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PHYSICAL ACTIVITY PATTERNS, DIETARY INTAKE AND HEALTH STATUS AMONG UNIVERSITY OF NAIROBI LECTURERS IN KENYA

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ABSTRACT

Health status based on lifestyle-related disease is a concern in many developing countries, including Kenya. Factors related to such disease conditions, are important in ensuring economic sustainability in future. Currently there is limited research in this area. The main objective of this study was to determine the relationship between physical activity patterns, dietary intake and health status of lecturers at the University of Nairobi. The study adopted a cross-sectional survey design. Proportionate and simple random sampling techniques were used to select a sample of 120 lecturers as study participants. Data collection included the use of a questionnaire with a physical activity checklist based on 7-day recall, 24-hour food recall, anthropometric and blood pressure measurements, and also diabetes-related questions. Descriptive statistics mainly means, percentages and correlations were used to analyze data. Inferences were made using chi-square statistics, which revealed a significant relationship between health status and physical activity (χ^2 =27.54, N=118 p<0.05) and that lecturers who had at least one of the health problems consumed averagely higher amounts of proteins, fat, carbohydrates and kilocalories compared those without any of the health problems. In conclusion, results indicated that the health status of lecturers tended to be more contingent upon physical activity patterns than dietary intake.

Key words: Physical activity; Dietary intake; Health status.

INTRODUCTION

Health conditions such as obesity, high blood pressure and type 2 diabetes mellitus, commonly found in developed countries, are normally associated with inappropriate diet and physical activity patterns. Recent publications have indicated that such conditions are now a major public health concern in sub-Saharan Africa, particularly in urban centres (World Health Organization (WHO), 2003). The link between such health conditions and dietary intake has received substantial research attention however the relationships with the physical activity patterns of those at risk has not been adequately documented, particularly in sub-Saharan Africa (Omondi, 2005). The at-risk groups appear to be those of medium to high socio-economic status including company managers, university lecturers, senior government officials and businessmen or women, especially those living and working in urban environments. As much as the poor may suffer from malnutrition and related illnesses, the groups in question are at risk of suffering from illnesses attributable to living a sedentary lifestyle. Maintaining an active lifestyle by participating in regular physical activity has several health benefits. Physical activity reduces chances of developing hypertension and type 2 diabetes and lowers the risk of dying from such diseases by 50 percent (Bijen & Feskens, 1999). In this study, the relationship between physical activity patterns, dietary intake and health status of lecturers at the University of Nairobi was established. In the following section, the terms "physical activity patterns", "dietary intake" and "health status" are discussed.

Physical activity patterns referred to all movements in everyday life including manual work, recreation exercise and sporting activities (WHO, 1997). Physical activities can be categorized as follows: sedentary activities for instance watching television, light activities such as lecturing while standing up, moderate activities such as brisk walking and heavy activities such as weight lifting (United States Department of Health and Human Services (USDHHS), 2002; Ainsworth *et al.,* 2000). Dietary intake referred to the consumption of proteins, fats, carbohydrates and kilocalories in excess of what the body can utilize and which can have a negative impact on health status. According to Williams (1994) individuals who consume high amounts of total fat are likely to develop poor cholesterol levels, which are associated with high blood pressure and other health risks. Health is defined by WHO (1997) as "a state of complete physical, mental and social well-being and does not only consist of the absence of disease or infirmity." This definition is general and if considered would classify all individuals as unhealthy. In this study, using blood pressure, type 2 diabetes mellitus and overweight/obesity of the participants operationalizes health status. The WHO/ International Society of Hypertension Writing Group (2003) defined high blood pressure as ≥140/90 mmHg for systolic/diastolic respectively. However, most health clinics in Kenya consider high blood pressure patients as those ≥120/80 mmHg systolic/diastolic. Overweight cases are those with a BMI of ≥25 kg/m^2, while obese cases are ≥30 kg/m^2 by WHO (2000) standards.

