Biotechnology knowledge and perceptions issues among students in the Faculty of Agriculture and Forestry, University of Ibadan

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Abstract

This study investigated agricultural students' knowledge and perception of biotechnology issues. The study was carried out at the Faculty of Agriculture and Forestry of the University of Ibadan. Proportionate sampling method was used to select a sample size of two hundred and sixty four (264) respondents. Variables measured included respondents' demographics, biotechnology information sources, knowledge and perception. The data were analyzed using frequencies, percentages and mean for descriptive analysis while Chi-square analysis, Pearson Product Moment correlation and analysis of variance were used for inferential analysis. Findings reveal that 54.5% of the respondents were female, 56.1% of the respondents had negative perceptions towards biotechnology issues while 82.2% of the respondents had average knowledge level on biotechnology issue. A significant relationship exists between each of respondents' years of formal education, ($r = 0.122$, $p = 0.047$), religion, ($\chi^2 = 8.015$, $p = 0.018$) department ($\chi^2 = 23.498$, $p = 0.024$) and their knowledge of biotechnology. Significant difference exists between the knowledge level of the respondents across the sampled departments ($F = 3.446$, $p=0.003$). It was concluded that most of the respondents had unfavorable perception and an average knowledge level on biotechnology issues. The study recommends that learning should not be limited to classroom setting alone. Visits to research institute or private firms who are into research on biotechnology should be arranged for students of faculty of agriculture.

Keywords: Biotechnology, Knowledge, Perception, Agricultural students

INTRODUCTION

Agricultural biotechnology is a new and rapidly emerging area of science and technology. It promises new ways to harness and improve the biological potentials of crops, livestock, fish, and trees, and improved ways to diagnose and control the pests and pathogens that damage them (Serageldin and Persley, 2000). However, students tend to have poor understanding of biotechnology issues, though the impact of these technologies on peoples' everyday lives is increasing daily. Students are an important audience in the biotechnology discourse. It is pertinent that students in the Faculty of Agriculture and Forestry who are future scientists and advocates are knowledgeable about biotechnology issue.

Generally literature is replete with knowledge and perception studies relating to biotechnology. Early studies of biotechnology and students, suggested lack of understanding of the scientific and science principles not only by the researchers but also by students, many of whom are expected to be future advocates of the processes and applications of biotechnology (Labov, 2003 and Wingenbach *et al* 2002). Current trend still indicates that lack of knowledge about biotechnology and remain the primary reason for anxiety about Genetically Modified Organism (GMO) (Tegegne, Aziz, Bhavsar and Wiemers, 2013 and Lamanaukas, 2008).

The lack of knowledge of biotechnology widely reported among student may be attributed to the inability of scientists to explain biotechnology breakthrough in simple terms. This, may be seen as an information and education gap, which may be due to lack of understanding the technical science behind biotechnology (Wingenbach *et al* 2002). Contributing to this misinformation on biotechnology is the low knowledge of students on basic agricultural and biological sciences. This lack of understanding generates concern. Results emanating from surveys indicate that provision of factual information increases audience acceptance (Hoban, 2003).

Scientists remain a major source of information to the student audience despite the

use of complex of scientific language in providing biotechnology breakthrough. Goodrum *et al* (2001) point to scientific literacy as a key element in scientific discourse as it helps students to develop deeper understanding of the world around them and enable them participate meaningfully to relevant discourse about everyday life activities. Biotechnology represents a typical scientific discourse (Sturgis *et al,* 2005) and scientific literacy helps individual to be knowledgeable about science content and ability to critique scientific debates (Coll *et al* 2008). Students are a part of the biotechnology discourse and their lack of knowledge and poor perceptions of biotechnology issues continues to generate interest among researchers and hence remains the focus of numerous studies.

Researchers concerns about lack of biotechnology knowledge among students undermine the expectation that they become future campaigners of the concept and processes and applications of biotechnology (Alberts and Labov, 2003). It also complicates the desire for students who are major stakeholder in the biotechnology discourse that are expected to understand the basics of biotechnology and its implications in agricultural development, environment, personal and public health. Investigating students' knowledge and perception of biotechnology in the faculty of agriculture and forestry is critical to educating them in biotechnology.

Overall, agricultural biotechnology and perceptions are based on information source, cultural preferences and confidence in governmental safeguards (Hoban, 2003). He also argued that lack of knowledge and experience of a topic can lead to inaccurate perception and providing factual information improves acceptance and hence perception. Furthermore, students often struggle to translate information from scientists about biotechnological breakthroughs as a result of the complexity of the language (Doerfert, Faberston, Akers and Kister, 2005). Biotechnology issues relating to students knowledge and perception can be viewed along these lines of thought. Can the same be said for students of the Faculty of Agriculture and Forestry who have opportunities to become engaged in science classes, laboratories and dialogue with university scientists and lecturers? This study thus determined respondents' personal characteristics, information sources, assess their perception and knowledge of biotechnology and the influence of the various departments on their knowledge of biotechnology. Also relationships between respondents' personal characteristics and their biotechnology knowledge, perception, information sources, and influence of departments on their knowledge of biotechnology were investigated.

