

Physiology/Medical Education

## Awareness and Attitudes of Secondary School Students about Physiology Discipline in South-west, Nigeria

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**Summary:** Physiology remains one of the core disciplines on which all biological and medical sciences were founded. In Nigeria, it is known that most students study Physiology at the undergraduate level by chance and not by choice and end up performing poorly, which could be mainly due to low awareness and knowledge of the discipline, its opportunities, and prospects. Therefore, this study investigated the awareness, attitude, and knowledge about Physiology among senior secondary school students in South-west Nigeria. A cross-sectional study was conducted on 544 students offering science subjects in senior secondary schools in South-west Nigeria, using a questionnaire designed to measure their awareness, attitude, and knowledge about Physiology. Our results showed a high level of awareness, with television being the dominant medium of information. However, knowledge of Physiology was low, while most students also showed interest in knowing more about it. Although gender does not seem to influence the level of knowledge, females had a better attitude towards learning about Physiology. Although the place of residence did not affect attitude, it was associated with the level of knowledge. In conclusion, the high awareness and low knowledge observed in this study suggest a need to educate students at the early stages of education about the opportunity and prospects of Physiology and other science-related disciplines.

**Keywords:** Physiology, awareness, education, attitude, Nigeria

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Manuscript received- January 2022; Accepted- November 2022

DOI: <https://doi.org/10.54548/njps.v37i2.13>

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### INTRODUCTION

The term Physiology is from Ancient Greek (physis), meaning 'nature, origin', and (logia), meaning ('study of'). It is the scientific study of the functions within a living system. Physiology has a long history, arguably having its root in the works of Aristotle and Galen. The term Physiology was first introduced by the French physician Jean Francois Fernel in his *De Naturali Parte Medicinæ* in 1542 (Lemoine & Pradeu, 2018). Physiology is a sub-discipline of biology that focuses on how organisms, systems, organs, tissues, cells, and biomolecules carry out the chemical and physical functions in a living system and the environment (Hall & Guyton, 2011). Physiology remains one of the core disciplines on which all biological and medical sciences are founded (Lemoine & Pradeu, 2018; Tubbs, 2015).

Human Physiology (subsequently called Physiology) is offered as a course of study at undergraduate and

postgraduate levels in many universities globally. A degree that is known to prepare students to be critical thinkers who can come to independent rational conclusions regarding their health and use the guiding principles of scientific thinking and inquiry as a model for understanding the world around them to achieve sustainable development goals (Idonije *et al.*, 2014). There is no doubt that there is an increasing need for students to study human Physiology either at undergraduate or postgraduate levels due to several reasons; including (1) the increasing demands of medical students offering Physiology at the preclinical level, (2) an increased need for basic medical researchers to translate research findings from bench side to bedside, and (3) increase in the awareness about the relevance of Physiology to the society to solve human health and environmental challenges. According to the Bureau of Labour Statistics, the US department of labour, employment of exercise physiologists is projected to rise about 10% within ten years

between 2018 and 2028, faster than all other occupations on average (U.S Bureau of Labor Statistics, 2020); a value which is still expected to grow considering emphasis been made on exercise and preventive care for the improvement of general health.

In Nigeria, it is generally observed that many students who study Physiology at the undergraduate level do so by chance and not by choice, with only very few opting for it as their preferred course of choice. This is because they could not qualify for preferred courses like Medicine and Surgery or Pharmacy. What seems worse is that many of the students that eventually study Physiology, because of their lack of interest, do not take the course seriously and, in the end, perform poorly in their academic endeavours. This could be primarily due to the lack of awareness about Physiology as a course of study among secondary school students and inadequate orientation about Physiology at the level where students begin to form and choose their career paths. To our knowledge, there is no report on the level of awareness of Physiology as a course of study among secondary school students in Nigeria. Therefore, this study aimed to investigate the level of awareness and knowledge of Physiology as a course of study amongst secondary school students in South-west Nigeria.