The following research questions guided the conduct of this study. What are the physical activity patterns, dietary intake and associated health status of the participants? Further, what is the relationship between physical activity patterns, dietary intake and health status of the participants? It was hypothesized that health status is not contingent upon physical activity patterns and that dietary intake does not influences health status. These research questions were answered and the hypothesis tested while controlling for confounding factors such as age, alcohol consumption, cigarette smoking and heredity.

METHOD

The study was conducted in Nairobi, the largest city in Kenya where there is an increased likelihood of accessing individuals who are less active, overweight and likely to suffer from illnesses such as type 2 diabetes and hypertension, problems more common in urban settings. A cross-sectional descriptive survey was undertaken among a sample of lecturers. Data was colleted for a period of three months and analyzed. The study was limited to 600 lecturers at the University of Nairobi. A lecturer in this case included an academic staff holding the position of Lecturer, Senior Lecturer, Associate Professor or Professor. Informed consent was obtained among all lecturers who participated in the study. This was done after obtaining a research permit from the Ministry of Education Science and Technology. Permission was also granted by the university administration. One hundred and twenty (120) lecturers from four of the seven campuses of the University of Nairobi were involved in the study. The sample size was arrived at using Creative Research Systems (2003) formula as follows:

$$SS = \{Z^2 * (P) * (1-P)\} \div C^2$$
$$= 1.96^2 * 0.5 * 0.5 \div 0.08^2$$
$$= 150 \text{ lecturers}$$

Where: SS=Sample size, Z=1.96 (precision for 95% level of confidence), P=0.5 (the worst percentage that can ever pick a choice), C=0.08 (confidence interval). However, since the population was finite, correction for finite population was carried out as follows:

New SS = SS ÷ {1+ [SS-1] ÷Pop} (where: Pop=Population).
=150÷ {1+ [150-1] ÷ 600
=120 lecturers.

The lecturers were proportionately distributed across the campuses and a simple random method used to select individual lecturers as follows: 60 lecturers were selected in Main campus, 35 in Chiromo, 15 in Lower Kabete and 10 in Parklands.

Data were collected using a questionnaire. The questionnaire consisted of three sections; quantitative physical activity frequency checklist, a standard 24-hour food recall assessment form and health status assessment questionnaire. Additional questions targeted control of some possible intervening factors i.e. age, alcohol consumption, cigarette smoking and heredity. The questionnaire was administered to each respondent by the researcher. Protein, fat, carbohydrate and kilocalorie intakes were computed from a standard 24-hour food recall assessment form to establish the dietary intake of the participating lecturers. This computation was made possible with the help of a standard food table developed by Latham (1979) and used again by K'Okul (1991). The quantitative physical activity frequency checklist had a list of common activities in urban areas categorized into ordinal discrete variables namely: light, moderate and high intensity activities. For each case the respondent was required to tick (√) the activity he/she participated in the past one week indicating the time spent in minutes and the number of days spent per week. Time in minutes spent doing light and high intensity physical activities was converted to minutes spent in moderate intensity physical activities per day as an equivalent alternative. This conversion was based on the ratio that for every 60 minutes spent in light activity, only 30 minutes of moderate intense and 20 minutes for heavy intense is required as equivalent alternative (Ainsworth *et al.*, 2000; Ainsworth *et al.*, 1993; USDHHS, 2002; WHO, 2003).

Body Mass Index (BMI) which is measure of body fat was computed from weight and height measurements of each subject using a standardized bathroom scale and stadiometer respectively. BMI of participants were classified according to WHO (2000) standards as follows: <18.5 kg/m^2 is underweight, 20-24.99 kg/m^2 is normal, 25-29.99 kg/m^2 is overweight and ≥30 kg/m^2 is obese. Finally, blood pressure (BP) was measured using an aneroid sphygmomanometer. The researcher recorded both systolic and diastolic measurements. Blood pressure values above 90 mmHg for diastolic and 120 mmHg for systolic was considered high. A diastolic blood pressure of above 90 mmHg is a WHO (2000) standard, while a systolic blood pressure of above 120 mmHg is Kenyan standard.

