South Punjab
- Living in urban or rural areas of South Punjab
- Minimally physically active

EXCLUSION CRITERIA OF THE PARTICIPANTS

- Any disability which can cause ineligibility to perform any PA
- Individuals with missing data
- Individuals failed to give consent form

SAMPLE SIZE

The sample size of 385 was estimated by using 95% confidence level, 5% margin of error with expected frequency of physically active people in South Punjab as 50.0% (conservative approach). Sample Size 2.0 calculator was used to calculate the sample size, screenshot of calculation attached.

Formula:

$$n = Z^2_{1-\alpha/2} * \frac{P(1-P)}{d^2}$$

Where

n = Sample size

$Z_{\alpha/2}$ = Critical value of the normal distribution = 1.96 for 95% Cl

P = expected proportion of physically active people = 50%

d = Margin of error = 5%

SAMPLING TECHNIQUE

From the districts of South Punjab, 19 union councils were selected at random by using lottery method. One cluster was selected at random from each union council and 20 or 21 person meeting inclusion and exclusion criteria from each cluster were interviewed

with structured questionnaire.

GLOBAL PHYSICAL ACTIVITY QUESTIONNAIRE

The WHO developed the global physical activity questionnaire (GPAQ) for the surveillance of PA. The GPAQ is a valid and reliable tool, which has been used in more than hundred countries. It covers various components of PA such as intensity, duration and frequency. It assesses three domains of PA including occupational PA, transport-related PA and leisure time PA.

PILOT STUDY

In this pilot study, a total of 20 adults completed the including age, gender, socio demographic factors like residential status, marital status, and educational status, family history of HTN, DM, CVD and obesity were collected from the participants through a structured questionnaire. The participants were asked to comment on difficulties they experienced in completing the questionnaires and to give suggestions in conducting assessments during the main study. The participants were not found any mistake in the questionnaire and recommended for the main study.

DATA COLLECTION PROCEDURE

The approval of the study was sought from the Advance Studies Review Board, the Islamia University of Bahawalpur. Data including age, gender, sociodemographic factors like residential status, marital status, and educational status, family history of HTN, DM, CVD and obesity were collected from the participants through a structured questionnaire. The participants were tested for HTN, DM, CVD and hypercholesterolemia and BMI was measured. The PA of all participants was measured through GPAQ.

DATA ANALYSIS PROCEDURE

Statistical Package for Social Sciences (SPSS) version 25 was used for entry and analysis of data. Data for age, BMI, and time spent on different physical activities were described by using mean±SD and median (IQR). The data for gender, family histories of various diseases, disease status of HTN, DM, CVD and hypercholesterolemia, residential, martial, educational and PA status were described by using frequency and percentages. MET were calculated for overall PA per week and WHO criteria was used to distribute them among three categories, low activity (MET < 600), moderate activity ($600 \leq$ MET <3000) and vigorous activity (MET ≥ 3000). Association of NCD with PA were tested by using chi-square, likelihood ratio and fisher exact test.

RESULTS

Body mass index

The body structure of the participants was also evaluated through BMI. The minimum BMI was 17 kg/m^2 and the maximum was $34kg/m^2$. The mean BMI was 24.5±4.0 and the median BMI was 23.8(21.9 – 27.7) (Figure 1).