## MATERIALS AND METHODS

The study was conducted in the South-west region of Nigeria, one of the country's six geopolitical zones, mainly populated by the Yoruba tribe. This study was conducted in a student population from 16 randomly selected secondary schools (4 per state viz Oyo, Ogun, Osun, Ondo) in 4 of the six states in the South-west (SW) geopolitical zone. Students from senior secondary 2 and 3 in science classes were included in this study. Students were selected by a systematic quota random sampling technique. A total of 544 students (both male and female) were enrolled (Ogun = 169; Oyo = 150; Osun = 141; Ondo = 84). Participation of the students was voluntary. A questionnaire (Supplemental Data 2) designed to measure students' awareness, knowledge, and attitude toward Physiology was used as a tool for data collection. The questionnaire consisted of two (2) questions of awareness, six (6) to examine knowledge, two (2) to examine their attitudes towards the discipline, and nine (9) questions to assess their knowledge of other disciplines in relation to Physiology. Consent was obtained from the principals of the schools, and verbal consent was also taken from the students in the presence of their teachers. The entire questionnaire was explained to the student who self-completed it, staying completely anonymous.

**Sampling:** The process of determining the sample size for the research was based on the data collected from the National Bureau of Statistics (NBS, 2019). The population comprised all senior secondary school students in the South-west region of Nigeria in 2017, which is approximately 24.8% of the total number of students in senior secondary schools in the whole of Nigeria. The minimum sample size was calculated using the sample size determination formula below:

$$n = \frac{N \times Z^2 \frac{P(1-P)}{E^2}}{(N-1) + Z^2 \frac{P(1-P)}{E^2}}$$

*Physiology awareness in South-west Nigeria*

Where  $N$  = population size (Number of senior secondary school students in SW);  $Z$  = Z-statistic at 96% confidence level = 2.05,  $E$  = Error margin, which is  $\pm 4\%$ ;  $P$  = The population proportion of the number of senior secondary school students in SW against the total number nationwide = 24.8%. The minimum sample size estimated was 490. A total of 600 questionnaires were administered. A total of 544 students participated in the study.

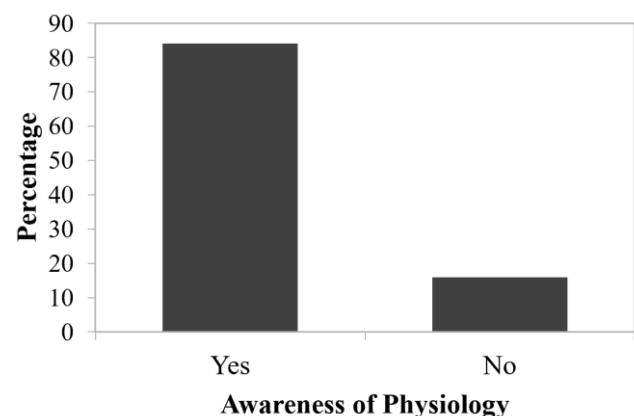
## Statistical analyses

Data were coded and then analysed using Statistical Package for the Social Sciences (SPSS version 20.0, IBM Corp. Armonk, NY, USA). The descriptive statistics were presented as number and percentage of subjects in each category. Three scores were computed using two (2) questions each for awareness (Q1 + Q2) and attitude (Q9 + Q10) and six (6) questions for knowledge (Q3 + Q4 + Q5 + Q6 + Q7 + Q8). For awareness and attitude, a student who responded with at least 1 'Yes' was regarded as 'High', while 0 'Yes' was 'Low'. For knowledge, a response of at least four (4) correct answers was regarded as 'High knowledge', while two (2) or below total correct answers were regarded as 'Low knowledge'. Qualitative data were analysed using Chi-square for any association.  $P < 0.05$  was considered statistically significant.

