

CLINICAL RESEARCH

# Educational Awareness and Knowledge Concerning Field of Biotechnology among Biotechnology Students at Debre Birhan University, North Shewa, Ethiopia

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## **ABSTRACT**

### **BACKGROUND**

Progressive natural sciences, for example, biotechnology, are assuming control over the million-dollar businesses because of their approaching applications, just as their significance in the well-being of living creatures. This investigation aims to decide the variables associated with choosing this field, their vocation inclinations, educational awareness, and knowledge of biotechnology.

### **METHODS**

The study undertook at Debre Birhan University through a pre-approved questionnaire given to the students joined in the biotechnology department. A total of 220 students, 130(60.46%) females, 85(39.53%) males, and 5 (2.32%), failed to give their data. Students who were involved in this study gave their agreement to record their responses. Student replies were analyzed using the Statistical Package for the social sciences (SPSS) [version 20.0].

### **RESULTS**

Out of 220 Biotechnology students, 215 participants filled the questionnaire; therefore, the response rate was (97.72%). Of 215 respondents, 116(53.95%) were not mindful of the scope of biotechnology before getting admission in the biotechnology program, 20(9.30%) were interested in research. In contrast, 29(13.48%) were either indifferent or indeterminate about their choices.

## **CONCLUSIONS**

Almost all participants, 186(86.51%), we're able to seek a job in biotechnology after their graduation, and Personal curiosity was the prominent factor 139(64.65%) included in the choice succeeded by status 31(14.41%) and income 15(6.97%) correspondingly.

## **KEYWORDS**

Awareness; Biotechnology students; Debre Birhan University; Knowledge; North Shewa

## **INTRODUCTION**

Biotechnology is a science and innovation field that shows a fast improvement in the 21st century. Ethiopia is one of the nations keen on using biotechnology to move the present economy towards a top-level economy. Science instruction has a significant task in creating human assets and abilities for the biotechnology field in non-industrial nations to make progress [1]. Biotechnology is one of the comparatively new expanses of science that progressively impacts our lives globally almost in all fields of society, from medical care and food items to environmental issues and energy sources [2,3].

Although cheese, wine, and beer are the products of old-style biotechnology, they are even now considered prominent parts of human innovation action. The present-day biotechnology displays remarkable high quality joined with restricted information on the part of the community [4,5]. Currently, scientific literature, the capacity to peruse and expound on science and innovation, biotechnology specifically inside the setting of this investigation, is planned for all because of its importance in traditional settings and that it empowers people to participate in argument and decision-making in settings highlighting scientific knowledge [6,7].

Hence, current contentions emphasize the requirement for individuals to know something about science and make science open to all. Natural sciences' scope and applications cover unique and different methods, including organisms [8,9]. Many progressions in the field of agriculture and medication have been made conceivable by biotechnological applications. For example, many genetically modified crops are available, a technique that alters a person's genes to treat or cure disease already exists, and treatments of disorders caused by pathogens are possible [10-13]. With the help of microbiology, biotechnology has reformed clinical sciences by presenting various drugs and proteins that are accessible either in the bazaar or in advanced exploratory stages [14,15]. Genetic engineering almost certainly has, from one viewpoint, given some marvellous items, yet some ethical and moral contemplation can be a state of worry about humanity [16,17]. Now, it is the time to make students mindful of the relative multitude of upsides and downsides of biotechnology items or study for the eventual fate of science. This study envelops that load of variables engaged with choosing biotechnology, their vocation prospects, disposition, and information concerning the biotechnology profession among biotechnology scholars at Debre Birhan University, North Shewa, Ethiopia.