RESULTS AND DISCUSSIONS

Demographic Characteristics

About 90% of lecturers from the four campuses were males and only 10% percent were females thereby limiting the possibility of doing comparisons between genders. The mean age was 45.6 (±6.6) years ranging from a minimum of 31 years to a maximum of 66 years.

Physical Activity Patterns and Health Status

Physical activities were initially categorized as light, moderate, and high intensity. Specific types of activities were ranked according to the number of lecturers who participated in them (Table 1). The most popular activities among lecturers included lecturing while standing up, driving, climbing stairs, walking (briskly and slowly). Other activities included dusting furniture, removing cobwebs, ironing, cooking, pruning, sporadic jogging, scrubbing floors and sporting activities like cycling and swimming. However, this last group of activities had the lowest number of lecturers that got involved. Uniformity in activity levels among the study group was attained by converting minutes spent in all light activities to equivalent minutes spent in moderate activities per day in the ratio 60:30 as described earlier in the method section. The group mean of 82.9 minutes per day was used as cut off level to divide the sample into two groups i.e. active and less active. Subjects who scored above the group mean were labeled as active and they constituted 47.5% of the total group while those who scored below the group mean were labeled as less active and they constituted 52.5%. This means that slightly more lecturers were less active the active.

TABLE 1. **PHYSICAL ACTIVITY RANKED BY THE NUMBER OF LECTURERS INVOLVED**

Physical activity category	N=120 Number of lecturers involved	Rank
Light activities		
Lecturing (standing)	120 (100.00%)	1
Driving a car	100 (83.33%)	2
Walking slowly	85 (70.83%)	3
Ironing	23 (19.17%)	4
Sporadic jogging	21 (17.50%)	5
Vacuuming	17 (14.17%)	6
Conditioning exercise/warm up	17 (14.17%)	6
Cooking	14 (11.67%)	7
Gardening/pruning	14 (11.67%)	7
Cycling, very light effort	11 (9.17%)	8
Removing cobwebs	10 (8.33%)	9
Dusting furniture	9 (7.5%)	10
Washing	9 (7.5%)	10
Swimming (slow treading)	5 (4.17%)	11
Pool game	3 (2.50%)	12
Mopping	3 (2.50%)	12
Sweeping	1 (0.83%)	13
Golf (powered)	1 (0.83%)	13
Table tennis	1 (0.83%)	13

Moderate activities		
Climbing stairs	115 (95.83%)	1
Walking briskly (approx. 3-5 km/hour)	69 (57.5%)	2
Cycling (5-9 km/hour, level terrain)	3 (2.50%)	3
Scrubbing floor	3 (2.50%)	3
Weight training	2 (1.67%)	4
Golf (pulling and carrying clubs)	2 (1.67%)	4

Table 1 shows that most participants participated in light activities, followed by moderate activities. None of the lecturers participated in high intensity physical activity. The leading activity in the category of light activities was lecturing while standing, followed by driving and walking slowly. In the category of moderate physical activity, climbing stairs was the leading activity, followed by brisk walking.

The international recommendation for the adequacy of physical activity is at least 30 minutes of moderate intensity for five or more days a week (WHO, 2003; USDHHS, 2002). In contrast, the study group recorded a group mean of 82.9 minutes of moderate activity per day for all days of the week by average. This translated to the fact that the majority of lecturers scored above the minimum international requirement and were therefore active by that standard. Nevertheless, it is logical to argue that this standard could be applicable in developed countries more so in America and European countries where these average measurements were obtained. The WHO (2003) and USDHHS' (2002) recommendations only provided the minimum requirement, but they were silent on the environmental coverage of the standard implying that the average minutes in moderate intensity physical activity per day in a given group may vary from population to population. To sum up this argument it is practically sound that in a population, some individuals may participate more in physical activities than others. The difference in the level of participation may have an impact on the overall health status. That is why among the subjects in the group investigated, some individuals performed above average and were labeled active while others performed below average and were labeled less active. The impact of this difference in the level of active participation on health status is explained in the following paragraphs.