## RESULTS

**Study Population:** A total of 544 students were enrolled in this study. The participants were senior secondary school science students from 4 of 6 states of the SW geopolitical zone in Nigeria, viz. Oyo, Ogun, Osun, Ondo. The majority of the respondents' age ranges from 10 to 20 years (98%). 308 (56.6%) were males, while 236 (43.4%) were females. The majority were of Yoruba ethnicity (81.6 %) and mostly resided in urban areas (66.9%) (Supplemental data 1).

**Awareness and knowledge of Physiology as a discipline:** We began our investigation by asking a general question on the awareness of Physiology as a discipline. About 84.1% claimed to have heard about Physiology, while 15.9% said to have not heard it before (Figure 1). Majority of the students also believed that Physiology is a medical discipline (85.5%).



**Figure 1.** General awareness of Physiology among secondary school student in South-west Nigeria

To identify misconceptions or incorrect responses, the students were tested for knowledge of Physiology by asking questions relating to the discipline (Table 1). Approximately 77.0% believed Physiology deals with how people think, perhaps mistaking it for psychology or philosophy, as these courses mainly relate to thinking. To further establish the students' claims on their knowledge of Physiology, they were asked to define Physiology in their terms. Surprisingly, only about 36.0% mentioned points relating to Physiology, while the majority (63.6%) said things that were unrelated to Physiology (Table 1).

**Table 1.**

Distribution of the study sample according to their responses to the questions about knowledge of Physiology.

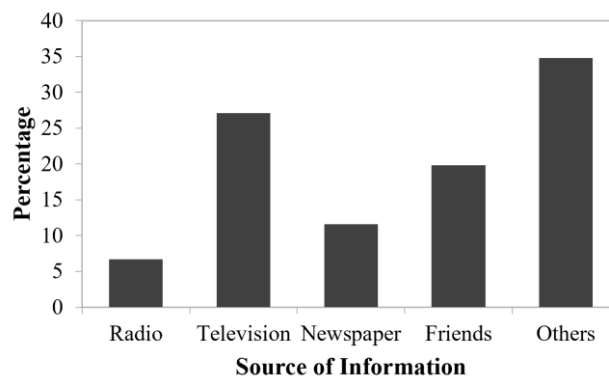
Questions	% Correct answer	% Reporting with a wrong response (Misconceptions)
Does Physiology deal with the study of body functioning?	76.4	23.5
Does Physiology deal with the production of drugs?	48.4	51.6
Does Physiology deal with the way people think?	23.0	77.0
Does Physiology deal with structure of the body?	23.6	76.5
Can people who study Physiology work in the hospital?	42.1	57.9
In your own terms, can you define Physiology?	36.4	63.6

Table 2 shows the distribution of responses to questions about knowledge of Physiology vis a vis other related medical disciplines. The majority of the students also agreed that Physiotherapy (72.5%), Biochemistry (82.2%), Pharmacy (88.6%), and Medicine & Surgery (87.6%) are medical-related disciplines. Likewise, they claimed to be able to differentiate that Physiology deals with body functions (76.4%) while anatomy deals with body structures (75.5%). In contrast, when asked if Physiology also deals with body structures, 76.5% assumed that it did. Also, 51.6% of the students thought that Physiology does not deal with drug production, but Pharmacy does (73.1%).

**Table 2:**

Distribution of the study sample according to their responses to the questions about knowledge of Physiology in relation to other related medical disciplines.

Questions	% Correct answer	% Reporting with a wrong response (Misconceptions)
<b>Is Physiology one of the medical courses? vs.</b>	86.0	14.0
Is physiotherapy one of the medical courses?	72.5	27.5
Is biochemistry one of the medical courses?	82.2	17.8
Is pharmacy one of the medical courses?	88.6	11.4
Is medicine and surgery one of the medical courses?	87.7	12.3
<b>Does Physiology deal with the study of body functioning? vs.</b>	76.4	23.5
Do people who study biochemistry deal with what is happening in our cells and how cells communicate with each other?	61.9	38.1
Do medical doctors treat people who are ill?	62.5	37.4
<b>Does Physiology deal with the production of drugs? vs.</b>	48.4	51.6
Do people who study pharmacy produce drugs?	73.1	26.9
<b>Does Physiology deal with structure of the body? vs.</b>	23.6	76.5
Does Anatomy deal with the study of body structure?	75.5	24.5



**Figure 2.**

Sources of information on awareness of Physiology among secondary school student in South-west Nigeria.