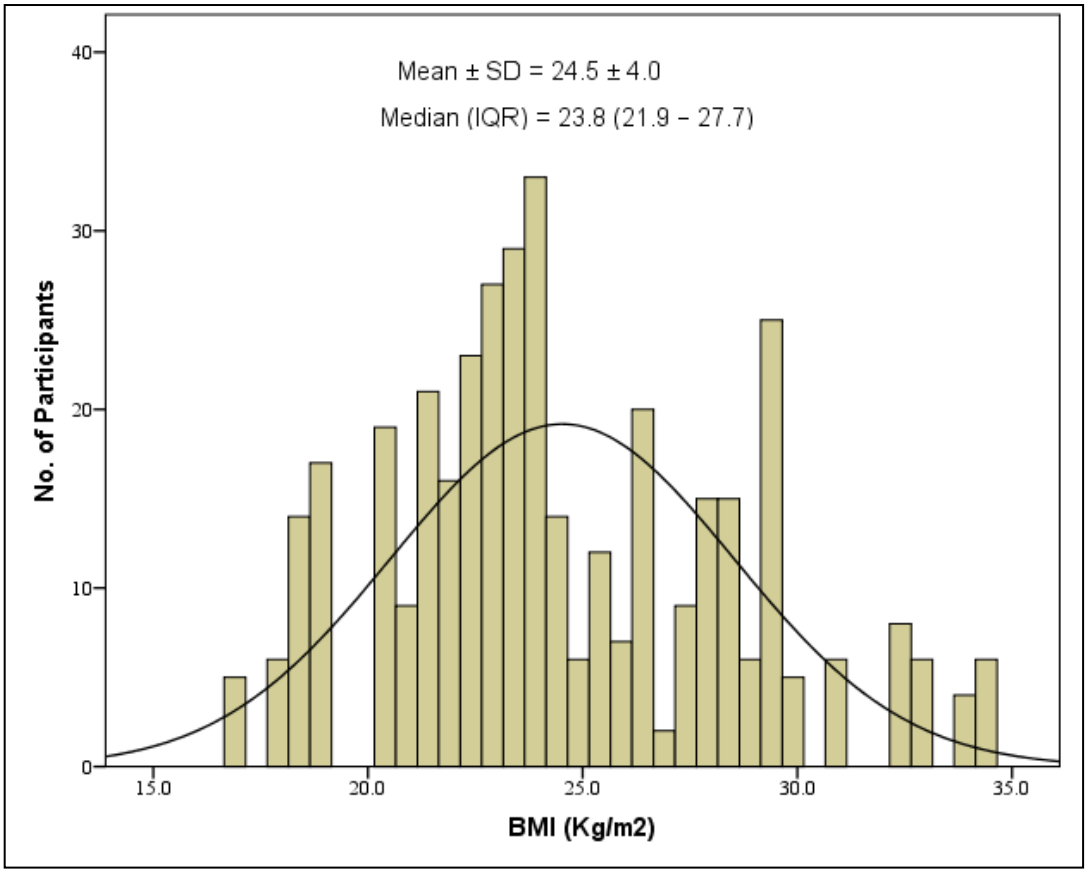

Figure 1 BMI of the study participants

FAMILY HISTORY OF NCDS

They were also asked for the history of these NCDs and it was noted that 46(11.9%) had family history of HTN, while DM was found in families of 197(51.2%) of the participants. Obesity was also quite common, i.e. 42.1% of the families had obesity in their families while 106(27.5%) had history of CVD (Table 1).

Table 1: ***History of NCDs***

		n	**%**
HTN	Yes	46	11.9
	No	339	88.1
Diabetic	Yes	197	51.2
	No	188	48.8
CVD	Yes	106	27.5
	No	279	72.5
Obesity	Yes	162	42.1
	No	223	57.9

SEDENTARY BEHAVIOR

The average time spent during a typical day by sitting or reclining was 435.5±121.6 minutes or 7.3±2.0 hours. The median time was 450.0(360.0 – 480.0) minutes or 7.5(6.0 – 8.0) hours. So 75.0% of them were spending their time by sitting or reclining for 6.0 or more hours a day and 25.0% were spending even more than 8.0 hours a day. Six to ten hours a day was the time spent while sitting or reclining for majority of the study participants (Figure 2).