## **MAIN TEXT**

### ***Main text***

### ***Study area and design***

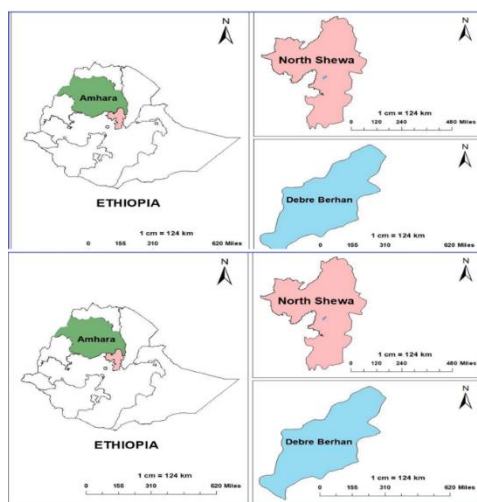
In this study, a pre-approved questionnaire was the principal tool for data gathering. The study was undertaken at Debre Birhan University through a pre-approved questionnaire given to the students joined in the biotechnology department. A total of 220 students, 130(60.46%) females, 85(39.53%) males, and 5(2.32%), failed to give their data. Students who were involved in this study gave their agreement to record their responses. The responses were analyzed by statistical package for the social sciences (SPSS) version 20.0. Debre Birhan University is in Debre Birhan town, North Showa Zone, Amhara National Regional State, 130 km North-East of Addis Ababa, the capital city of Ethiopia.

### ***The admission selection process and requirements***

All the freshman students, after they have completed the first-semester study, they have been given the opportunity to choose the department they are interested in. In this process, three main selection criteria have been applied, namely, the capacity of the departments that how many students they accept, the first-semester cumulative grade point average (CGPA), and students' interest in which department they want to join. Based on the above selection criteria and requirements, students will allocate to different departments.

According to 2021 Registrar Office reports on July 28, the University has 25,346 students, ten colleges, and 53 departments. Among 25,346 students, 10,759 attended regular programs, 11,890 were summer program students, and 2697 were extension program students. Out of 10,759 regular students, 10,195 were undergraduates (6,469 males and 3,726 females), 547 were MSc students (352 males and 195 females), and 17 were Ph.D. students (15 males and two females). Of 11,890 summer students, 9,826 were undergraduates (7,111 males and 2715 females), 2064 were MSc students (1708 males and 356 females). Out of 2697 extension program students, 2,151 were undergraduates (1,195 males and 956 females), 546 were MSc students (409 males and 137 females). All undergraduate students were the source of the population.

The study population was biotechnology students from the second year to the final year of the biotechnology department. Many questions were asked concerning job preferences, attitude about the scope of biotechnology, awareness regarding this field, the impact on the healthcare system, and factors inducing their choice and postgraduate studies. The answers gathered were saved in excel sheets and further analyzed by statistical package for the social sciences (SPSS) software version 20.0.



**Figure 1:** Study area.

## RESULTS

The overall response rate was 215 (97.72%), and the mean age was 21.5 years. The non-respondent rate was 5 (2.32%). Table 1 reveals the knowledge and attitude of students regarding the scope of biotechnology. 90 (41.86%) students knew about the area of biotechnology before admission. Most of the 161 (74.88%) thought that biotechnology education and practice positively affect the health care system. Half of them, 108 (50.23%), thought that biotechnology education and training do not affect the healthcare system. In comparison, 20 (9.30%) did not know whether biotechnology education affects or does not affect the health care system. 67(31.16%) students were not sure about their professional roles.