Blood pressure, type 2 diabetes mellitus and BMI were used as indicators of health status. Health status was generally determined by the number of lecturers who had at least one health problem (abnormal) forming one group and those without any of the health problems (normal) forming another group. The distribution in Table 2 implied that most of the participants had at least one of the health problems. In general terms, the proportions indicated are within a confidence interval of ± 8% and this means that the proportion of participants that could be found with at least one problem at any time within the period this research was conducted is between 59.8% and 75.8%, which is a worrying outcome.

TABLE 2. **PROPORTION OF PARTICIPANTS BY HEALTH CONDITIONS**

Health Condition	**N=120 Proportion (%)**
Specific health condition	
Systolic BP above 140 mmHg	9.1
Systolic BP above 120 mmHg	49.1
Diastolic BP above 90 mmHg	47.5
BMI of 25 kg/m^2 and above (overweight)	42.5
BMI of 30 kg/m^2 and above (obese)	8.3
Diabetic/Blood sugar above normal	15.0
General health condition	
At least one of the three health problems present	67.8
None of the health problems present	32.2

Table 2 shows the proportion of participants with a specific health condition. The data indicates that among those with one health problem, the most common problem was that of high blood pressure followed by overweight and diabetes being the least common health problem. Approximately one-third (32.2%) of the participants did not have any of the health problems and about two-thirds (67.8%) had at least one health problem.

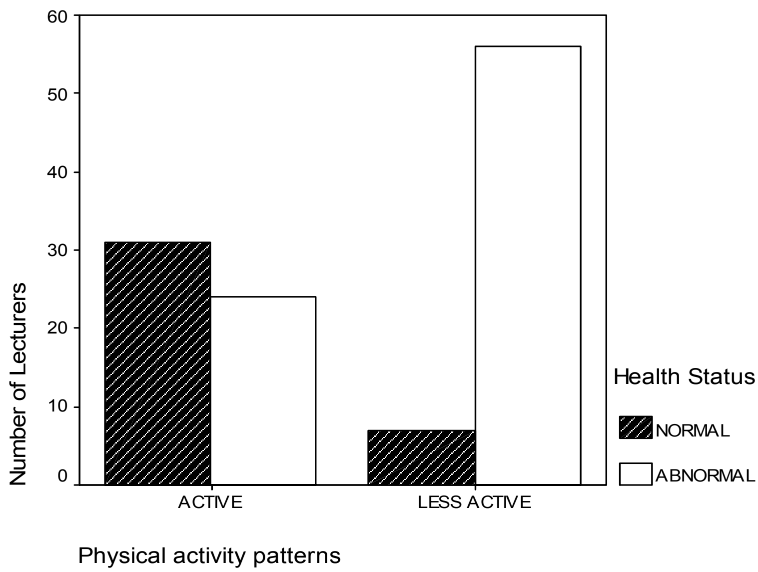

FIGURE 1. **HEALTH STATUS OF LECTURERS ACROSS PHYSICAL ACTIVITY PATTERNS**

Figure 1 shows health status of lecturers across physical activity patterns. There were more normal (lecturers without any of the health problems) than abnormal (lecturers with at least one of the health problems) participants among those who were active. On the contrary, lecturers who happened to be less active had more cases with abnormal health conditions than cases with normal health.

Physical activity patterns and health status were compared to show their relationship and it appears as if health status may have been contingent upon physical activity patterns (Figure 1). However, this statement needs further proof by means of a higher statistical test which focuses on each measure of health status.