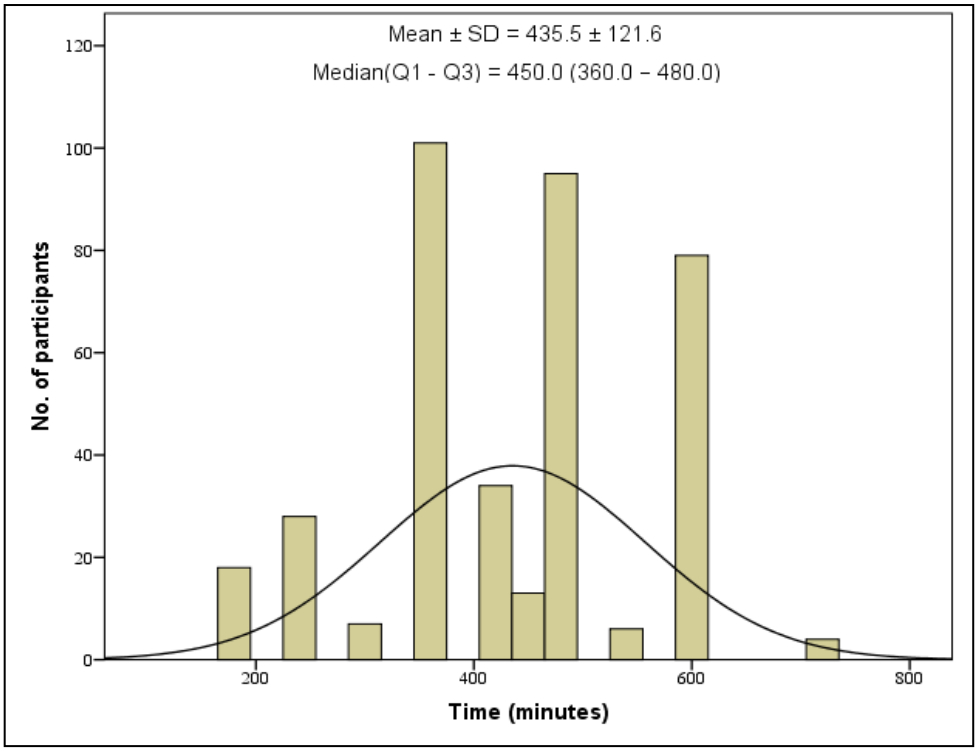

Figure 2: Sedentary behavior of the participants in terms of time spent on reclining on a typical day

BMI and PA

Finally, the association of BMI was also studied with family histories of all NCDs under observation also with PA. Those having family history of HTN had 45.7% of overweight but none in obese category as compared to those with no history who had 28.3% overweight and 10.3% obese. This difference was significant with p-value 0.002. Those who had family history of DM had 35.0% were overweight and 13.7% were obese as compared to those having no history had 25.5% overweight and 4.3% obese, and this difference was also significant with p-value <0.001. The rate of overweight and obese cases were 38.7% and 9.4% among those with family history of CVD and in comparison were 27.2% and 9.0 % were overweight and obese respectively and this association was just insignificant with p-value 0.077. Those with family history of obesity had 49.4% overweight and 19.8% obese as compared to those who had no history had 16.6% and 1.3% respectively. Those having activities of vigorous intensity at work had 11.4% overweight but no obese case, while the comparative group had 36.0% overweight and 11.8% obese. Those having activities of moderate intense at work had no obese and 15.5% of overweight and in comparative group these were 18.9% and 46.5% respectively. Those who were having bicycle or

walk as a mean to go to office had 22.7% overweight and 2.2% obese and comparative group had 49.1% overweight and 25.9% obese and difference was highly significant with p-value <0.001. Those having vigorous intensity sports had 88.0% of cases in normal weight while only 12.0% overweight and comparative group had 35.4% overweight and 11.6% obese. Finally those with moderate sports activities had 20.7% overweight and no obese and the comparative group had more than 55.0% cases were either overweight or obese (Table 2).

