

# Sleep Patterns, Physical Activity Levels and Dietary Intake of University Students in Southwestern Nigeria: Changes During COVID-19 Pandemic

Monday Daniel Olodu<sup>1,2,\*</sup>, Adeleye Abiodun Adeomi<sup>1,3</sup>,  
Abdulkareem Babalola Murtala<sup>1</sup>, Joy Adurapemi Odedele<sup>1</sup>, Eunice Othuke Oboreh<sup>1</sup>

<sup>1</sup>Department of Community Health, College of Health Sciences, Obafemi Awolowo University, Ile-Ife, Nigeria

<sup>2</sup>Consortium for Advanced Research Training in Africa (CARTA) Fellow, Ibadan, Nigeria

<sup>3</sup>Consortium for Advanced Research Training in Africa (CARTA) Fellow, Witwatersrand, South Africa

\*Corresponding author: [mondaiyolodu@gmail.com](mailto:mondaiyolodu@gmail.com)

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**Abstract Background:** Evidence shows that independent of the pandemic, the university students already exhibit poor sleep patterns, low physical activity and sub-optimal dietary intake. The restrictive measures imposed to curb the disease spread are likely to influence these modifiable factors. This study seeks to assess the influence of COVID-19 on sleep patterns, physical activity level and dietary intake of university students in Southwestern Nigeria. **Methods:** A total sample size of 396 undergraduates were selected using a multi-stage sampling technique. A semi-structured self-administered questionnaire, which had three sections, was used to elicit information. Sleep patterns were assessed with questions adapted from Pittsburgh Sleep Quality Index (PSQI). Physical activity was assessed using items from the International Physical Activity Questionnaire (IPAQ)-Short Forms (SF), and dietary intake was assessed using items from the PLife COVID-19 questionnaire. **Results:** Most of the students had increased sleep-wake time (60.4%), Sleep duration (62%) and at least eight hours of sleep/day (55.1%). A majority (85.3%) had a low physical activity level, and their diet remains unchanged except for water (48.7%), fruit (43%) and dietary supplements (32.6%), which increased slightly. A majority (84.8%) had a worsened dietary intake. Statistically significant relationships exist between sleep quantity, physical activity and dietary intake ( $p < 0.05$ ). **Conclusion:** The COVID-19 pandemic positively influences the sleep quantity of university students. However, it further compounded the low physical activity and unhealthy dietary intake. A sustainable measure to curtail the spread of a virus, with minimal interference in physical activity and dietary intake of this vulnerable group, should be considered in future pandemics.

**Keywords:** COVID-19, physical activity, sleep pattern, dietary pattern, university student

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## 1. Introduction

Coronavirus Disease 19, also known as COVID-19, is viral pneumonia which is caused by a new strain of coronavirus, called Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2). It emerged in Wuhan city, Hubei province, China, in November 2019 and thereafter spread across the world. It was officially declared a pandemic on March 11, 2020, by the World Health Organization (WHO) [1]. Since its emergence, it has affected the world in unprecedented ways. This pandemic brought with it adverse consequences on the daily life of people around the world in terms of health, economy and social [2].

According to the WHO, there has been soaring morbidity and mortality, with 178,837,204 confirmed cases of COVID-19, of which there were 4,293,591 deaths globally as of 9th August 2021. In Nigeria, there were 178,086 confirmed cases of COVID-19 with a death toll of 2,187 at the same period since the first confirmed case was reported by the Nigeria Centre for Disease Control (NCDC) on the 27th February 2020 [3]. The healthcare system in a bid to match the demands placed on it by the pandemic has been overburdened with increased pressure on health professionals, shortage of medical supplies, and a decreased attention to non-COVID health-related issues [4]. Furthermore, with the progression of the pandemic, there were forecasts of even worse health outcomes, especially in the low and middle-income countries [5].

Global economies also took a major hit, there was a drastically reduced manpower available as a result of widespread illness, hospitalization, isolation, and death [6]. There was also increasing panic with a greater risk aversion in investment activities leading to a fall in stock returns and increase in the prices of food and also the inadequacy of food available for consumption [7,8]. This cascade of events necessitated the governments of most nations of the world, including Nigeria, to put measures in place to contain the spread of COVID-19.