**Knowledge source of Physiology:** The sources of knowledge on Physiology were designed into multiple choices. Television broadcast (27.1%) and "Others" sources (34.8%) were reported as the major sources of information about Physiology. "Others" sources included but were not limited to teachers, family members, schools, books, etc. Radio accounts for about 6.7%, while newspapers and friends were 11.6% and 19.8%, respectively (Figure 2).

**Attitude toward learning about Physiology:** The participants were tested to know their attitude toward knowing or learning about Physiology. About 57.0% of the students replied that they could study Physiology at the university, while the rest stated no interest. About 68.8% of the students would like an awareness event on Physiology in their schools.

**Factors associated with awareness, knowledge, and attitudes toward learning Physiology:** We also investigated factors influencing students' awareness, attitude, and knowledge about Physiology (Table 3). Chi-square analyses revealed an association between the source of information and awareness  $X^2(5) = 94.0, p < 0.0001$ . Gender does not seem to influence Physiology knowledge,  $X^2(1) = 0.463, p=0.496$ .

However, knowledge of Physiology is dependent on the residence, as there is a higher percentage of students (60.2%) living in urban areas with high knowledge compared to rural areas (37.2%),  $X^2(1) = 25.426$ ,  $p < 0.0001$ . Father, but not mother's educational background is associated with the knowledge of Physiology,  $X^2(6) = 31.892$ ,  $p < 0.0001$ ; (mother:  $X^2(6) = 4.349$ ,  $p = 0.63$ ). Source of information is also associated with knowledge  $X^2(5) = 61.645$ ,  $p < 0.0001$ . Furthermore, female students are more likely to learn about Physiology than males,  $X^2(1) = 11.80$ ,  $p < 0.001$ , as 91.1% of females had a high attitude compared to males, 80.5%. In addition, residence does not influence attitude towards learning Physiology,  $X^2(1) = 1.15$ ,  $p = 0.238$ . This implies that students in SW seem motivated regardless of their location. In contrast to the influence of father's educational background on knowledge, attitude of the student towards learning Physiology is not dependent on their parent's educational background (father:  $X^2(6) = 1.17$ ,  $p = 0.978$ ; mother;  $X^2(6) = 5.673$ ,  $p = 0.461$ ).

**Table 3.**

Chi-square test of association between socio-demographic characteristics and awareness, attitude, and knowledge of Physiology.

<b>Variable</b>				
<b>Awareness</b>	<b>High</b>	<b>Low</b>	<b>X<sup>2</sup></b>	<b>P-value</b>
Source of information	406	138	94.016	< 0.0001
<b>Knowledge</b>	<b>High</b>	<b>Low</b>	<b>X<sup>2</sup></b>	<b>P-value</b>
Gender			0.46	0.5
Male	158	150		
Female	128	108		
Source of information	286	258	61.65	< 0.0001
Father's education	286	258	31.89	< 0.0001
Mother's education	286	258	4.35	0.63
Residence			25.43	< 0.0001
Urban	219	145		
Rural	67	113		
<b>Attitude</b>	<b>High</b>	<b>Low</b>	<b>X<sup>2</sup></b>	<b>P-value</b>
Gender			11.81	0.00
Male	248	60		
Female	215	21		