Table 2: ***Association of BMI with family history of obesity, NCDs and PA status***

		BMI								
		≤ 24.9 Normal		25.0 - 29.9 Overweight		30.0+ Obese		Total		P-value
		n	%	n	%	n	%	n	%	
Family history of Hypertension	Yes	25	54.3	21	45.7	0	0.0	46	100.0	0.002
	No	208	61.4	96	28.3	35	10.3	339	100.0	
Family history of Diabetes	Yes	101	51.3	69	35.0	27	13.7	197	100.0	<0.001
	No	132	70.2	48	25.5	8	4.3	188	100.0	
Family history of CVD	Yes	55	51.9	41	38.7	10	9.4	106	100.0	0.077
	No	178	63.8	76	27.2	25	9.0	279	100.0	
Family history of Obesity	Yes	50	30.9	80	49.4	32	19.8	162	100.0	<0.001
	No	183	82.1	37	16.6	3	1.3	223	100.0	
Work involve vigorous-intensity activity	Yes	78	88.6	10	11.4	0	0.0	88	100.0	<0.001
	No	155	52.2	107	36.0	35	11.8	297	100.0	
Work involve moderate-intensity activity	Yes	169	84.5	31	15.5	0	0.0	200	100.0	<0.001
	No	64	34.6	86	46.5	35	18.9	185	100.0	
Walk or use a bicycle (pedal cycle) for at least 10 minutes continuously to get to and from places	Yes	205	75.1	62	22.7	6	2.2	273	100.0	<0.001
	No	28	25.0	55	49.1	29	25.9	112	100.0	

Vigorous-intensity sports, fitness or recreational (leisure) activities	Yes	73	88.0	10	12.0	0	0.0	83	100.0	<0.001
	No	160	53.0	107	35.4	35	11.6	302	100.0	
Moderate-intensity sports, fitness or recreational (leisure) activities	Yes	142	79.3	37	20.7	0	0.0	179	100.0	<0.001
	No	91	44.2	80	38.8	35	17.0	206	100.0	

Association of NCDs with PA in terms of MET

When the physical activity status after conversion into MET was tested with non-communicable diseases, it was observed that all four diseases and Obesity had highly significant association with MET with p-values <0.001. There was not a single case of HTN, DM, hypercholesterolemia and CVD among 157 participants having vigorous activity status, also 90.4% had normal BMI and remaining 9.6% were falling in overweight category. Among 128 cases with moderate activity status, 6(4.7%) had HTN, 10(7.8%) had DM, 6(4.7%) had hypercholesterolemia and none of them had CVD. There was again none of these cases falling in category of obese cases with BMI ≥ 30 kg/m^2. However a significant number, i.e. 61(47.7%) of them, were overweight and remaining had normal BMI. All obese cases were falling among those with low level or no physical activity (35.0%) of low or no PA, and only 24.0% of them had normal BMI. In addition, there were 13.0% among them with HTN, 19.0% with DM, 17.0% with hypercholesterolemia and 12.0% with CVD (Table 3).

Table 3: ***Relation of PA in terms of MET with NCDs***

		MET							
		Low (n = 100)		**Moderate (n = 128)**		**Vigorous (n = 157)**		**Total (n = 385)**	
		n	**%**	**n**	**%**	**n**	**%**	**n**	**%**
HTN	Yes	13	13.0	6	4.7	0	0.0	19	4.9
	No	87	87.0	122	95.3	157	100.0	366	95.1

Likelihood ratio = 25.67 P-value < 0.001									
DM	Yes	19	19.0	10	7.8	0	0.0	29	7.5
	No	81	81.0	118	92.2	157	100.0	356	92.5
Chi-square = 31.68 P-value < 0.001									
Hypercholesterolemia	Yes	17	17.0	6	4.7	0	0.0	23	6.0
	No	83	83.0	122	95.3	157	100.0	362	94.0
Chi-square = 32.00 P-value < 0.001									
CVD	Yes	12	12.0	0	0.0	0	0.0	12	3.1
	No	88	88.0	128	100.0	157	100.0	373	96.9
Likelihood ratio = 33.48 P-value < 0.001									
BMI	< 25.0	24	24.0	67	52.3	142	90.4	233	60.5
	25.0 - 29.9	41	41.0	61	47.7	15	9.6	117	30.4
	≥ 30.0	35	35.0	0	0.0	0	0.0	35	9.1
Chi-square = 185.12 P-value < 0.001									