Measures that were adopted included physical distancing, restriction on non-essential travel, cancellation of various events, closure of businesses and points of social interaction. The restrictions in physical social interactions were found to be highly beneficial in the substantial reduction in COVID-19 transmission [9]. However, they were not as effective in sub-Saharan countries especially due to the poor state of medical facilities and living conditions, and overly strict lockdown implementation without a concomitant increase in COVID-19 testing [10]. These measures, though useful in curbing the spread of the disease, conversely negatively impacted other aspects of health such as sleep, physical health, nutrition and mental health of citizens globally and in sub-Saharan Africa [11,12,13]. The state of economic affairs of nations was also further worsened with a fall in production of goods and provision of services, loss of jobs and closure of businesses, resulting in the economic downturn and a drop in gross domestic product (GDP) of many nations, and also disruption in the food supply chain leading to food insecurity [14].

People were confined to their homes, jobs were lost or evolved into remote work, disruption in sleep patterns, decrease in physical activity and poor dietary intake, there were also fewer opportunities for social interaction, gatherings for entertainment or religious purposes and other important aspects of the human experience [13,15]. This was also the state of affairs in Nigeria, though compliance to the measures by citizens was poor [16]. Students were not left out in this regard, schools were shut down and work was halted at the peak of the pandemic [17]. School closures reached a peak on the 27th of April 2020 with 1,645,751,674 schools affected globally as reported by the United Nations Educational, Scientific and Cultural Organization (UNESCO) [18]. In Nigeria, 39,440,016 learners were affected by school closure in response to COVID-19 of which 1,513,371 were tertiary learners [18]. In the Southwestern part of Nigeria, several tertiary institutions were closed including, Obafemi Awolowo University, Ile-Ife, which shut down all activities on the 20th March 2020 in a bid to curb the spread of the virus amongst its students. Following these school closures, societies transitioned to remote learning, which was particularly difficult in sub-Saharan Africa with limited resources for online learning [19].

The Closure of schools is accompanied by significant changes in the modifiable habits of university students [20,21]. These changes portend debilitating consequence for this group as evidence shows that independent of the pandemic the university students already exhibit sub-optimal dietary intake and low physical activity level [22]. The restrictive measures imposed to curb the disease spread are likely to encourage these unfavourable habits.

This study seeks to assess the influence of COVID-19 on sleep patterns, physical activity levels and dietary intake of university students in Southwestern Nigeria.

## 2. Methods

### 2.1. Study Design and Setting

A descriptive cross-sectional study design was used. The study was done at Obafemi Awolowo University (OAU), Ile-Ife, Osun State, Nigeria in March 2021. Obafemi Awolowo University is owned by the federal government of Nigeria and it is established in Ile-Ife, Osun State, Nigeria. It is located on a vast expanse of land totalling 11,681 hectares and it is settled on the GPS coordinates of 7°31'14.7612" North and 4°31'49.1340" East. The institution has 13 faculties, 82 departments, and two colleges. The student population is about 35,000 and the majority reside in private hostels located outside the campus. There are several outlets situated both within the hostels and in the academic where different local, western dishes and snacks were served. The campus has a large sports centre equipped with a swimming pool, gyms, running track, and an array of fields and courts for university-level sports events. The outbreak of COVID-19 has resulted in the total shutdown of most institutions within the country, including universities. This brought all activities on the university campus to a complete halt for a period of a year (March 2020 - February 2021). This study was done following the ease of lockdown when university students were allowed to resume schools in batches.

### 2.2. Participants

All undergraduates from 200 level and above, who have spent enough time on campus to have their sleep pattern, physical activity and dietary intake influenced by their stay were eligible for the study.

