

Research Article

## The relationship between physical activity level and obesity among medical students at International University of Africa, Sudan

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**Keywords:**

Obesity, physical activity, medical students, Sudanese.

**ABSTRACT**

**Background:** Obesity is a leading preventable cause of death worldwide, with increasing rates in adults and children. Several studies had investigated the relationship between physical activity and obesity but this relationship is still controversial and few attempts were made to study this relationship among medical students especially in Sudan. Therefore, the aim of this study was to determine the relationship between physical activity level and obesity among the medical students of the International University of Africa. **Methods:** This was cross section descriptive facility-based study conducted among 200 medical students at International University of Africa (IUA) selected by stratified random sampling. Data were collected by self-administered questionnaire which included sociodemographic data. Anthropometric measurements were done for each participant. Physical activity level was determined by the short form of the international physical activity questionnaire (SF-IPAQ). Data were analyzed using SPSS version 23 program. Descriptive data were presented as means and standard deviations of means or percentages. Correlation analysis and Chi-Square test were used to assess associations/ differences between different variables.  $P < 0.05$  was considered statistically significant. **Results:** The mean age of participants was  $21.76 \pm 2.48$  years. The prevalence of obesity among students was 6.5% and most of the students had either low or moderate physical activity level (24.5% and 48.5% respectively). Male students had higher level of physical activity than female students ( $P < 0.001$ ). There was no significant relationship between physical activity level and obesity in both male and female students. **Conclusion:** The study revealed insignificant relationship between obesity and physical activity level.

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### INTRODUCTION

Obesity is a medical condition in which excess body fat has accumulated to the extent that it may have a negative effect on health (WHO, 2015). Obesity is a leading preventable cause of death worldwide, with increasing rates in adults and children (WHO, 2015). In 1997 the WHO formally recognized obesity as a global epidemic (WHO, 2015) and in 2013, the American Medical Association classified obesity as a disease (Andrew Pollack, 2013). In 2014, 600 million adults (13%) and 42 million children under the age of five were obese (WHO, 2015). Kuwait, Bahrain, Saudi Arabia and United Arab Emirates are in the list of top ten countries worldwide in term of obesity (Ono and

Guthold, 2005). Recent surveys found that in Kuwait, 48% of females and 36% of males were obese, whereas 77% of females and 74% of males were overweight (World Health Organization (WHO), 2009). In Saudi Arabia 44% of the female population and 28% of the male population were found to be obese. However, 71% of women and 66% of men were reported to be overweight (World Health Organization (WHO), 2009). A study conducted in Sudan revealed that the combined prevalence of obesity and overweight is 37.50% (18.75% in each case) among the included subjects (Ahmed et al., 2011). Sedentary lifestyle plays a significant role in obesity. The level of physical activity is reduced in developing countries and sedentary behaviors have risen (Musaiger et al., 2016), and there has been a large shift towards less physically demanding work (World Health Organization, 2004). Currently at least 30% of the world's population gets insufficient exercise, this is primarily due to increasing

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use of mechanized transportation and a greater prevalence of labor-saving technology in the home (World Health Organization, 2004), which may contribute to the occurrence of obesity and other chronic diseases (Musaiger et al., 2016). Prospective observational population studies in adults, from the last 20 year, with physical activity measured at baseline were few, and had given inconsistent results with regard to the effect of physical activity on body weight change and development of obesity (Andersen et al., 2000). Several studies reported a negative association between physical activity and weight gain, i.e. that lower physical activity predicts higher subsequent weight gain (Schmitz et al., 2000; Sherwood et al., 2000; Wagner et al., 2001; Wenche and Holmen, 2004). On the other hand some studies did not find an association (Rainwater et al., 2000; Ball, 2002) and one study reported a reverse association, suggesting that higher baseline levels of BMI predict future low levels of physical activity (Petersen et al., 2004). These discrepancies in results may be due to variations in sample size, study designs, publication bias and presence of confounding factors (Wareham et al., 2005). It has been suggested that physical activity at baseline is not related to weight gain, but that the converse is true, as a higher BMI at baseline is related to an increased risk of later physical inactivity (Petersen et al., 2004). This raises important questions about reverse causality. However, it is difficult to determine the direction of causality for this type of data because of the marked difference in the measurement precision of physical activity and obesity (Wareham et al., 2005). Longitudinal studies that use more accurate measurement of both activity and weight change might be able to more accurately estimate the true relationship between changes in these measures (Wareham et al., 2005). However, ultimately there remains a 'chicken and egg' argument, which may not be resolvable using observational data (Wareham et al., 2005). Since medical student are the future doctors and role models in our community. They will have heavy stressful work in future and they need to be healthy and to keep themselves away from risk factors of diseases like obesity. Doctors' behavior doesn't just impact them and their families it had an impact on all community (Yousif et al., 2019). Although several studies had been conducted worldwide to determine the relationship between obesity and physical activity among medical students, to the best of our knowledge minor attempts were made to investigate this relationship among Sudanese medical students. Therefore, the aim of this study was to determine the relationship between physical activity level and obesity

among the medical students of the International University of Africa in Khartoum, Sudan.

