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Assessing Public Awareness and Ethical Perceptions of CRISPR-Cas9 Gene Editing Technology

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Abstract

Background: CRISPR-Cas9 represents an innovative gene editing technology that has the power to revolutionize medicine, agriculture, and biotechnology. Nevertheless, public understanding and ethical acceptance are paramount for its integration into society.

Objective: This study explores public awareness, self-reported knowledge, and ethical attitudes towards CRISPR-Cas9, with a special emphasis on its therapeutic and enhancement-related purposes.

Methods: A structured questionnaire was administered to 107 participants with a wide range of demographic backgrounds. The questionnaire asked for information on age, gender, education, and occupation, as well as opinions on CRISPR awareness, ethical opinions, and the role of cultural or religious beliefs. Quantitative analysis was carried out using descriptive statistics.

Results: 51.4% of 107 participants reported knowing about CRISPR, and only 42.1% reported having sufficient knowledge to hold an opinion.

The participants rated their level of understanding in gene editing as an average of 2.64 out of 5. While therapeutic uses were moderately supported (mean = 3.0/5), respondents opposed embryo editing (2.84/5) and enhancement (2.79/5) less. Religious and cultural beliefs moderately affected opinions (3.19/5). Awareness and acceptance were greater among more educated and younger individuals.

Conclusion: The research indicates a knowledge deficit in the public's awareness of CRISPR-Cas9 and the necessity of focused education. Therapeutic uses tend to be approved, but ethical issues persist, particularly for non-therapeutic purposes. Prompts for informed public discussion are necessary to ethically regulate gene editing technologies.

Keywords: CRISPR-Cas9, gene editing, public perception, bioethics, awareness, ethical attitudes, biotechnology.

1. Introduction

CRISPR-Cas9 technology has transformed the world of genetic engineering as it is precise, efficient, and cost-effective. CRISPR-Cas9 is a genome-editing tool that can be used to edit DNA in a living organism very precisely, which has immense potential for the treatment of genetic diseases, enhancement of agriculture, and advancements in biomedical research (Rasheed, Gill et al. 2021). CRISPR-Cas9 has attracted the entire world since its invention in 2012 for its therapeutic potential, especially for editing gene mutations that cause inherited diseases (Singh, Braddick et al. 2017).

However strong its scientific promise, public awareness and ethical acceptability of CRISPR-Cas9 have been little investigated. The ethical debate over gene editing is multifaceted, involving issues of the distinction between therapy and enhancement, threat of off-target effects, possibility of eugenics, and religious or cultural opposition (Farooq 2024). With the boundary between medical innovation and ethical obligation becoming increasingly blurred, it is now essential to measure public sentiment, which in turn can shape regulatory choices, funding policy, and the inclusion of gene editing within health systems.

Additionally, perception and awareness are also shaped by demographic variables including age, educational level, working background, and cultural environment (Sales, Rodríguez Sousa et al. 2024). Knowing these variables assists in determining gaps in knowledge and societal issues that must be addressed. Public opinion surveys can be powerful instruments to bring out this subtle appreciation, particularly in developing nations where public education regarding innovative biotechnologies is scarce (Tait 2023).

This research will explore public awareness, knowledge, and ethical attitudes towards CRISPR-Cas9 technology (Seiter and Fuselier 2021). Surveying a broad range of individuals, we assess the way individuals think about using gene editing for the purposes of therapy versus enhancement, and to what extent such views are informed by personal, cultural, and religious factors. The aim is to generate insight capable of informing future science communication approaches and shaping policy on the ethics of gene editing technologies.

2. Methodology

2.1 Study Design

The research used a quantitative, cross-sectional survey design to measure public awareness, knowledge, and ethical views regarding CRISPR-Cas9 gene editing technology. A structured questionnaire was used to gather information on the demographics of participants, familiarity with gene editing technologies, and their attitudes toward the ethical aspects of CRISPR use, especially in therapeutic versus enhancement contexts.

2.2 Participants

A total of 107 participants were recruited using a non-probability convenience sampling method. Participants were selected from various backgrounds to ensure diversity in age, gender, education level, and occupation. Inclusion criteria required that participants be aged 18 years or older and willing to voluntarily participate in the survey.