### 2.3. Sample Size Determination and Sampling Technique

The sample size was determined using Leslie Fischer's formula for a single population proportion [ $n = Z^2 p(1-p)/d^2$ ]. The prevalence of unhealthy meal patterns amongst undergraduates was 62.7% from a previous study [23], with a 95% CI and 5% precision. After estimating a non-response rate of 10%, the total sample size was 396. The respondents were selected using a multi-stage sampling technique. In the first stage, out of ten faculties that were available at the time of this study, seven were selected by simple random sampling (balloting method). Also, in the second stage, a simple random sampling technique was used in selecting three departments from the seven faculties except for the faculties of Pharmacy, Dentistry and Clinical Sciences which have only one department, totalling 15 departments. At the level of the departments, eligible participants were chosen by convenience sampling technique since most of the students have not been allowed to resume physical lectures as at the time of the study.

## 2.4. Data Collection Tools and Technique

A semi-structured self-administered questionnaire was used for data collection. The questionnaire was adapted from previously standardized questionnaires. The questionnaire had three main sections which assessed the respondents socio-demographic characteristics, sleep patterns, physical activity level and dietary intake before and during the ongoing pandemic. Sleep patterns were assessed with questions adapted from Pittsburgh Sleep Quality Index (PSQI). Physical activity was assessed using items from the International Physical Activity Questionnaire (IPAQ)-Short Forms (SF) [24]. The dietary intake was assessed using items from the PLifeCOVID-19 questionnaire [12], which had previously been used in assessing dietary intake. Before the study, the questionnaire was pretested amongst undergraduates in another faculty outside the chosen faculties to ensure validity and reliability of the instrument and also to correct any ambiguous questions.

## 2.5. Measurement of Variables

Sleep pattern was assessed with three questions; how many hours per day did you spend sleeping during this pandemic? Has your time spent on sleeping changed (compare to what it was before the pandemic)? Do you sleep & wake up late? The first question was quantified in hours and dichotomize into less than 8 hours and vice-versa. While the remaining two questions were categorized as decrease or increase, and Yes or No.

Physical activity questions assessed the time spent being physically active. It has a total of 5 questions which were scored (-1) for decreased physical activity, (0) for unchanged physical activity and, (1) for increased physical activity. The highest attainable score is 5. A score above the median score of 3 was graded as a high physical activity while a score below the median score was graded as low physical activity.

Dietary intake question assessed the changes in the amount of food consumed by the respondents and also the pattern of the food consumed i.e. healthy or unhealthy. It has a total of 14 questions which were scored (-1) for a decreased intake of healthy food choices, (0) for an unchanged dietary intake and, (1) for an increased intake of healthy food choices. The highest attainable score was 14. A score above the median score of 7 was graded as a healthy intake while a score below the median score was graded as an unhealthy intake.

## 2.6. Data Analysis

Data entry and statistical analysis were done using the IBM- Statistical Product and Service Solutions (SPSS) version 25. Univariate analysis was carried out and the results were presented as frequencies and percentages. Bivariate analysis was also carried out using chi-square to determine the relationship between sleep pattern, physical activity and dietary intake. The level of significance was set at  $p < 0.05$ .

## 3. Result

Table 1 shows the socio-demographic characteristics of participants. Out of 396 questionnaires that were administered, 374 were accurately filled. This gave a response rate of 94.44%. The majority (77%) were between 18-24 years old, with a mean age of 22.78 ( $\pm 2.611$ ). Both sexes were fairly represented. The majority were Christians (84%), of the Yoruba tribe (82.9%) and were in 400 level of study (81%). Most of the participants receive at most N30,000 monthly (72.7%) and stayed with their family (88.8%) during the lockdown as a result of the pandemic. The majority of the participants neither smoke a cigarette (97.6%) nor drink alcohol (87.4%).