**Table 1:** Attitude and knowledge of Debre Birhan University students regarding biotechnology scope.

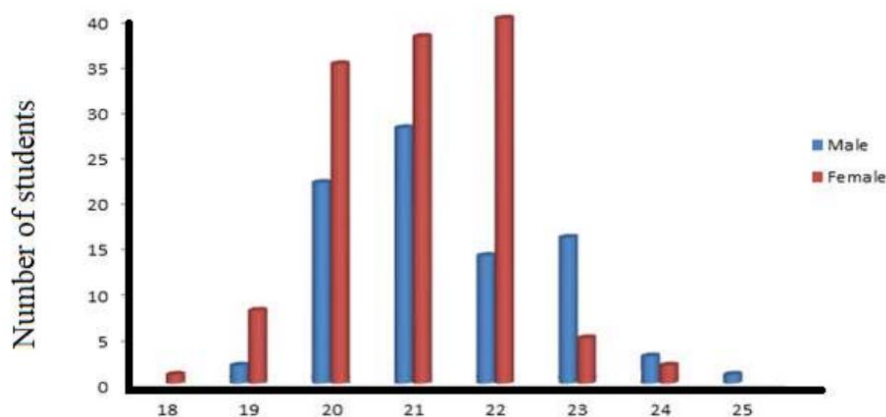
Questions	Responses, n (%)			Mean ± standard deviation
	Yes	No	don't know	
Before biotechnology, were you aware of its scope?	90 (41.86)	72(33.48)	44 (20.46)	68.67 ± 23.18
Does biotechnology education and practice affect the healthcare system?	87 (40.46)	108 (50.23)	20 (9.30)	70.00 ± 44.03
Does biotechnology education and practice have a positive effect on the health care system	161 (74.88)	35 (16.27)	19 (8.83)	71.67 ± 77.78

**Table 2:** Preferences and knowledge of students toward the professional role and postgraduate studies.

Questions	Responses, n (%)			Mean ± standard deviation
	Yes	No	Maybe	
Are you aware of the postgraduate studies' opportunities related to your chosen field?	104 (48.37)	51 (23.72)	60 (27.90)	71.67±28.36
Have to acquire much more knowledge and skills than other healthcare students?	114 (53.02)	46 (21.39)	55 (25.58)	81.67±54.17
Security of what my professional role will be?	67 (31.16)	106 (49.30)	42 (19.53)	71.67±32.25

**Table 3:** Students' knowledge and understanding of biotechnological issues and concepts.

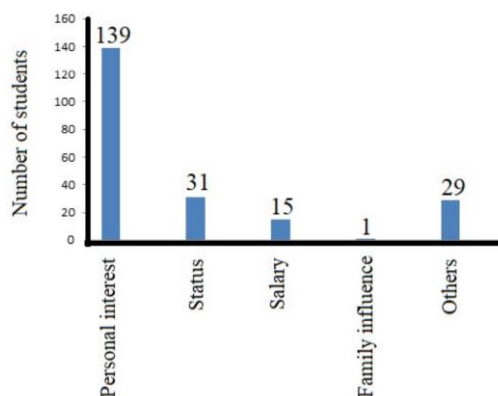
Questions	Responses, n (%)		Mean ± standard deviation
	Yes	No	
Is biotechnology a risk to the environment and humans?	65 (30.23)	150 (69.76)	107.5 ± 60.10
Is birth control and prenatal testing and the issues associated with it should be included in the lessons?	165 (76.74)	50 (23.25)	107.5 ± 81.32
Is human cloning, issues associated with it, and bioethics education should be included in the lessons?	168 (78.13)	47 (21.86)	107.5 ± 85.56
Is genetic modification of food, animals, plants, and humans a good thing?	190 (88.37)	15 (6.97)	102.5 ± 123.74
Is using genetically engineered microorganisms in vaccines for the benefit of humanity a good thing?	197 (91.62)	18 (8.37)	107.5 ± 126.57



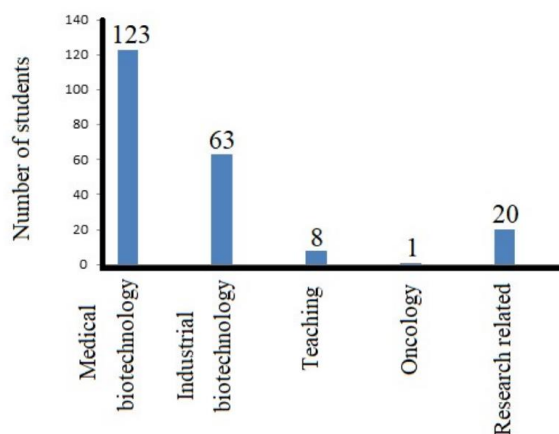
**Figure 2:** 18 to 25 years were the age of the respondents.