2.3 Survey Instrument

The questionnaire consisted of both closed-ended and Likert-scale items. It was divided into four sections:

- **Section A:** Demographic Details – gender, age, level of education, and occupation.
- **Section B**: Knowledge and Awareness – consisted of questions regarding if the participant had ever heard about CRISPR, and self-rated knowledge on a 5-point Likert scale.
- **Section C:** Ethical Perceptions – queried ethical perceptions of the acceptability of CRISPR uses, such as therapeutic gene editing, enhancement, and embryonic modifications. Answers were rated on a 5-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree).
- **Section D:** Influencing Factors – investigated the impact of religious or cultural beliefs on ethical positions.

Validation was done by piloting the questionnaire with a small number prior to full usage.

2.4 Data Collection

The questionnaire was completed online on platforms like Google Forms and shared via social media and email. It was anonymous and voluntary, and informed consent was given prior to participation. The questionnaire was left open to respond to for three weeks. The study was conducted between March to May 2025.

2.5 Data Analysis

Data collected were imported into Microsoft Excel and examined by the use of descriptive statistical techniques (Lindquist and Sulewski 2024). Percentages and frequencies were determined for categorical variables (e.g., education level, gender), while mean scores were derived for items using Likert scales to measure trends in knowledge and perception among ethics. Graphics were produced to give a visual impression of the spread of responses based on important demographic and perception variables. Tabulated summaries were employed as needed to maximize clarity and readability.

2.6 Ethical Issues

The ethical standards were observed during the study. Participants were told the purpose of research, were guaranteed confidentiality of data, and allowed the right to withdraw at any point in time. No personal details were obtained.

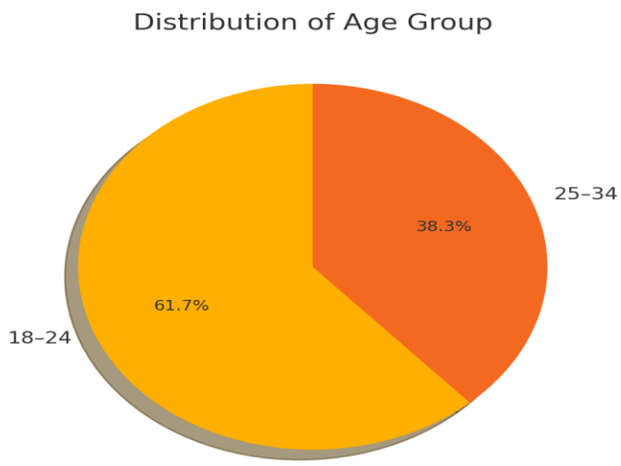
3. Results

107 participants filled in the survey. Results below illustrate demographic information, levels of awareness, and ethical attitudes toward CRISPR-Cas9 technology.

3.1 Demographics

Age Group

Most of the partic 8.3% in the 25–
34 years categor ewly employed
professionals, co



Gender
The gender split w ts.

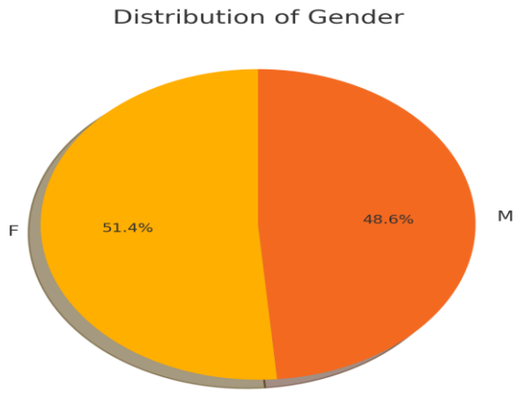


Figure: Distribution of responses for Gender.

Education Lev
Individuals ref e degree holders
constituted 37. nd 28.0% had no
formal educatio

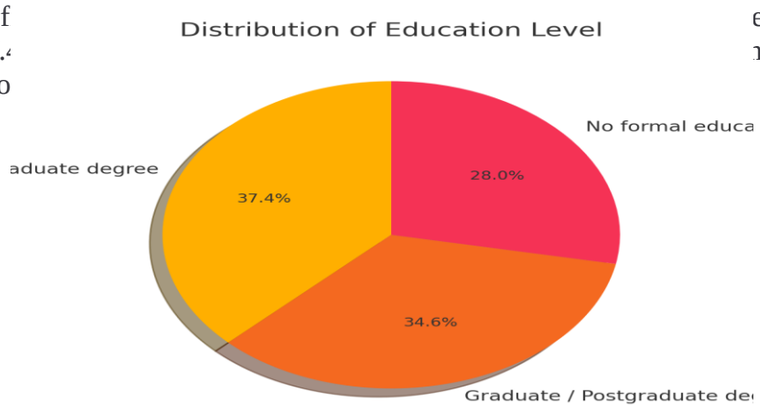


Figure: Distribution of responses for Education Level.