**Table 1. Socio-demographic Characteristics of the Respondents (N=374)**

Variables	Frequency (%)
<b>Age (years)</b>	
18-24 yrs.	288 (77.0)
25-31 yrs.	86 (23.0)
Mean $\pm$ SD	22.78 $\pm$ 2.611
<b>Sex</b>	
Male	165 (44.1)
Female	209 (55.9)
<b>Religion</b>	
Christianity	314 (84.0)
Islam	53 (14.2)
Traditional	7 (1.8)
<b>Ethnicity</b>	
Yoruba	310 (82.9)
Igbo	36 (9.6)
Others	28 (7.5)
<b>Levels</b>	
<400	71 (19.0)
400 & Above	303(81.0)
<b>Income</b>	
30,000 & below	272(72.7)
>30,000	102 (27.3)
<b>Body Mass Index</b>	
Malnourished	105 (28.1)
Normal weight	269 (71.9)
<b>Smoke</b>	
No	365 (97.6)
Yes	9 (2.4)
<b>Alcohol</b>	
No	327 (87.4)
Yes	47 (12.6)
<b>Living Arrangement</b>	
Live alone	42 (11.2)
Live with family	332 (88.8)

Figure 1 shows the sleep pattern of the respondents. A majority (60.4%) agreed that they sleep and wake up late during the lockdown. About 62% of the participants increased the duration of their sleep and had at least eight hours (55.1%) of sleep per day.

Figure 2 shows the physical activity level of the student during the school closure. A majority (85.3%) of the students had a low physical activity level whereas only 14.7% had a high activity level.

Participants compared their diet before Covid-19 and during the ongoing pandemic using the 12 food group. Across all the food group, a majority of the

participants neither increase nor decrease their diet. However, water intake (48.7%), fruit consumption (43%) and dietary supplements use (32.6%) increase among participants. The three most decreased group were candy and chocolate (40.6%), Ice cream and sweetened drinks (36.1%) and pastries (32.1%) as shown in Figure 3.