As per Table 2, 104 students (48.37%) were aware of postgraduate opportunities in their field, 51(23.72%) weren't aware of postgraduate opportunities in their respective areas. In contrast, the remaining students were either not interested or unsure about their decision 60 (27.90%). As per figure 2, the age of students ranged from 18 to 25

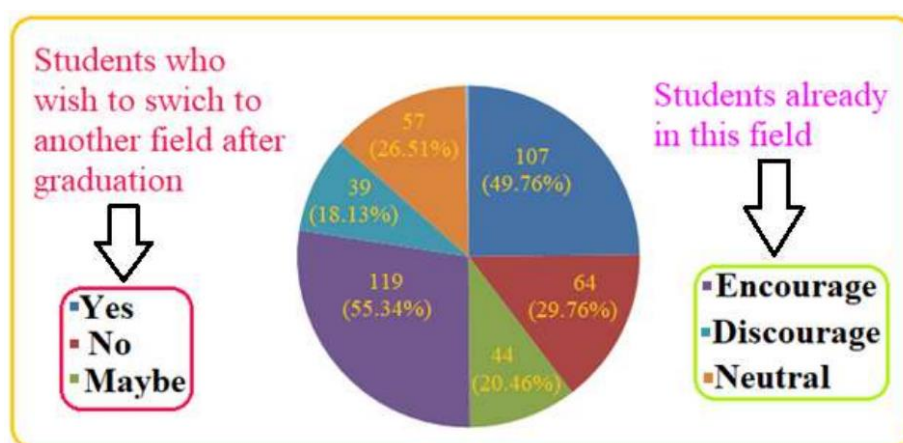
(mean age was 21.5, SD = 2.45). Among 215 respondents, one female student was 18-years old, and one male student was 25. Whereas ten students were 19 years old (2 males and eight females), 57 students were 20-years old (22 males and 35 females), 66 students were 21-years old (28 males and 38 females), 54 students were 22-years old (14 males and 40 females), 21 students were 23-years old (16 males and five females), five students were 24-years old (3 males and two females), and one student was 25-years old (male).



**Figure 3:** Influencing factors choosing biotechnology as a major study field.



**Figure 4:** Specialization preference of students.



**Figure 5:** Career prospect-related questions and students' replies.

As per Figure 3, they were influencing factors choosing biotechnology as a significant study field was personal interest 139(64.65%), status 31(14.41%), salary 15(6.97%), family influence 1(0.47%), and other factors 29(13.48%) respectively. As per figure 4 preferred area of specialization after graduation was medical

biotechnology 123(57.21%), industrial biotechnology 63(29.30%), teaching based jobs 8(3.72%), and other areas were oncology 1(0.47%), research-related jobs 20(9.30%). As per figure 5, 107(49.76%) students wanted to pursue other fields rather than biotechnology, and 39(18.14%) students were discouraged strongly by their superior fellow students.

Among 215 respondents, 114(53.02%) considered obtaining more knowledge and skills than other healthcare students. Numerous students 150(69.76%) believed that biotechnology is not a risk to the environment and humans, and also, as per table 3, above 88% of the participants encouraged genetic modification of various organisms for a better variety of food, breed, and protection against different pathogens via vaccines.