Occupation

The sample consisted [illegible] Researchers (19.6%), with the remaining fi [illegible] lanced representation of views from both sc

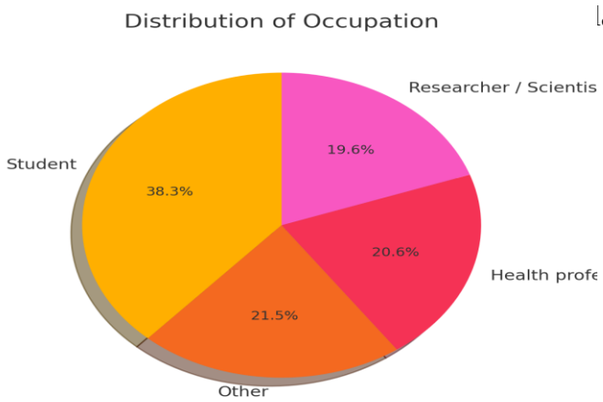


Figure: Distribution of responses for Occupation

3.2 Awareness and l

Heard of CRISPR

More than half (51.4 [illegible] ing moderate public awareness of gene-ec

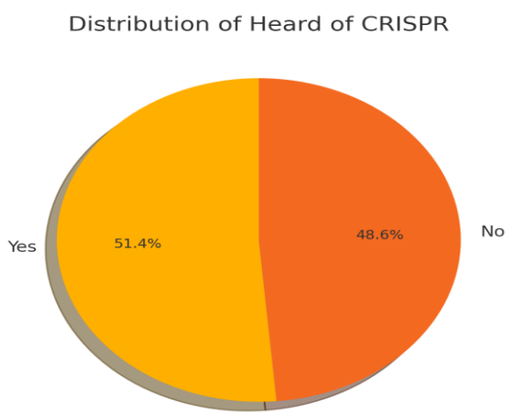


Figure: Distribution of responses for Heard of CRISPR

Enough Knowledge to Form an Opinion

When asked whether they had enough knowledge to hold an opinion about CRISPR: 42.1% answered "Yes" and 57.9% said "No". This indicates low self-assurance in knowledge about gene-editing by the general population.

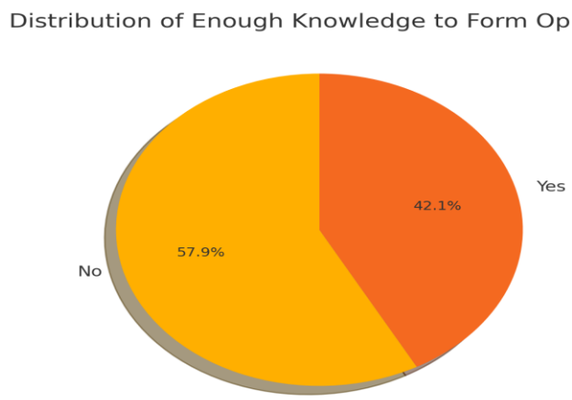


Figure: Distribution of responses for Enough Knowledge to Form Opinion.

3.3 Perceptions and Attitudes

Self-reported levels of knowledge and ethical perception were scored on a 5-point Likert scale (1 = very low/strongly disagree, 5 = very high/strongly agree):

Measure	Mean Score (out of 5)
Self-rated knowledge	2.64
Support for treatment use	3.00
Ethical acceptance for embryo editing	2.84
Support for treatment-only applications	2.79
Religious/Cultural influence on opinion	3.19

Summary Table:

Variable	Category	% of Respondents
Age Group	18–24 years	61.7%
Age Group	25–34 years	38.3%
Gender	Female	51.4%
Gender	Male	48.6%
Education Level	Undergraduate	37.4%
Education Level	Graduate/Postgraduate	34.6%
Education Level	No formal education	28.0%
Occupation	Students	38.3%
Occupation	Health Professionals	20.6%
Occupation	Researchers	19.6%
Heard of CRISPR	Yes	51.4%
Heard of CRISPR	No	48.6%
Enough Knowledge to Form Opinion	Yes	42.1%
Enough Knowledge to Form Opinion	No	57.9%