TABLE 3A. **RELATIONSHIP BETWEEN PHYSICAL ACTIVITY PATTERNS AND HEALTH STATUS**

Health Status	**N**	df	**Correction for Discontinuity (χ^2-Value)**	**Sig. (2-tailed) P-Value**
Diastolic BP	118	1	19.228	.00
Systolic BP	118	1	24.826	.00
Body mass index	116	1	21.781	.00
Blood sugar	109	1	4.502	.034
Overall health (At least one health problem)	118	1	27.54	.00

Table 3a shows that all measures of health status had significant relationship with physical activity patterns (p<0.05). Therefore with these results we can infer that health status is contingent upon physical activity patterns.

TABLE 3B. **RELATIONSHIP BETWEEN PHYSICAL ACTIVITY PATTERNS AND HEALTH STATUS AFTER YATES' CORRECTION FOR DISCONTINUITY**

Health Status	**N**	df	**Correction for Discontinuity (χ^2-Value)**	**Sig. (2-tailed) P-Value**
Diastolic BP status	118		17.629	.00
Systolic BP status	118		24.021	.00
Body mass index status	116		20.078	.00
Blood sugar status	109		3.469	.063
Overall health status (At least one health problem)	118		25.508	.00

Table 3b shows that all measures of health status had significant relationship with physical activity patterns (p<0.05) except for blood sugar status that was insignificant (p>0.05) after applying Yates' correction for discontinuity.

To test the null hypothesis that health status is not contingent upon physical activity patterns, use was made of χ^2 statistics. Physical activity outcomes (active versus less active) were cross tabulated with outcomes of each measure of health status (normal versus abnormal) and chi-square values generated from observed frequencies. Results in Table 3a indicates a significant relationship existed between health status and physical activity patterns ($p<0.05$). These results may be compared with the outcomes of other studies. For example in the case of type 2 diabetes, some studies have shown that physical activity plays a significant role in the development of type 2 diabetes mellitus. According to Krishna *et al.* (2004), physical activity decreases insulin resistance and can aid in both preventing type 2 diabetes mellitus and managing the disease. Exercise reduces the rate of blood glucose, increases the number of insulin receptors and increases the sensitivity and level of absorption of insulin by the tissues

(Richter & Galbo, 1986; Richter & Schneider, 1981). Comparing the above conclusions with the study results, physical activity patterns similarly played a greater role on type 2 diabetes among the subjects even though the relationship was statistically insignificant (Table 3b) after applying correction for discontinuity and could have been otherwise if more subjects were involved or actual measurements of blood sugar for each lecturer were taken.

Coming to the relationship between physical activity and BMI, lecturers who spend more time in physical activity tended to have normal Body Mass Index. This indicates that the longer the duration of moderate intensity physical activity, the lower the Body Mass Index. Observed frequency confirmed that more less active lecturers scored BMI above 25 kg/m^2 compared to active individuals. A study by Klem *et al.* (1997) of 629 and 155 overweight women and men showed that subjects lost an average of 30 kg and maintained a required minimum weight loss of 13.6 kg for five years after engaging in physical activity. This means that overweight individuals can reduce weight if they engage in steady physical activity for a predetermined period and the intensity of physical activity they should sustain depend on the amount of weight (grammes) they require to lose within that period. Nevertheless, for physical activity to have an impact on weight loss an individual must be exposed to active lifestyle for a long period under normal conditions. Losing weight is not just a one day event.

Finally, in the case of blood pressure a significant relationship existed between physical activity patterns and hypertension. Lecturers who participated more in physical activity also tended to record normal blood pressure (both systolic and diastolic). Similarly, Yang *et al.* (1996) investigated the prevalence of risk factors for hypertension and singled out a lack of sufficient physical activity as independent risk factor for hypertension. The current study agrees that a lack of sufficient physical activity is a strong predictor for hypertension.