## DISCUSSION

Motivation and passion remain vital ingredients to perform excellently in any endeavour. While there are no official reports, it has been observed that many graduates of Human Physiology from Nigerian universities are neither passionate nor motivated about their course of study. The poor motivation may result from inadequate orientation about prospects and opportunities of Physiology at the early stage. To this end, many of the students ended up studying Physiology by chance and not by choice. Many have probably not heard about the course, Physiology, or what it entails until getting to the university when offered a Physiology admission letter because of not satisfying the requirements to secure their original course of interest. We hypothesized that the awareness and knowledge about Physiology as a course of study is low among university entering candidates. Therefore, to understand and address this problem, we sought to investigate the level of

awareness, knowledge, and attitude of senior secondary school science students about Physiology as a course at the university. This study observed a generally high level of awareness but poor knowledge of Physiology as a course of study among secondary school students. Most students show interest in knowing more about Physiology by organizing awareness programs in their schools to educate them more about the opportunities and prospects of Physiology as a course of choice.

This study was carried out in the South-west of Nigeria. The South-west has the highest number of universities (Mogaji, 2019). In addition, reports by the Joint Admission Matriculation Board (JAMB), the body tasked by the Federal Government of Nigeria to conduct matriculation examinations, showed that universities from the South-west account for one-fourth of the top ten institutions of choice in 2018 (JAMB, 2018). Similarly, approximately 23% of total registered students in 2019 were from the South-west (JAMB, 2019). Taken together, the SW region of Nigeria produces a significant number of students preparing for tertiary education annually.

In this study, 97.6% of the students enrolled in the survey are between the ages of 10 to 20 years; the age bracket is considered when career choices begin (Schoon, 2016). The gender of the responders is comparable with 56.6% males and 43.4% females (Supplemental Data 1). However, this was not the case in the past, when females have always been behind the males in the number of school attendance. This proportion suggests a level of gender equality in this region of the country. The majority of the responders, 84.5%, were of Yoruba ethnicity, a consistent finding because the indigenous language of the SW is Yoruba, although it is inhabited by people from different ethnicity in Nigeria and beyond. Also, we found that most of the respondents, approximately 77.0% reside in urban areas, while 23.4% live in rural areas (Supplemental Data 1). This is consistent with earlier reports that urban children have higher school attendance rates than rural areas (Kazeem *et al.*, 2010). Compared to the rural areas, the urban areas have many different schools and academic training facilities, including private and public schools and learning centers facilitating academic pursuits, which could explain the disparity in school attendance from the two residential areas.

In this survey, we observed a high awareness of Physiology among the students (Figure 1), and television broadcast accounted for the highest single source of information (Figure 2). Previous reports have also indicated that television accounted for the primary source of information among secondary students (Bamise *et al.*, 2011). Therefore, this suggests that television is an important medium to propagate necessary information among these age groups and will serve as a great tool to inform them about the relevance of Physiology and other science courses.

Although the students showed a high level of awareness about Physiology, we found low knowledge of Physiology among the students. While 76.4% of the students claimed Physiology deals with studying body functioning, 77.0% equally believed Physiology deals with how people think, perhaps mistaken for psychology or philosophy, as these courses mainly relate to thinking. In addition, 76.5% think it deals with the study of body structure, perhaps mistaken for Anatomy, and 51.6% believe it deals with drug

production, mistaken for Pharmacy. When asked to define Physiology in their terms, only about 36.0% mentioned points relating to Physiology, while the majority, 64.0%, said unrelated things to the meaning of Physiology (Table 1). These suggest that the students generally have insufficient knowledge of Physiology. Many students have little idea, as reflected by their high awareness level, but they are mostly unsure of the context of Physiology as a discipline. However, most students seem to know about other courses such as Anatomy, Biochemistry, Pharmacy, and Medicine & Surgery, suggesting that their knowledge of these courses is generally higher than that of Physiology (Table 2). This finding corresponds with the choice of courses spread within these medical-related disciplines in the university.