## METHODS

This was observational descriptive cross-sectional facility-based study conducted among medical students at the International University of Africa. Any student with chronic diseases like chronic renal failure, liver failure, tuberculosis or endocrine disorders was excluded from the study. Two hundred students, selected by systematic random sampling, were included in the study. Sociodemographic data were collected by self-administered questionnaire (age, gender). Weight was measured using normal weighing scale with subject taking off shoes and recorded to the nearest 0.5 Kg. Height was measured using a measuring tape, with the individual standing straight next to the wall, with the heels, buttocks, shoulders and occiput touching the wall without shoes and recorded to the nearest 0.1 cm. Body Mass Index was calculated from the anthropometric data collected using the following equation:

$$\text{BMI} = \text{weight (Kg)} / \text{Height}^2 (\text{m}^2) \text{ (WHO, 2015)}$$

Physical activity level was assessed using the short form international physical activity questionnaire (IPAQ) which assesses the individuals physical activity in the past 7 days as part of their everyday lives, which includes the following domains like walking, moderate activity which requires moderate physical effort like carrying light loads and double tennis and vigorous activity which requires hard physical effort like heavy lifting, digging and aerobics; and all these activities should have taken at least 10 minutes at a time. Scores were given for each domain which was converted into MET- minutes/week. The following values were used for the analysis of IPAQ data: Walking = 3.3 METs, Moderate PA = 4.0 METs and Vigorous PA = 8.0 METs (Research, 2004). Finally, the candidates were categorized into low, moderate and high physical activity groups based on their MET values (Brisbois et al., 2012).

For further analysis the participants were classified into male and female students (96 and 104 respectively). Data were analyzed using SPSS version 23. Descriptive data were presented as means and standard deviations of means or percentages. Correlation analysis was used for assessing associations between BMI and physical activity level. Chi-square test with 95% confidence level was used to determine the relationship between the gender and physical activity and between gender and obesity.  $P < 0.05$  was considered statistically significant.

## Relationship between physical activity level and obesity

### *Ethical consideration:*

The study was approved by the ethical committee at the international university of Africa and written consent was obtained from each participant.

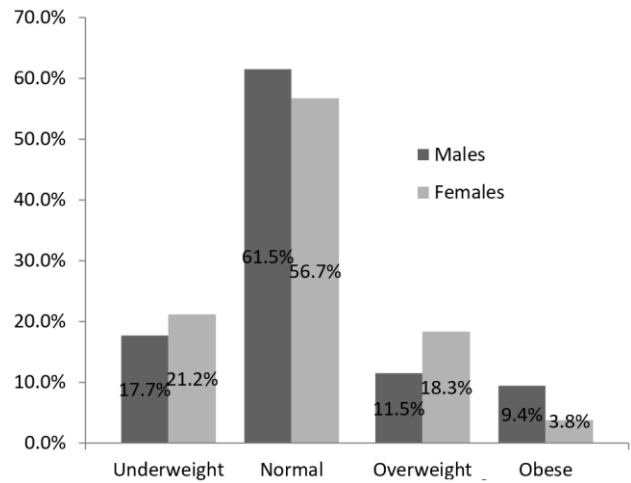
### RESULTS

The mean age of students was 21.76 years  $\pm$ 2.48. Fifty two percent (104) of the study participants were females while 48% (96) were males. The mean weight of the students was 65.17 kg  $\pm$ 15.5. Their mean height was 1.69 m $\pm$ 0.09. The mean body mass index (BMI) was 22.48 $\pm$ 4.42 (Table 1)