Dietary Intake and Health Status

Dietary intake refers to the amount of nutrient consumed by an individual on a daily basis. In this study it was limited to individuals' daily fat, protein, carbohydrate and kilocalorie intakes. Dietary intake of participants involved recall of food items consumed in the past one day. However, important dietary information in this study required specific quantities of fat, protein, carbohydrates and kilocalorie consumed by each lecturer per day. These were calculated and assigned for each lecturer as explained in dietary data collection procedures in the method section. In order to investigate the role diet played on health outcomes of individuals, it was more practical to focus on differential effects and associations rather than experimental effect since the latter requires follow up for a long period. Statistical mean of dietary intakes showed some figure differences on protein, fat, carbohydrates and kilocalorie intakes with larger values in favour of lecturers with at least one of the health problems (Table 4).

TABLE 4. **MEAN DIETARY INTAKE OF LECTURERS BY HEALTH STATUS OUTCOMES**

		Mean Dietary Intake (SD)			
Health Status	**N**	**Total Fat Intake (g/day)**	**Protein Intake (g/day)**	**Carbohydrate Intake (g/day)**	**kilocalorie Intake (kcal/day)**
Body Mass Index					
Normal	51 (51.00%)	68.75 (34.59)	129.4 (39.04)	180.54 (38.79)	2462.13 (727.88)
Overweight	49 (49.00%)	78.81 (45.39)	138.64 (44.32)	188.35 (45.00)	2594.14 (919.69)
Diastolic BP					
Normal	58 (56.86%)	72.70 (44.60)	132.04 (40.93)	181.38 (40.17)	2439.30 (840.22)
High Diastolic BP	44 (43.14%)	75.88 (33.55)	138.57 (44.28)	189.50 (43.62)	2669.72 (787.88)
Systolic BP					
Normal	50 (49.02%	68.14 (31.79)	126.31 (38.13)	178.07 (38.19)	2413.80 (724.01)
High Systolic BP	52 (50.98%)	79.78 (46.25)	143.09 (44.82)	191.44 (44.14)	2658.79 (897.12)
Blood Sugar					
Normal	79 (81.44%)	74.52 (40.14)	132.25 (39.49)	182.61 (38.84)	2481.68 (774.45)
Diabetic	18 (18.56%)	83.31 (38.31)	161.29 (42.40)	207.63 (46.75)	3050.66 (832.77)
Overall Health					
Normal (None of the health problem present)	33 (27.5%)	67.22 (36.44)	126.52 (38.44)	176.00 (38.27)	2331.88 (724.49)
Abnormal (one or more health problems)	69(67.65%)	77.35 (41.53)	138.85 (43.76)	189.14 (42.82)	2637.61 (852.14)

Table 4 shows average consumptions across measures of health status. Lecturers with abnormal health conditions recorded higher amounts of protein, fat, carbohydrates and kilocalorie intakes than lecturers who did not experience any of the health problems. This implies that lecturers who were abnormal consumed averagely higher amounts of protein, fat and kilocalories than normal lecturers and were more likely to develop at least one of the health problems.

In addition, diastolic blood pressure was highly associated with kilocalorie intake implying that lecturers with high diastolic blood pressure tended to consume more kilocalories (Table 5). This kind of association did not occur between other measures of dietary intake and measures of health status. Failure to find any association may be supported by the argument of Willett (2002) who proposed that experimental studies lasting one year or longer have not shown a link between dietary fat and weight. Sempos *et al.* (1999) goes further to explain that such a failure could be due to methodological limitations and a better suggestion is to evaluate the relationship between dietary intake and overweight/obesity with a consideration given to information from observational epidemiology as well as experimental and clinical intervention studies.