For instance, in 2015, the University of Ibadan (South-west, Nigeria) recorded 162 applicants for Physiology as opposed to 9,879 for Medicine, 2,420 for Pharmacy, 837 for Biochemistry, and 470 for Physiotherapy. Similarly, Ahmadu Bello University, Zaria (North-west, Nigeria), recorded 176 applications in Physiology as against 12,555 in Medicine, 4,189 in Pharmacy, 212 for Anatomy, and 1,917 in Physiotherapy (JAMB, 2016). In the same year, University of Calabar (South-south, Nigeria) recorded 114 for Physiology, 5,213 for Medicine and Surgery, 181 for Anatomy, and 464 for Biochemistry (JAMB, 2016). The relatively low application for Physiology could be due to insufficient knowledge of the course.

After examining the students' awareness and knowledge about Physiology, this study further seeks to know their general attitude and interest in Physiology as a course of study. While 57.0% of the students indicated they could study Physiology at a university, the remaining 43.0% were uninterested or unsure. This is also demonstrated in the above statistical report from JAMB that Physiology is about the least preferred course in the medical-related disciplines. Concerning the low knowledge of Physiology, the students were willing to be taught about Physiology through awareness events held in their schools. This is interesting because, at this stage, the students showed no substantial interest in studying Physiology in university, and no one will consider studying a course s/he does not know. Despite this, they demonstrated significant interest in knowing more about the opportunities and prospects that await Physiology graduates. Therefore, we see a chance to educate them about the relevance of Physiology and its possibilities in this contemporary age.

Moreover, when we determined factors that might influence the student's perception, attitude, and knowledge about Physiology, we found a significant association between the source of information and awareness. While gender does not seem to influence the knowledge of Physiology, residence affects the level of knowledge. This is in line with the previous reports that students who reside in urban areas were better informed than those from rural areas (Sabnis *et al.*, 2016; Wilson *et al.*, 1989). This is understandable considering that rural areas relatively lack the basic amenities (like electricity, internet, and electronic media devices) that could provide the students with the requisite information.

Earlier reports indicate that parental educational status has a long-term influence on children's educational and occupational success (Dubow *et al.*, 2009). In this study, we

found that the father's but not the mother's educational background was associated with the students' knowledge of Physiology. This may be because fathers have more influence than mothers in their homes in an average African setting, and their children may tend to listen to them more. Although our study did not determine which parent influences which gender, the report shows that a father's education has a stronger effect than a mother's education on perceived parental encouragement, college attendance and graduation for males. However, for females, both fathers' and mothers' education has an almost equal effect (Sewell & Shah, 1968).

Further study is required to delineate how much influence each of the parents wields and how much it affects the children's choice of courses, particularly science-based courses, in the university. Interestingly, we found that female students are more likely to learn about Physiology than males. This is probably due to increased awareness and orientation for girls as part of the push for women's participation in science, technology, engineering, and mathematics (STEM) industries (Charlesworth & Banaji, 2019; Wang & Degol, 2017). Several studies have shown the effect of rural-urban residency on academic performance, and the reports have been conflicting, with some showing urban residents do better, some rural residents perform better, and others show no difference (Alokan & Arijesuyo, 2013; Bulala *et al.*, 2014; Faisal *et al.*, 2016). These reports suggest that rural-urban residents may or may not impact particular school abilities. While we did not investigate residency's impact on academic performance in this study, we found that residency does not influence attitude toward learning Physiology. This implies that the students seem motivated regardless of their location.

In conclusion, this study provides preliminary data from a country and region where current information on students' awareness and knowledge about Physiology is unavailable. In this study, we have shown high awareness but low knowledge about Physiology discipline among senior secondary science students, television as their dominant medium of information, and indifferent attitude towards studying Physiology as a course at the university. Also, we found that residence and father's educational background influences knowledge of Physiology among the students and that females are more likely to study Physiology. This study, therefore, provides the requisite data demonstrating a generally low knowledge of Physiology as a course of study. This affords us a credible opening to educate the students at the early stages about the opportunity and prospects of Physiology and other science-related disciplines in Nigeria. Further studies will be needed to assess the awareness of Physiology in the other geopolitical zones of Nigeria.

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