**Table 1:** Anthropometric measurements of students (N=200)

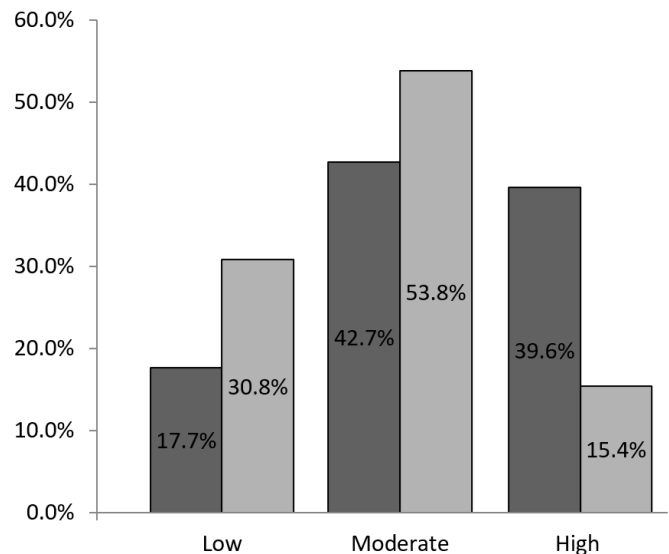
	Weight (Kg)	Height (m)	BMI (Kg/m <sup>2</sup> )
Mean	65.17	1.69	22.48
SD	15.51	0.09	4.43

According to the WHO classification of obesity, more than half of male and female medical students were normal (61.5% and 56.7 respectively), while 11.5% of males and 18.3% of females were overweight and only 9.4 % of males and 3.8% of females were obese. Chi-square test revealed no significant difference in BMI classification between male and female students (P value = 0.22) (**Fig. 1**). Our study shows that 24.5% of student had low physical activity level, 48.5% had moderate and 27 % had high physical activity level. When the analysis was applied to each sex separately, 39.6% of male students had high level of physical activity than female students (39.6% and 15.4% respectively) while 42.7% of male and 53.8 % of females had moderate level. Female students had lower level of activity than males (30.8% and 17.7% respectively). Chi-square test revealed significant difference in physical activity level between male and female students (Chi-square value = 15.85, P value <0.001) (**Fig. 2**). Pearson correlation test shows insignificant relationships between physical activity and BMI in both male and female students (Pearson correlation = 0.05, P value =0.33 for males and Pearson correlation = 0.25, P value= 0.16 for females). (Figs. 3A and B).