METHOD

The study was conducted in the Faculty of Agriculture and Forestry, University of Ibadan, Nigeria. This Faculty is made up of eight departments; Animal Science, Agricultural Extension and Rural Development, Agricultural Economics, Agronomy, Forestry Resource Management, Fisheries and Aquaculture, Wildlife and Ecotourism, and Crop Protection and Agricultural Biology. The target population consisted of all 300, 400, and 500 students in the eight departments. Stratified and proportionate random sampling techniques were used to select 40% students from 300, 400 and 500 levels from the eight departments which resulted in a total of 264 students. The 100 and 200 level students were not included in the study because they only take courses at the faculty level and have not been assigned to departments in the Faculty.

A well structured questionnaire based on the research objectives and hypotheses developed for the study was used to collect data. Information was collected on knowledge, perception, sources of information and personal characteristics of the respondents. Descriptive statistics and inferential statistics such as chi-square, ANOVA and correlation were used to analyze the data collected.

Measurement of variables

A series of 28 items and 30 statements were used to measure their biotechnology perception and knowledge.

a) Knowledge of biotechnology: Students were asked to respond to 30 statements, half positively worded and half negatively worded. They were asked to provide a yes (1) or no (0) answers. Maximum and minimum scores of 30 and zero were possible. Overall, knowledge scores were categorized into high, average and low.
b) Perception of biotechnology: Students responded to 28 statements on a five point Likert scale with the following ratings: strongly agree (5), agree (4), undecided (3), disagree (2) and strongly disagree (1). Negatively worded items were reversed before summing the score. Maximum and minimum scores of140 and 28 were possible. Finally, overall perception scores were

categorized into favourable (74-148) and unfavourable (less than 74).

RESULTS AND DISCUSSION

Respondents' personal characteristics

Table 1 shows that respondents were a mix of female (54.5%), and male (45.5%), aged between 21-25years. Results also show that many respondents had early education in private primary (65.9%) and public secondary (56.8%) schools respectively, had between 3-5 years university education. Averagely they have had 15-19 years of formal education which is considered to have some influence on their knowledge and perception of biotechnology and related issues. However, religious affiliation indicates that majority are Christians (68.2%).

Table 1: Personal characteristics respondents'

Variables	Frequency	Percentage
Gender		
Male	120	45.5
Female	144	54.5
Age		
16-20	39	14.8
21-25	175	66.5
26-30	44	16.7
31-35	4	1.50
Above 35	1	0.40
Religion		
Islam	83	31.4
Christianity	180	68.2
Traditional religion	1	0.40
Primary school attended		
Private	174	65.9
Public	90	34.1
Secondary school attended		
Private	114	43.2
Public	150	56.8
Respondents Department		
Agricultural Extension	34	12.9
Agricultural Economics	65	24.6
Agronomy	37	14.0
Animal Science	42	15.9
Crop protection & Environmental Biology	17	6.40
Forestry	25	9.50
Wildlife and fisheries	44	16.7
Years of formal education		
10-14	52	19.5
15-19	197	74.7
20-25	15	5.80

Respondents' knowledge of biotechnology

Table 2a presents the result of respondents' knowledge of biotechnology. The results on respondents' knowledge of biotechnology show that respondents' knowledge was high on issues relating to the fact that biotechnology is the genetic manipulation of living things ($\bar{x}$ = 0.898), being a practical application of genetically modified plants to increase productivity and resistance against diseases ($\bar{x}$= 0.754). Many (82.2%) of the respondents' were averagely knowledgeable about biotechnology while only 17.0% had high knowledge (Table 2b). This finding negate previous reports of poor biotechnology knowledge among students (Chad *et al* 2010; Wingenbach *et al* 2002; and Hallman, Adelaja, and Schilling 2002).

Table 2a: Distribution of respondents by knowledge on biotechnology issues.