For the assessment of attitude and knowledge, the Debre Birhan University student responses for the question regarding the scope of biotechnology were 90 with yes, 72 with no, and 44 replied as we don't know ( $M \pm SD = 68.67 \pm 23.18$ ). The next question regarding biotechnology education and practice affecting the healthcare system was 87 with yes, 108 with no, and 20 with don't know reply ( $M \pm SD = 70 \pm 44.03$ ). Similarly, for the question regarding biotechnology education and practice with a positive effect on the health care system, 161 replied yes, 35 replied no, and 19 replied as don't know ( $M \pm SD = 71.67 \pm 77.78$ ) (Table1).

The assessment of preferences and knowledge of students towards the role in the profession and postgraduate studies, the responses for the question regarding the awareness of the opportunities in postgraduate studies related to their chosen field was 104 with yes, 51 were with no, and 60 of them replied as don't know ( $M \pm SD = 71.67 \pm 28.36$ ). Another question regarding acquiring much more knowledge and skills than other healthcare students, the responses were 114 as yes, 46 as no, and 55 replied that they don't know ( $M \pm SD = 70 \pm 44.03$ ). Responses for the question regarding the security of their professional role in the future were 67 with yes, 106 with no, and 42 replied as they don't know ( $M \pm SD = 71.67 \pm 32.25$ ) (Table 2).

Assessment of students' knowledge and understanding of biotechnological issues and concepts with the question on whether the biotechnology field is a risk to the environment and humans, the replies were 65 with yes, and 150 with no all in all, ( $M \pm SD = 107.5 \pm 60.10$ ). For the question of whether birth control and prenatal testing and its issues should be included in the lessons or not, the replies were 165 with yes, and 50 with no ( $M \pm SD = 107.5 \pm 81.32$ ).

Question regarding the association of human cloning issues and the inclusion of bioethics education in the lessons the replies were 168 with yes, and 47 replied as no ( $M \pm SD = 107.5 \pm 85.56$ ). For the positive opinion on the genetic modification of food, animals, plants, and humans, the responses were 190 with yes, and 15 were replied as no ( $M \pm SD = 102.5 \pm 123.74$ ).

Ultimately, the question on whether the use of genetically engineered microorganisms in vaccines for the benefit of humanity is a good thing or not, the replies were 197 as yes, and 18 replied with no ( $M \pm SD = 107.5 \pm 126.57$ ) (Table 3).

## **DISCUSSION**

The improvement of biotechnology in Ethiopia these days ought to have the option to change the general public's view towards this scientific field. Due to the deficient and absence of related data, society had the wrong perspective and negative suppositions towards the biotechnology field. When an individual studies biotechnology, he becomes more acquainted with an innovation that is, on the one hand, ancient (i.e., making bread) and then again is new (i.e., rDNA, genetic engineering). This "cutting edge" biotechnology has quickly added to the advancement of clinical, agricultural, and industrial breakthroughs. Even though it reveals a high capacity to resolve a set of difficulties in our advanced world, it is overseen by numerous ethical debates [18]. The high significance of the biotechnology subject has asked to do a specific duty at the college and university level toward advising scholars in a "sound" way about the scientific and specialized parts of biotechnology just as to qualify them as future experts to adapt to the guidelines and dangers of biotechnology. For this reason, conducting a survey is required to know educational awareness and knowledge among biotechnology undergraduate students at Debre Birhan University in issues related to biotechnology and understanding its ethics.

As per the demographical information (Figure 2), most study subjects were females, addressing 130(60.46%) of the participating students. 39(18.14%) students were discouraged strongly by their superior fellow students; this may be because of fewer job opportunities for most senior graduates. Instead, 119(55.34%) students were encouraged to enrol in the subject. The response may be because biotechnology is comprehensive, and Ethiopia will open many biotechnology companies shortly. Biotechnology is a many-sided part of science, and scholars' experiences in this field primarily depend on their satisfactory agreement and information on significant ideas.