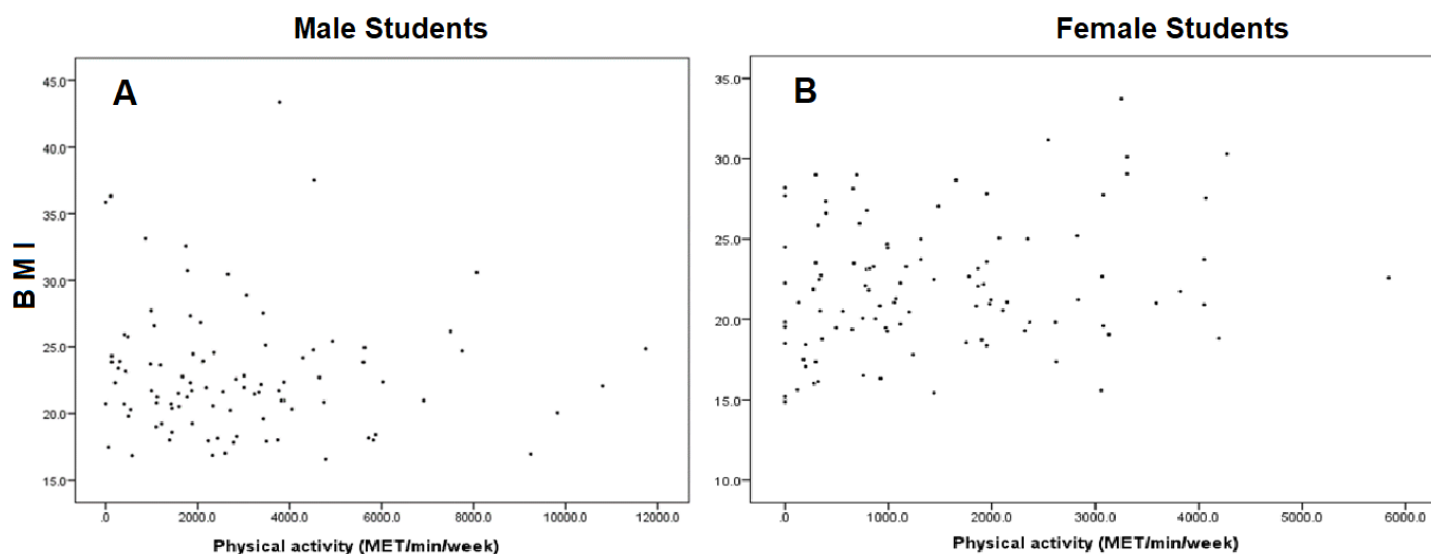


**Fig. 1.** Association between gender and Body mass Index classification Chi-square value = 4.38 P-value =0.22

The prevalence of obesity among medical students, observed in this study, is in consistence with various studies conducted nationally and worldwide. In this study 6.5% of the undergraduate medical students were obese, which is less than the prevalence among medical students at Ribat university 9.2% (Abdalla and Mohamed, 2008) . However, it is similar to Ajman study in which the prevalence was 6.9% (Ahmed et al., 2015).



**Fig. 2.** Association between gender and Physical activity (Chi-square value = 15.85, P-value of association test < 0.001)



**Fig. 3.** The relationship between physical activity and BMI across gender (A: Male students, B: Female students)

medical students at Ribat university 9.2% (Abdalla and Mohamed, 2008) . However, it is similar to Ajman study in which the prevalence was 6.9% (Ahmed et al., 2015) . . An Indian study conducted at Azeezia medical college showed a prevalence of 6.3%(Napolean and Stephen, 2014) , another closely related result are the Indian Kanchipuram 8.6%(Kokila Selvaraj, 2013) and west Bengal 9%(M. Basu, K. Sarkar, B. Shahbabu, S. Ray, G. Barik, 2016) studies performed on medical students of both districts, slightly lower figures 4.3% were seen in the study of Crete Greece(Bertsias et al., 2003), the Malaysian study by Boo N Y et al. 2010 (3.3%)(Boo N Y, Chia G J Q, Wong L C, Chew R M, Chong W, 2010) and the AIMST University in Malaysia which showed a prevalence of 5.2%(Gopalakrishnan et al., 2012).

The impact of exercise intensity on change in body composition is uncertain (Ekelund et al., 2007). Most of the students in this study are minimally active 48.5% and highly active 27% followed with least figures by inactive individuals with 24.5% this was in consistence with the Napolean Reny et al. 2014 study which found that 40.2% of students were doing exercise of which 15% did daily exercise and 25% did regular exercise while the rest do exercise occasionally; 59.8% of candidates were physically inactive (Napolean and Stephen, 2014). In the Wattanapisit A et al. 2016 study, less than half of participants (49.5%) were physically active (Wattanapisit et al., 2016) , in line with this is the Basu et al. 2016 results which concluded that only 34% of the study population had habit of regular exercise(M. Basu, K. Sarkar, B. Shahbabu, S. Ray, G. Barik, 2016). This was not the case in the sandheep sugathan et al. 2014 study were overweight and obese

students did engage in exercise for more than 60 minutes duration per week, but was not meeting the required physical activity level (Sugathan and Bagh, 2014). The present study showed significant high physical activity levels among male compared to female students. This finding in in agreement with previous studies (Rao et al., 2012; Al-Asousi and El-Sabban, 2016; Wattanapisit et al., 2016) However, other studies either disclosed insignificant difference (Bakr, Ismail and Mahaba, 2002; Alkahtani and Awad, 2016)or females predominance(Bergier et al., 2012)

In the present study, no significant association was found between the physical activity level and obesity in both sexes which is supported by the studies of Napolean Reny et al. 2014 (Napolean and Stephen, 2014), Boo et al. 2010 (Boo et al 2010); Wattanapisit et al. (2016) as well as the Kanchipuram study which also revealed that physical activity and obesity were statistically insignificantly related; although, most participants follow a sedentary lifestyle e(Kokila Selvaraj, 2013). In the Swedish prospective case-control study by U Ekelund et al. 2007 Physical activity and Physical Activity Energy Expenditure are only weakly related to gain in Body Weight and Fat Mass, therefore among obese individuals change in activity level was not related to change in BW and FM (Ekelund et al., 2007) which was also in line with our study. But in some of the studies conducted on medical students, physical inactivity was significantly associated with obesity; this is the case in Basu et al. 2016(M. Basu, K. Sarkar, B. Shahbabu, S. Ray, G. Barik, 2016) and sandheep sugathan et al. 2014 (Sugathan and Bagh, 2014) results.

**Conclusion:** In this study, most of medical students had

low to moderate physical activity levels and male students had higher activity level than females. Male students had more physical activity level than females. There was no significant relationship between obesity and physical activity level. Further large-scale cohort or interventional studies are needed to reinvestigate this relationship.