S/N	**Knowledge statements**	**Mean Score**
1.	Biotechnology is the genetic manipulation of living things.	0.898
2.	Mutation is a genetic aberration.	0.799
3.	All lethal genes are harmful.	0.487
4.	Engineered microbes have any long-term effects on the environment.	0.652
5.	Biotechnology contribute to erosion of rural values	0.546
6.	GMOs do not pose any threat to the environment	0.542
7.	Genetically modified crops present health hazards to humans.	0.538
8.	Biotechnology is the genetic manipulation of living things for the benefit of human health.	0.250
9.	Could biotechnologically engineered crops invade sensitive habitats and become a threat to native plants.	0.549
10	Genes are consequences of nucleotide on chromosomes.	0.724
11.	Bacterial genes from yoghurt that can be consumed can be incorporated into cell in human organism.	0.367
12.	Recessive genes are never expressed.	0.508
13.	Hybrid seeds cannot be saved, so purchasing new seed every year.	0.508
14.	Hereditary materials in plants can be changed to make them resistant to plants and disease.	0.727
15.	Practical application of GM plants may increase productivity and resistance of plants against diseases.	0.776
16.	Application of GM methods on animals can increase animal resistance against identical.	0.754
17.	Genetically modified or cloned animals are always bigger than ordinary ones.	0.398
18.	It is possible to transfer animal genes into plants because DNA is chemically identical.	0.458
19.	By eating a genetically modified fruits, a person genes could become modified.	0.629
20.	Propagation of plants by cutting cloning.	0.489
21.	Genes are not normally transmitted from species to species in nature.	0.439
22.	Bread rising is a biotechnological process.	0.595
23.	Before application of GM plants, It is obligatory to perform a risk assessment about possible harmful influences of GM plants on the health of people animals (other organism) and the environment.	0.705
24.	Genetical modification to plants can increase nutritional quality and flavour of fruits and develops traits to withstand shipping process.	0.701
25.	Foods with increasing nutritional value and vitamins can be created through genetic modification.	0.716
26.	Genetic modification is painful for animals.	0.587
27.	Recombinant bovine somatotrpine is an animal drug that increases milk produced by dairy cows.	0.564
28.	Consumption of GM food can destroy human genes.	0.572
29.	GM crops are sterile.	0.553
30.	Mutations are result of cloning.	0.523
	Overall Mean Score for 30 items	0.585

Table 3: Biotechnology knowledge among respondents

Knowledge	Frequency	Percentage
High	45	17.0
Average	217	82.2
Low	2	0.8

Respondents' perception of biotechnology

Information on respondents' perception of biotechnology (Table 3a) reveals that respondents' were somewhat supportive of biotechnology practices for developing crops to be more resistant to insect attack thereby reduce pesticide application ($\bar{x}$ = 4.25). Also respondents' were interested to know more about genetically engineered foods ($\bar{x}$ = 4.19), but also agreed with the use of plants in which genes increasing the quality and productivity are inserted ($\bar{x}$ = 4.00). Respondents generally agreed to the use, consumption, and support for biotechnology practices ($\bar{x}$ = 4.25 - 3.50). Overall, 56.1% of the students had unfavorable perception to biotechnology issues while 43.9% had positive perception (Table 3b). This implies that most of them are unfavorably disposed to biotechnology issues despite their average to high knowledge of biotechnology (Table 3a). Additional information may be a key to improving biotechnology knowledge among respondents because Lewis and Leach (2006) noted that additional knowledge influences the ability to identify key issues and enhance understanding.

Table 3a: Distribution of respondents by perception on biotechnology issues(N = 264)

Perception statements	Mean Score
1.Altering the genes in fruit to improve their taste is not acceptable to me	3.26
2. I am against altering the genes of fruits and vegetables to make them stay fresh longer.	2.97
3.Consumption of genetically modified food is risky	3.20
4. I would not give Gm Food to children.	3.16
5. I agree with the use of genetic engineering if it helps with therapy of genetically determined diseases.	3.97
6. I support the use of food biotechnology to modify plant's genetic structure to be more resistant to damage by insects, thereby reducing pesticide applications	4.25
7.Altering the genes of plants so that they will grow better in salty soils is acceptable to me	3.67
8. I agree with the use of plants in which genes increasing quality and productivity were inserted.	4.00
9. I want to know more about genetically engineered foods.	4.19
10. I trust the food industry to take necessary actions to provide safe genetically engineered foods.	3.81
11. I think the current governmental regulations are sufficient to protect the public from risks associated with genetically engineered foods.	3.10
12. Public is sufficiently informed about risks associated with genetically engineered foods.	2.84
13. Genetically modified food does not influence human health	2.95
14. I would eat genetically modified tomatoes.	3.47
15. I think that genetically modified products taste better.	3.11
16. If I find that the product is made from genetically modified stuff, I will buy it	3.46
17. Inserting genes from human cells into the fertilized eggs of sheep is acceptable to me.	2.52
18. I support changing the genes in cattle to make their meat more nutritious to eat.	3.39
19. I am opposed to transfer of genetic material between plants and animals.	3.38
20. Manipulation with DNA are unethical	3.50
21. Men do not have rights to intervene to DNA, it is against nature.	3.06
22. We should not alter the genes in plants to get them to make more oils useful in manufacturing.	3.07
23. Genetic manipulations disturb ecological relationships.	3.30
24. There is threat of hybridization between genetically modified and normal plant which would endanger original genetic resources of wild plant.	3.50
25. I would support a ban on the production and purchase of genetically engineered products	3.17
26. Use of GM microbes to decomposing human sewage is acceptable to me.	3.82
27. I support the use of genetic engineering for non food purpose such as production of human medicines.	3.60
28. I agree with production of insulin with using genetically modified microbes.	3.62
Overall mean score for all 28 items	**3.41**