Those scholars who knew about biotechnology instruction had a great disposition toward this field, and they had the option to pick an area of research when contrasted with other students. Nevertheless, more extensive parts of the scholars included in this study do not think about the extent of biotechnology before induction. Nearly every one of the scholars of Ethiopia, Pakistan, and some different nations want to get into clinical school in the wake of passing their Higher Secondary School assessments [19,20]. Thus, in this manner, upon admission, they stay tangled and experience the ill effects of an outrageous degree of uneasiness while choosing a field of specialization in their graduation time [21-23]. Thus, pretty much every scholar of science thinks about the degree and significance of clinical careers. However, they stay ignorant of these fields. This response is because of several critical reasons listed as a) few of them are from constricted educational programs with an obsolete plan of courses instructed at the primary and secondary level, b) absence of professional direction by expert guides in instructive organizations, c) critical perspectives, and strict contention displayed by the overall population towards biotechnology and genetically changed organic entity causing deterrent in the advancement of this field [24,25]. The outcomes of our research are related to different investigations that decided lacking information and awareness of college scholars toward biotechnology before they get admission [26-30].

A vast majority of studies were pointing to mindfulness and information toward biotechnology among the overall population. A significant number of these researches were drawn from Eurobarometer, a broad overview on society, science, and innovation in European nations [31].

Likewise, there are various investigations worldwide on the understandings and consciousness of biotechnology since formal tutoring is viewed as quite possibly the best way to add to people's logical education [32]. For example, researchers [33-37] reported as weak-to-good under the knowledge of biotechnology among Brazilian, British, Taiwanese, Australian, and Turkish students. The results of our study showed similar conclusions.

The outcomes of investigations done by researchers [38,39] revealed that related acceptance of scholars, positive awareness, and knowledge towards genetically modified organisms were outstanding. The trend is similar to the results of our study (Table 3). But our study's findings contrast with the previous researches done by [38,40,41], which additionally announced frail information on biotechnology among various student groups. Although, the study subjects had elegant perspectives toward utilizing genetically modified organisms and genetic engineering in agro-industry, human medication, and decaying of human sewage. The opportunities in the biotechnology sector as a career option in Ethiopia are to be enhanced with revisions in the educational plan to make scholars more educated about this field. A comparative report publicized that scholar of the United Kingdom and Taiwan having more information about biotechnology at the primary level had more curiosity in this field when contrasted with the individuals who had deficient colleagues with biotechnology basics in the underlying phases of their studies [34].

There is a strong need in non-industrial nations like Ethiopia to make their scholars of schools and universities significantly more mindful about biotechnology and their subfields. 111(51.62%) respondents had decreased reaction concerning postgraduate studies, which indicates loss of imagination in them, which might be the consequence of melancholy and nervousness about the role of biotechnology in the future [42]. Nevertheless, the outcomes of our study showed 20 (9.30%) scholars were interested in research and needed to seek after professions in it.

In our report, being not mindful, neutral, or mindful was considered the final response; yet, it was not satisfactory whether these sentiments were formed by different effectors, i.e., impact from family or companions. The effect of these groups on educational awareness and knowledge regarding biotechnology needs investigation.

## **CONCLUSION**

This research imparts to know the level of information and mindfulness towards biotechnology and its application among scholars at Debre Birhan University. The results of the study showed scholars accepted that biotechnology schooling and practice firmly impact medical care administrations. Their most loved professions were medical biotechnology and industrial biotechnology, respectively. Individual interest was the most affecting component engaged with this determination. Many respondents were uninterested in research-related jobs and teaching.

Only one student was interested in oncology, while 119 participants (55.34%) could advance their professions in biotechnology after graduation.

## **DATA AVAILABILITY**

All of the required data will be available upon request to the corresponding author.



## **CONSENT**

Written informed consent was obtained from each participant.

## **AUTHORS' CONTRIBUTIONS**

All authors contributed equally to the reported work, in the concept and design of the research, execution, data collection, analysis, and interpretation and engaged in the drafting and critical review of the paper.

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## **CONFLICTS OF INTEREST**

There are no conflicts of interest.

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