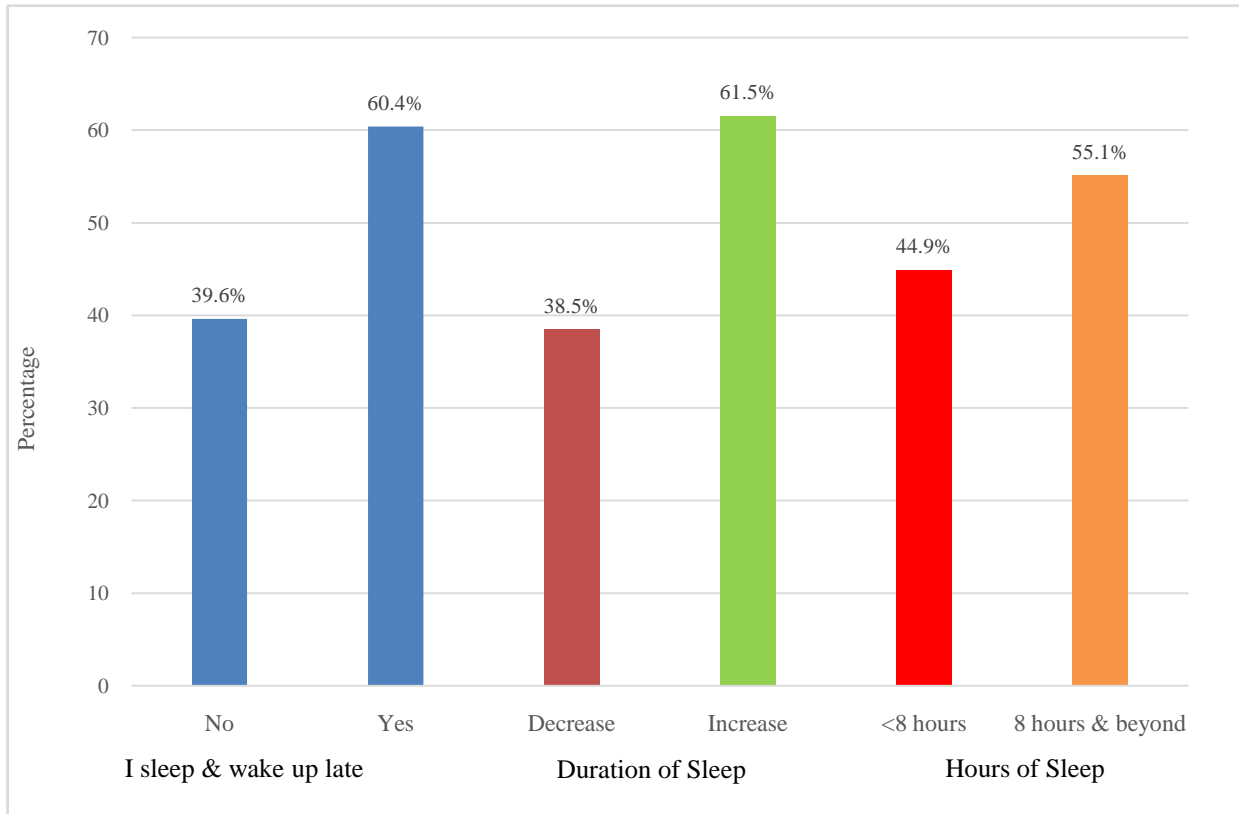


Figure 1. Assessment of Sleep Patterns

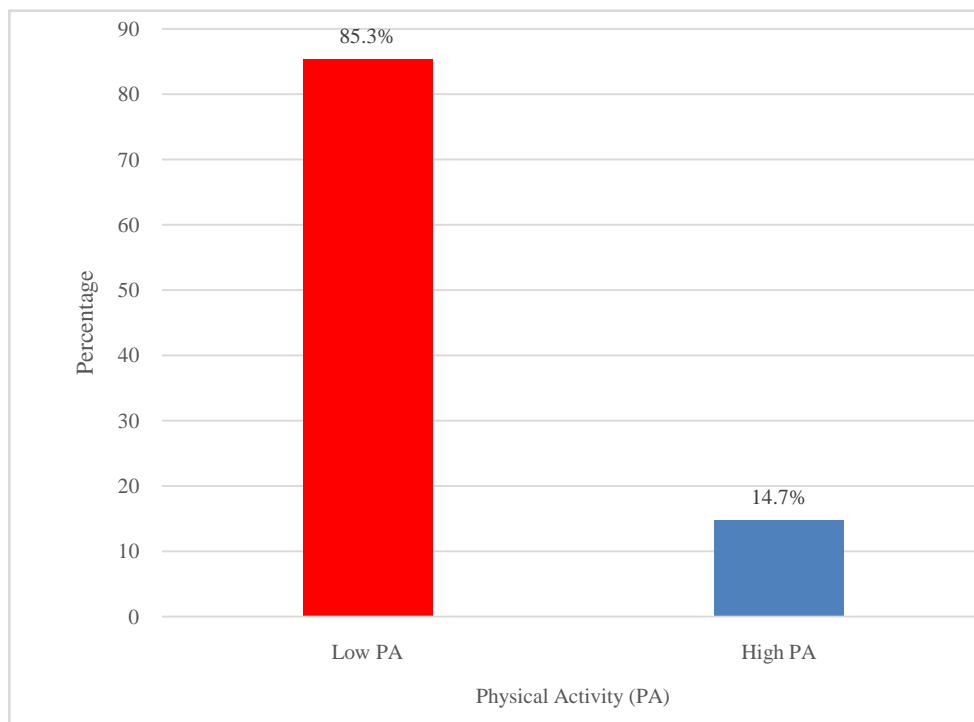


Figure 2. Changes in Physical Activity Level of Participants

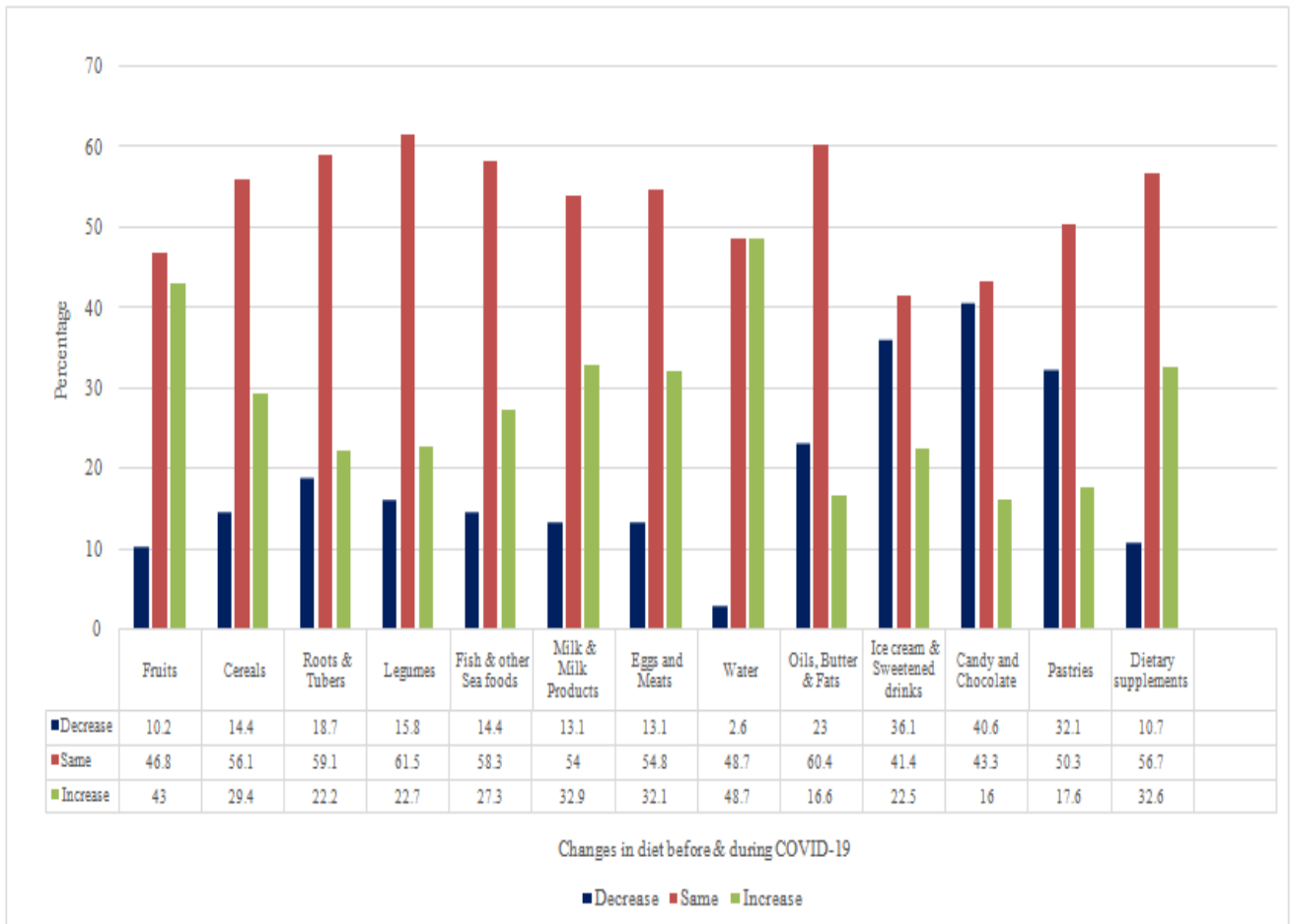


Figure 3. Changes in Dietary Intake of Participants

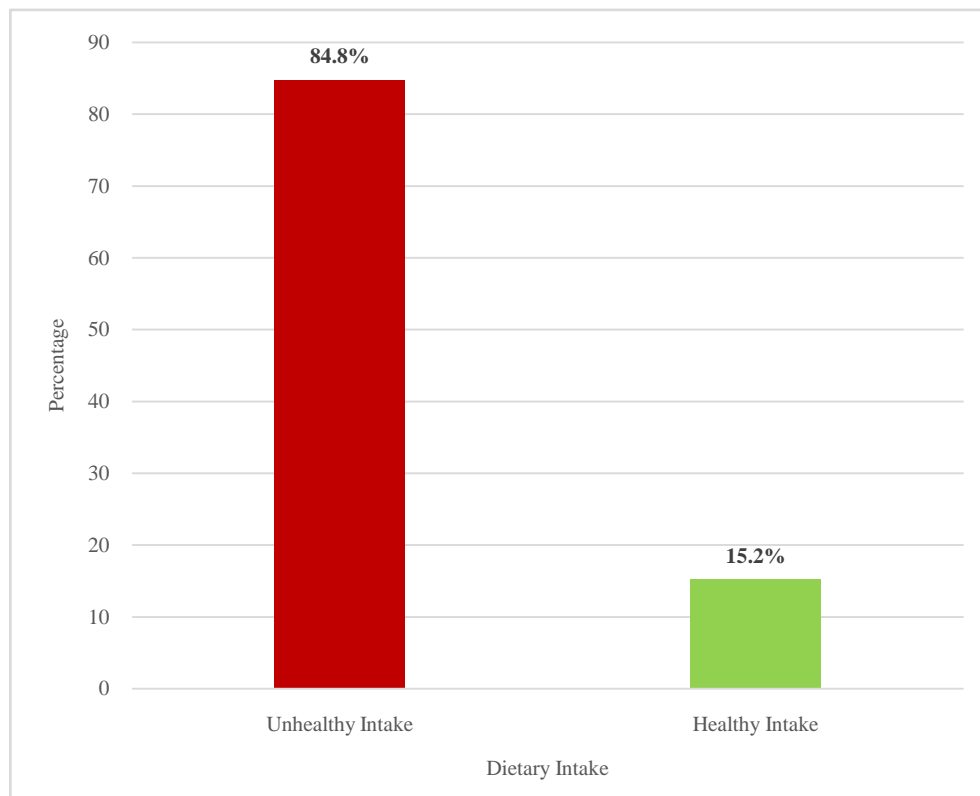


Figure 4. Dietary Intake of Participants

The dietary intake was dichotomized into healthy and unhealthy. A majority (84.8%) had an unhealthy dietary intake while 15.2% had healthy intake as shown in Figure 4.

Table 2 shows the relationship between sleep quantity, physical activity, and dietary intake. A significant relationship exists between sleep quantity and physical activity ( $p < 0.05$ ). Also, a statistically significant relationship exists between sleep quantity and dietary intake ( $p < 0.05$ ).