#### ACKNOWLEDGMENT

The authors would like to thank department of physiology at International University of Africa for their great help and support. Also, many thanks to the medical students who willingly participated in this study.

#### REFERENCES

- Abdalla, S. M. and Mohamed, E. Y. (2008) 'Obesity Among Medical Students of The National Ribat University , Khartoum 2008', (10), pp. 16–19.
- Ahmed, Aisha M. B; Ahmed, Hoyam, A; Mohammed, Tagwa, E; Alawad, Samia, S. (2011) 'Prevalence of obesity and overweight among the female students in basic school levels in Omdurman- Sudan', Sudan Medical Laboratory Journal, 1(2), pp. 20–25.
- Ahmed, E. A. et al. (2015) 'Obesity Among University Students: A cross-Sectional Study in Ajman, UAE', Gulf Medical Journal, 4, pp. 14–23.
- Al-Asousi, M. and El-Sabban, F. (2016) 'Physical Activity among Preclinical Medical Students at The University of Malaya, Malaysia', Journal of Nutritional Health & Food Science, 4(2), pp. 1–8.
- Alkahtani, S. and Awad, N. (2016) 'Comparing the Physical Activity Patterns of Male and Female Students in the Preparatory Year in Saudi Arabia', Journal of Obesity & Weight Loss Therapy, 6(2). doi: 10.4172/2165-7904.1000308.
- Andersen, L. B. et al. (2000) 'All-cause mortality associated with physical activity during leisure time, work, sports, and cycling to work.', Archives of internal medicine, 160(11), pp. 1621–8. doi: 10.1001/archinte.160.11.1621.
- Andrew Pollack (no date) 'AMA recognizes obesity as a disease', NewYork Times.
- Bakr, E. M., Ismail, N. A. and Mahaba, H. M. (2002) 'Impact of life style on the nutritional status of medical students at Ain Shams University.', The Journal of the Egyptian Public Health Association, 77(1–2), pp. 29–49. Available at: <https://www.scopus.com/inward/record.uri?eid=2-s2.0-33847021241&partnerID=40&md5=38915ad453ad2b5f72912c7a0ec31dc5>.
- Ball K, B. W. & C. D. (2002) 'Who does not gain In, weight? Prevalence and predictors of weight maintenance young women', International Journal of Obesity and Metabolic Related Disorders, 26, pp. 1570–1578.
- Bergier, J. et al. (2012) 'Physical activity of Polish adolescents and young adults according to IPAQ: A population-based study', Annals of Agricultural and Environmental Medicine, 19(1), pp. 109–115.
- Bertsias, G. et al. (2003) 'Overweight and obesity in relation to cardiovascular disease risk factors among medical students in Crete, Greece', BMC Public Health, 3(1), p. 3. doi: 10.1186/1471-2458-3-3.
- Boo N Y, Chia G J Q, Wong L C, Chew R M, Chong W, L. R. C. N. (2010) 'The prevalence of obesity among clinical students in a Malaysian medical school The prevalence of obesity among clinical students in a Malaysian medical school', Singapore Med J, 51(2), pp. 126–132.
- Brisbois, T. D., Farmer, A. P. and Mccargar, L. J. (2012) 'Obesity Diagnostic and Prevention Early markers of adult obesity: a review', International Association for the Study of Obesity, 13(April), pp. 347–367. doi: 10.1111/j.1467-789X.2011.00965.x.
- Ekelund, U. et al. (2007) 'Does physical activity equally predict gain in fat mass among obese and nonobese young adults?', International journal of obesity (2005), 31(1), pp. 65–71. doi: 10.1038/sj.ijo.0803361.
- Gopalakrishnan, S. et al. (2012) 'Prevalence of overweight/obesity among the medical students, Malaysia.', The Medical journal of Malaysia, 67(4), pp. 442–4. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/23082463>.
- Kokila Selvaraj, P. S. (2013) 'A Study on the Prevalence of Overweight and Obesity among Medical Students of Kanchipuram District Introduction ', National Journal of Research in Community Medicine, 2(2), pp. 140–144.
- M. Basu, K. Sarkar, B. Shahbabu, S. Ray, G. Barik, S. C. and R. N. M. (2016) 'pattern and determinants of overweight and obesity among medical students of kalkota', International Journal of Pharmaceutical Sciences and Research, 7(1), pp. 377–386. doi: 10.13040/IJPSR.0975-8232.7(1).377-86.
- Musaiger, A. O., Al-Khalifa, F. and Al-Mannai, M. (2016) 'Obesity, unhealthy dietary habits and sedentary behaviors among university students in Sudan: growing risks for chronic diseases in a poor country', Environmental Health and Preventive Medicine, 21(4), pp. 224–230. doi: 10.1007/s12199-016-0515-5.