TABLE 5. **CORRELATION MATRIX FOR DIETARY INTAKE VARIABLES AND HEALTH STATUS VARIABLES**

	Y_1	Y_2	Y_3	X_1	X_2	X_3	X_4
Y_1	1.000						
Y_2	.737**	1.000					
Y_3	.362**	.336*	1.000				
X_1	.138	.149	-.062	1.000			
X_2	.162	.246*	-.010	.772**	1.000		
X_3	.110	.072	.014	.720**	.464**	1.000	
X_4	.185	.176	.019	.733**	.890**	.638**	1.000

* Significant at α=0.05 level.
** Significant at α=0.01 level.
Note:
Dietary Intake Variables: X_1 = Protein intake; X_3 = Total fat intake; X_2 = Kilocalorie intake; X_4= Carbohydrate intake
Health Status Variables: Y_1= Systolic blood pressure; Y_2= Diastolic blood pressure; Y_3= Body mass index.

Table 5 is a correlation matrix for dietary intake variables and health status variables. The only statistically significant relationship for dietary intake variables and health status variables was between kilocalorie intake and diastolic blood pressure (r=0.246, p<0.05). However, intra- correlations revealed significant positive correlations between systolic BP and diastolic BP, systolic BP and Body Mass Index, protein intake and kilocalorie intake, protein intake and total fat intake protein intake and carbohydrate intake, kilocalorie intake and total fat intake, kilocalorie intake and carbohydrate intake and finally carbohydrate intake and total fat intake (p<0.01).Participants who consumed more kilocalories had a tendency of developing high diastolic pressure. On the other hand, participants who recorded high systolic BP also had a higher risk of recording high diastolic BP as well as high Body Mass Index. Similarly, participants with high intake of kilocalories were likely to register high fat and protein intake.

It is therefore important to acknowledge the fact that epidemiological investigations on any nutritive component of dietary intake require a long period and close monitoring of what individuals consume. However, daily food intake averages of what people consume may also explain their health outcomes when measurements are approximated with minimal bias and are necessary for quick interventions. It is also useful in a population where a large number of probable cases with poor dietary habits are suspected.

Intervening Factors

All lecturers who were diabetic, hypertensive and reported to have had any of their family members suffering from diabetes and hypertension were meant to be excluded from the study. However, none of the lecturers reported to have any of his or her biological relatives experiencing type 2 diabetes and high blood pressure. In addition, none of the respondents smoked cigarettes and only 42 (34.17%) were occasional consumers of alcohol. Since the researcher only intended to use frequent consumers of alcohol, the contribution of alcohol as a confounding factor to the occurrence of diabetes was treated with reservation. This ruled out the influence of alcohol taking, cigarette smoking and family history on health status. Age as an intervening factor was investigated by first categorizing the participants into age groups with a range of 10 years. This classification was based on the fact that for every 10 years after an individual has reached age 30, Basal Metabolic Rate reduces by 4% and an individual who is sedentary is likely to increase weight (Williams, 1994). Chi-square test revealed no relationship between age and the variables of health status ($p>0.05$). This implied that health status was not contingent upon age of an individual. Therefore, whether a lecturer fell between 35-45 years, 46-55 years or above 56 years, health status was likely to remain the same.

CONCLUSIONS

More lecturers who recorded high blood pressure, Body Mass Index equal to or above 25 kg/m^2 and suffered from type 2 diabetes mellitus scored below average in duration spent in moderate intensity physical activity compared to lecturers with normal blood pressure (below 120/90 mmHg), Body Mass Index between 20-24.99 kg/m^2 and who had no diabetes. This indicates that physical activity may have had a significant relationship with health status of the subjects ($p<0.05$). Subjects with at least one of the health problems recorded higher protein, fat and kilocalorie intakes compared to subjects without any of the health problem and kilocalorie intake was highly associated ($p<0.05$) with diastolic blood pressure. These results suggests that participating in physical activity regularly along with consumption of an appropriate diet may have a relationship with health outcomes measured in terms of overweight/obesity, hypertension and type 2 diabetes mellitus. However, there are limitations that need further investigations. For example, this study focused on a cross-sectional study design and considered the population in general; we suggest longitudinal studies that will compare males and females. Age should also be given more priority as it is generally believed that age is a factor contributing to the development of type 2 diabetes.

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