**Table 2. Association between Sleep quantity, Physical activity (PA) and Dietary Intake**

Variables	Sleep Quantity		$\chi^2$ , p-value
	<8 hours	$\geq 8$ hours	
<b>PA</b>			
Low	161(50.5%)	158(49.5%)	27.010,
High	7 (12.7%)	48 (87.3%)	<b>0.001**</b>
<b>Dietary Intake</b>			
Healthy	150(47.3%)	167(52.7%)	4.837,
Unhealthy	18 (31.6%)	39 (68.4%)	<b>0.030**</b>

\*\* Significant at  $p < 0.05$ .

## 4. Discussion

The overarching aim of this study was to assess the changes in sleep patterns, physical activity levels and dietary intake of students during the school closure caused by the COVID-19 pandemic. Our study showed that the sleep patterns of the students improve in quantity, duration and sleep-wake timing. Wright et al., [20] reported similar findings in the study done during COVID-19 stay at home orders in university students. Even a study done among high school pupils affirmed a positive change in sleep pattern during the COVID-19 pandemic [25]. The similarity of result was due to the measures taken to curtail the spread of the COVID-19, which include school closures and social distance restrictions. Sleep is essential to life, and its deprivation has been linked to poor quality of life and many health problems including, neuropsychiatric disorders, cardiovascular disease, diabetes and obesity [26]. Short sleep duration and poor sleep habits such as late bedtime were associated with poor academic performance among university students [27] and a risk factor for hypertension [28]. Studies have shown that Nigerian University students have a short sleep duration and poor sleep quality [29,30]. Our result showed that sleep pattern in university students is modifiable and can be improved when necessary measures are in place.