DISCUSSION

NCDs are global health threat and PA can play a role in preventing, treating and managing a range of chronic diseases that progressively affect the QoL and physical working of people worldwide (Thornton et al, 2016). PA has a significant impact on academic achievement, social harmony and mental health among children and adolescents. PA improves physical as well as mental health and prolongs the healthier lives among adult people. Though ample research work has been done worldwide,

however there is still a lacking of related work from Pakistan regarding different aspects of PA (Habib et al., 2022). The GPAQ developed for the surveillance of PA has been used in many countries. However, the utilization of the GPAQ was very low in studies from Pakistan. Most of the available studies assessed the level of PA using the GPAQ in students, labourers or patients. The evidence was still lacking in general population of Pakistan particularly of South Punjab. Therefore, the study aimed to assess PA status and its association with NCDs among adult population of south Punjab. In the present study, the lower prevalence of adequate PA and higher prevalence of NCDs suggested a significant relationship of insufficient PA with NCDs including DM, HTN, hypercholesterolemia and CVD. These findings are in agreement with other studies that physical inactivity is a major risk factor of NCDs and adequate PA can decrease their incidence.

In the present study, HTN was found in 4.9 % participants, DM in 7.5 %, hypercholesterolemia in 6.0 %, and CVD in 3.1 %. Similarly, the overall prevalence of IHD was 14.0 %, which included 12.3 % in males and 15.6 % in females (Pengpid et al., 2022). The prevalence of HTN was 41.5 %, DM was 11.2 %, and dyslipidemia was 32.5 %; and The prevalence of HTN, DM and dyslipidemia were markedly different between education levels, occupation, marital status, cigarette smoking, alcohol drinking, central and general obesity (all $p < 0.05$) in Chinese adults (Qiu et al., 2021). The prevalence of DM was 23.3 %, HTN was 42.2 %, hypercholesterolemia was 35.6 %, overweight/ obesity was 58.4 %, and current smoking was 17.5 % among Malaysian older adults (Chan et al., 2021). The frequency of overweight/ obesity was 75.6 %, alcohol consumption was 74.8 %, low consumption of fruits and vegetables was 51.7 %, physical inactivity was 36.3 %, and smoking was 27.9 % among Chilean adults (Aburto et al., 2021). The frequency of overweight was 33.6 %, and obese was 35.7 %. The frequency of 10-year CVD risk 10.1 % in obese and 9.5 % in overweight subjects was markedly higher than 6.3 % in normal weight people ($p < 0.001$) in American adults (Zhang et al., 2020). The prevalence of HTN 27.5 % in physically inactive individuals was significantly greater than 21.4 % in physically active individuals (p 0.04) (Rissardi et al., 2018).

In the present study, gender male, urban residence, being married, no formal education, and being employed were significantly related with HTN. Similarly, being married, occupation homemaker, and travelling through personal car were significantly related with DM. Differently gender male, rural residence, being married, higher education, occupation homemaker, and smoking were significantly related with hypercholesterolemia. Furthermore, being married, occupation homemaker, and travelling through personal bike were significantly related with CVD. Similarly, age groups 45 – 59 years (OR = 2.77) and ≥ 60 years (OR = 6.94) revealed higher risk of HTN; and age groups 45 – 59 years (OR = 2.35) and ≥ 60 years (OR = 3.52) revealed higher risk of DM compared to age group 18 – 44 years in Chinese adults (Qiu et al., 2021).

CONCLUSION

It was concluded that those having any kind of PA at work or during sports or even using bicycle or walk as activity had minimum chances of any NCDs like HTN, DM,

CVD or hypercholesterolemia and being physically active also causes to avoid obesity, which is base for many NCDs.

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