Table 3b: Respondents' overall perception of Biotechnology

Perception	Frequency	Percentage
Unfavorable	148	56.1
Favorable	116	43.9
Total	234	100

Respondents' selected demographics and perception of biotechnology

Results in Table 4 indicate that significant relationship existed between respondents' religion and their perception of biotechnology (χ^2 =8.015, p = 0.018). This result is consistent with previous finding which reported that consumer acceptance and approval of genetically modified foods and crops are influenced by religious values (Biel and Nilsson, 2005; Hossain *et al,* 2003 and Evensen, Hoban and Woodrum, 2000). It is expected that respondents who hold religious views would have lower support for biotechnology applications than those who are less religious. However, there was no significant relationship between respondents' gender and perception of biotechnology (χ^2 = .320, p = 0.018). Prokop *et al* (2007) reported that not all dimensions of attitudes are expected to be influenced by gender. Similarly, no significant relationship was found between level of study among respondents (χ^2 = 2.090, p = 0.353), department (χ^2 = 4.120, p = 0.660), ethnicity (χ^2 = 7.820, p = 0.252) and possession of agricultural property (χ^2 = 0.331, p = 0.252) and knowledge of biotechnology.

Table 4:Chi-square analysis of respondents selected demographics and biotechnology perception

Variables	χ^2	Df	P value	Decision
Gender	0.320	1	0.619	Not significant
Level of study	2.090	2	0.352	Not significant
Department	4.120	6	0.660	Not significant
Religion	8.015	2	0.018	Significant
Ethnicity	7.820	6	0.252	Not significant
Possession of Agric. property	0.331	1	0.565	Not significant

Respondents age, years of formal education and knowledge of biotechnology

Results on Table 5, show that significant relationship existed between respondents' years of formal education and their knowledge of biotechnology (r = -.0.122, p = 0.047), however, respondents' age (r= -0.43; p = 0.488) had no significant relationship with their knowledge of biotechnology issues. This result implies that years of formal education is a significant factor on the biotechnology knowledge while age is not a significant factor. This finding match those of previous age and education related studies which reported relatively poor understanding of biotechnology among lower grade students (Dawson 2007; and Chen and Raffen 1999).

Table 5: Correlation analysis showing the relationship between respondents' age, formal education and knowledge of biotechnology

Variable	r	P	Decision
Age	-0.43	0.488	Not significant
Years of formal education	0.122	0.047	Significant

Biotechnology knowledge among students across departments

An interesting outcome of the analysis (Table 6) reveals a significant and positive difference in the biotechnology knowledge of students across the eight departments in the Faculty of Agriculture and Forestry (F = 3.446, p = 0.003). It means that departments to which respondents belong has influence on their knowledge about biotechnology. Interestingly, most (24.6%) of the respondents' were from Agricultural Economics Department which is social science based. This result negates findings of Tegegne *et al* (2013) that social science students claim less knowledge about biotechnology compared to those in biological science.

Table 6: Analysis of variance and respondents' knowledge of biotechnology across departments

Variable	Df	Mean square	F	Sig.	Decision
Knowledge level	6	31.05	3.446	0.003	S

CONCLUSION AND RECOMMENDATION

Based on the findings, the following conclusion can be drawn: Most of the students were female, young and of Christian faith. Most were in their third year of study and are studying Agricultural Economics. Most of the respondents have unfavorable perception to biotechnology issues and average knowledge on biotechnology issues. Students' years of formal education and department are significant factors to their knowledge of biotechnology issues. Religion influenced respondents' perception to biotechnology issues across the sampled departments.

The study recommends that

- Since knowledge and experience increase the likelihood informed, unbiased opinion and perceptions, students should be engaged in meaningful discussions about the science of biotechnology and current issues in biotechnology.
- More research should be carried out across the eight departments in the faculty of Agriculture and Forestry.
- Learning should not be limited to classroom alone. Agricultural students should be made to visit research institute or private firms that are into biotechnology research. This will help improve their experiences and in turn their ability in using them to form perceptions about biotechnology.

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