In this study, the majority (85.3%) had low physical activity. Similar findings have been reported in university students across the globe by different researchers [31,32,33]. Worldwide, studies have shown that university students are more vulnerable to physical inactivity [34,35]. In Nigeria, before the COVID-19 outbreak, researchers have expressed concerns over the rise in physical inactivity in university students [36,37]. Also, a systematic review and meta-analysis carried out affirmed

the increasing prevalence of physically inactive persons in Nigeria and calls for a comprehensive strategy in improving physical activity across the country [38]. Increased physical activity has numerous health benefits and ultimately increased the quality of life [39], whereas an increase in physical inactivity is associated with chronic non-communicable diseases [40]. Our result shows a worsening state of physical inactivity in university students. Therefore, government and university management need to put in place measures to address this issue capable of soaring chronic non-communicable diseases in the nearest future in the population.

Globally, studies have shown that university students are at increased risk of developing unhealthy eating patterns as they are responsible for their food choices [41,42]. Skipping of meals [43], low intake of healthy foods such as fruits and vegetables [44], and increased intake of junk and fried foods [45] were common dietary practices among university students. These unhealthy eating practices can continue into adulthood and become a primary risk factor for chronic non-communicable disease. In our study, the majority of the participants do not have a change in diet pre-and during the COVID-19 pandemic. The prevalence of unhealthy eating intake (84.8%) was higher compared to what it was (62.7%) in a previous study [23]. In Nigeria, previous studies had expressed worries over the unacceptable level of unhealthy eating practices among university students [46,47]. Unfortunately, there was presently no known studies published during the ongoing pandemic on university students diet in Nigeria to compare our findings. However, studies done in Canada and Northeast Brazil during this period affirmed a decline in healthy eating practices in university students [21,48]. Our findings confirmed that university students' poor dietary intake was further worsened during the pandemic. Therefore, this group should be prioritized for intervention during this pandemic and in the future.

In our study, significant relationships exist between sleep quantity, physical activity and dietary intake. We found that a higher proportion of physically active students had longer hours of sleep. Studies across the globe confirmed that physical activity improved sleep duration in young adults [49,50]. Also, we found that a higher proportion of students with unhealthy dietary intake, sleep longer. Ogilvie et al [51] also affirmed that sleep indices were related to eating behaviour. Our study further brought to the limelight the interrelationship between these modifiable factors, hence, interventions targeting these age groups must consider these relationships.

There are few limitations in this study. First, the study was descriptive cross-sectional in design, therefore, cannot be used to determine the cause-effect relationship. Second, the data obtained from participants were self-reported and may be subjected to recall bias. Lastly, the sleep pattern considered in this study is limited to the duration and sleep-wake time. Further studies can consider sleep quality vis-à-vis the COVID-19 pandemic. However, the major strength of this study was that it was the first among university students following the resumption from the COVID-19 pandemic break that lead to schools' closure in Southwestern, Nigeria.

## 5. Conclusion

The COVID-19 positively influences the sleep quantity of university students. It further compounded the low physical activity and unhealthy dietary intake in the studied population. While the measures taken to curtail the virus are highly commendable, more sustainable measures with minimal interference in physical activity and dietary intake of this vulnerable group should be considered in the future. The variables considered are all modifiable and can be targeted as a point of intervention during this pandemic and beyond.

## Conflict of Interest

The authors declared that they have no conflict of interest.

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This research did not receive any specific funds from any agencies. It was self-funded by the authors.

## Authorship

MDO and AAA made substantial contributions to the conception and design of the study and formulating the research question while BAM, AJO and OEO made vital contributions in the implementation and data collection. All authors were involved in data cleaning, analysis and interpretation. All authors read and approved the final manuscript.

## Ethical Standards Disclosure

A written informed consent was obtained from the study participants after carefully explaining the objective of the study. Ethical clearance (IPH/OAU/12/1637) was obtained from the Health Research Ethics Committee (HREC) Institute of Public Health, Obafemi Awolowo University, Ile-Ife, Nigeria.

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