4. Discussion

The results of this study give valuable insights into public awareness, knowledge, and ethical attitudes toward CRISPR-Cas9 gene editing technology. While more than half of the respondents (51.4%) had heard of CRISPR, the mean self-assessed knowledge score (2.64/5) reflects only moderate understanding. This difference between awareness and understanding is in line with results from earlier research and indicates that scientific literacy regarding cutting-edge biotechnologies continues to be low among the general public (Hu, Xu et al. 2024). Interestingly, respondents overall indicated prudent endorsement of CRISPR use in therapeutic applications with a mean score of 3.0/5. This mirrors international trends, as the public worldwide supports gene editing for the treatment of disease over human enhancement or cosmetic uses. Support decreased with more ethically provocative applications, including the editing of embryos (2.84/5) or using

CRISPR only for enhancement (2.79/5). These findings mirror ethical reservations, probably grounded in cultural, religious, and societal values. A large majority of respondents (57.9%) claimed to have insufficient knowledge to hold a firm opinion about CRISPR. This highlights the pressing necessity for simple explanations and communication of science, promise, and ethical limits of gene editing technologies to the general public. As CRISPR moves from bench studies to the clinic, the public's understanding and acceptance will become the linchpin that determines regulations, funding priorities, and clinical uptake (Liao, Xiao et al. 2023). Demographic analysis also produced some interesting trends. Younger people (18–24) made up the largest majority of respondents and tended to be more open to CRISPR's therapeutic uses, perhaps due to more exposure to digital data and online science communication (Ramos, Almeida et al. 2023). Education also had an impact, as those with undergraduate or graduate degrees were more aware and supportive than those without educational training. Baroun 2021 showed in his study that religious and cultural views were found to affect ethical views (mean score: 3.19/5), highlighting the necessity of dialogue between scientific experts and cultural leaders to ensure that ethical systems match developing technologies (Baroun 2021). Successful policymaking in gene editing requires balancing scientific advancement with societal ethics.

5. Conclusion

This research emphasizes moderate public awareness and reserved ethical acceptance of CRISPR-Cas9 gene editing, particularly in therapeutic purposes. Although most participants are familiar with CRISPR, many do not possess adequate knowledge to make informed judgments, indicating an enormous educational gap. Gene editing attitudes are shaped by demographic factors like age, education level, and cultural or religious beliefs. The findings indicate a mostly optimistic view of the medical potential of CRISPR but with caution regarding its application in embryos or for enhancement. With further development of CRISPR technology, involving the public through open, participatory, and culturally competent communication will be critical. Policymakers, scientists, and educators must join forces to facilitate public literacy and ethical debate to ensure gene editing technologies are developed and utilized responsibly. These results can be used to guide future educational efforts and policymaking on gene editing technologies.

6. References

Baroun, A. E. (2021). The impact of knowledge, skills, and attitude on organisational performance among Kuwaiti employees within the private oil and gas sector in Kuwait: the moderating effect of power distance, University of Salford (United Kingdom).

Farooq, A. (2024). Human Gene Editing and Its Ethical Questions: Biomedical, Secular, and Islamic Perspectives, Hamad Bin Khalifa University (Qatar).

Hu, X., et al. (2024). "Development and assessment of cutting-edge biotechnologies." Journal of Biosafety and Biosecurity.

Liao, C., et al. (2023). "Bench-to-bedside: Translational development landscape of biotechnology in healthcare." Health sciences review **7**: 100097.

Lindquist, J. M. and C. A. Sulewski (2024). "Microsoft Excel." Handbook of Military and Defense Operations Research **21**.

Ramos, P. D., et al. (2023). "What do people think about genetic engineering? A systematic review of questionnaire surveys before and after the introduction of CRISPR." Frontiers in Genome Editing **5**: 1284547.

Rasheed, A., et al. (2021). "A critical review: recent advancements in the use of CRISPR/Cas9 technology to enhance crops and alleviate global food crises." Current Issues in Molecular Biology **43**(3): 1950-1976.

Sales, R. G., et al. (2024). "Degree of importance of demographic and socio-cultural factors in environmental perception: bases for the design of public policies in Argentina and Spain." Environment, Development and Sustainability **26**(4): 9005-9024.

Seiter, K. M. and L. Fuselier (2021). "Content knowledge and social factors influence student moral reasoning about CRISPR/Cas9 in humans." Journal of Research in Science Teaching **58**(6): 790-821.

Singh, V., et al. (2017). "Exploring the potential of genome editing CRISPR-Cas9 technology." Gene **599**: 1-18.

Tait, J. (2023). Environmental risks and the regulation of biotechnology. Technological change and the Rural Environment, Routledge**:** 168-202.