- Napolean, R. and Stephen, J. (2014) 'Prevalence of Overweight and Obesity Among Students of a Medical College in South India', *Indian Journal of Clinical Practice*, 25(4), pp. 333–337.
- Petersen, L., Schnohr, P. and Sørensen, T. I. a (2004) 'Longitudinal study of the long-term relation between physical activity and obesity in adults.', *International journal of obesity and related metabolic disorders: journal of the International Association for the Study of Obesity*, 28(1), pp. 105–12. doi: 10.1038/sj.ijo.0802548.
- Rainwater DL, Mitchell BD, Comuzzie AG, VandeBerg JL, S. and Changes, M. & M. J. (2000) 'Association among 5-year in weight, physical activity, and cardiovascular disease risk factors in Mexican Americans', *American journal of epidemiology*, 152(974–982).
- Rao, C. R. et al. (2012) 'Practice of physical activity among future doctors: A cross sectional analysis', *International Journal of Preventive Medicine*, 3(5), pp. 365–369. doi: 10.1017/CBO9781107415324.004.
- Research, I. C. (2004) *Guidelines for Data Processing and Analysis of the International Physical Activity Questionnaire (IPAQ) - Short Form* .
- Schmitz KH, Jacobs DR Jr, Leon AS, S. P. & S. B. and Ten (2000) 'Physical activity and body weight: associations over Development, years in the CARDIA study. Coronary Artery Risk And, in Young Adults.', *International Journal of Obesity Related Metabolic Disorders*, 24, pp. 1475–1487.
- Sherwood NE, Jeffery RW, French SA, H. P. & M. D. (2000) 'Predictors of weight gain in the Pound of Metabolic study.', *International Journal of Obesity and Related Disorders*, 24, p. 395–403.
- Sugathan, S. and Bagh, D. S. (2014) 'Prevalence and Correlates of Overweight and Obesity among Medical Students in Ipoh, Malaysia', *Academic Medical Journal of India*, II(1), pp. 22–24.
- T. Ono, R. Guthold, and K. S. (2005) *WHO Global Comparable Estimates*. Available at: <https://apps.who.int/infobase/Comparisons%0A.aspx>.
- Wagner A, Simon C, Ducimetiere P, Montaye M, B. V and And, Y. J. et al. (2001) 'Leisure-time physical activity With, regular walking or cycling to work are associated PRIME, adiposity and 5 y weight gain in middle-aged men: the Metabolic, Study', *International Journal of Obesity and Related Disorders*, 25, pp. 940–948.
- Wareham, N. J., van Sluijs, E. M. F. and Ekelund, U. (2005) 'Physical activity and obesity prevention: a review of the current evidence', *Proceedings of the Nutrition Society*, 64(2), pp. 229–247. doi: 10.1079/PNS2005423.
- Wattanapisit, A. et al. (2016) 'Physical activity among medical students in Southern Thailand: a mixed methods study', *BMJ Open*, 6(9), p. e013479. doi: 10.1136/bmjopen-2016-013479.
- Wenche DB, Holmen J, K. O. & M. K. (2004) 'Leisure time physical activity and change in body mass Health, an 11-year follow-up study of 9357 normal weight healthy women 20–49 years old.', *Journal of Women's Health*, (13), pp. 55–62.
- WHO (2015) *Obesity and overweight fact sheet No.311*, January, 2015
- World Health Organisation (WHO) (2009) *World Health Statistics*.
- World Health Organization (2004) 'Promoting Mental Health: Concepts, Emerging Evidence, Practice: Summary Report. Geneva, World Health Organization. Retrieved', [Http://www.who.int/Mental\\_Health/Evidence/En/Promoting\\_Mhh.Pdf](http://www.who.int/Mental_Health/Evidence/En/Promoting_Mhh.Pdf), p. 68. doi: 10.1111/j.1466-7657.2004.00268.x.
- Yousif, M. M., Kaddam, L. A. and Ahmed, H. S. (2019) 'Correlation between physical activity , eating behavior and obesity among Sudanese medical students Sudan'. *BMC Nutrition*, 5(6), pp. 1–8.