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Awareness of Complete Dominance Relationships among Allied Health Science Students

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Introduction: In complete dominance, the effect of one allele in a heterozygous genotype completely masks the effect of the other. The allele that masks the other is said to be dominant to the latter, and the allele that is masked is said to be recessive to the former. It suppresses the expression or dominates the effects of the recessive gene (or allele). Aim: This survey was conducted for assessing the awareness about complete dominance relationship among allied health sciences students. Materials and methods: This cross-sectional research was conducted on complete dominance relationships with a self-administered questionnaire containing ten questions distributed amongst 104 Allied Health science students.The questionnaire assessed the awareness about complete dominance relationships. Results: 87.5% of the respondents were aware about complete dominance, 73.1% were aware that complete dominance suppresses recessive allele 64.4% were aware that phenotype of heterozygote cannot be distinguished from that of dominant parent,58.7% were aware that the terms heterosis and complete dominance are similar ,68.3% were aware that eye color is an example of complete dominance. Conclusion: There is moderate awareness amongst allied health sciences students about complete dominance relationships. Enhanced awareness initiatives and allied health sciences educational programmes together with increased importance for curriculum improvements that further promote knowledge and awareness of Complete dominance relationships.

Keywords: awareness, complete dominance relationship, students.

1. Introduction

Allele is each of two or more alternative forms of a gene found at the same place on a chromosome. Dominance is the phenomenon whereby, in an individual containing two allelic forms of a gene, one is expressed to the exclusion of the other. In complete dominance, the effect of one allele in a heterozygous genotype completely masks the effect of the other. The allele that masks the other is said to be dominant to the latter, and the allele that is masked is said to be recessive to the former. It suppresses the expression or dominates the effects of the recessive gene (or allele)[1].

Heterosis can be the result of the masking of deleterious recessives by dominant or partially dominant alleles, each strain bringing to the hybrid a somewhat different collection of favorable dominants. Heterosis, hybrid vigor, or outbreeding enhancement is the improved or increased function of any biological quality in a hybrid offspring.[2]

Complete dominance occurs when offspring of two different, purebred strains resembles one of the parental form so closely that the other species escapes observation completely or cannot be detected with certainty.In modern terms, there is complete dominance when the phenotype of heterozygote cannot be distinguished from that of dominant parent.[3]

An example of complete dominance is eye color: In humans, eye color is influenced by numerous genes, and these all code for the six main eye colors: amber, blue, brown, green, gray, and hazel. These colors are based on the amount of melanin that is present in the iris. Brown is the most common eye color in the world with between 55 and 79% of the world's population having brown eyes. Thus, the brown color is regarded as the dominant trait. About 8-10% of the world's population has blue eyes. The brown-eye allele is always dominant over the blue and green-eyed alleles.[4] This survey was conducted for assessing the awareness about complete dominance relationship among allied health sciences students.

2. Materials and method:

This cross-sectional research was conducted on complete dominance relationships with a self-administered questionnaire containing ten questions distributed amongst 104 Allied Health science students.The students were randomly selected across various disciplines of Allied Health Sciences.The study setting was designated in the university campus.The survey instrument was a questionnaire pre tested and evaluated for validity and reliability concerns.

The questionnaire included ten questions eliciting the demographic data through open ended responses and multiple choice questions for the other responses.The study was approved by the Institutional Ethical Committee and informed consent was obtained from the participants. The questionnaire was posted in an online platform and the identity of the respondents were kept confidential.

The questionnaire assessed the awareness about complete dominance relationships .The responses were recorded and analysed.There were no incomplete responses and no dropouts from the study.The final data obtained was organized,tabulated and subjected to statistical analysis.

The salient questions in the study are:

1.In Complete dominance, the effect of one allele in a heterozygous genotype completely masks the effect of the other.

2.It suppresses the expression or dominates the effects of the recessive gene (or allele)

3.Complete dominance is when the phenotype of heterozygote cannot be distinguished from that of dominant parent.

4.Are the terms " heterosis" and "complete dominance" similar as heterosis is the result of the masking of deleterious recessives by dominant alleles.

5.Is eye colour an example of complete dominance as Colours are based on the amount of melanin present in iris.

3. Result:

87.5% of the respondents were aware about complete dominance (Fig.1), 73.1% were aware that complete dominance suppresses recessive allele (Fig.2),64.4% were aware that phenotype of heterozygote cannot be distinguished from that of dominant parent (Fig.3),58.7% were aware that the terms heterosis and complete dominance are similar (Fig.4),68.3% were aware that eye colour is an example of complete dominance (Fig.5)

Fig.1 In Complete dominance, the effect of one allele in a heterozygous genotype completely masks the effect of the other.

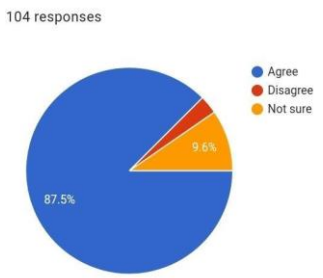


Fig.2 It suppresses the expression — or dominates the effects — of the recessive gene (or allele)

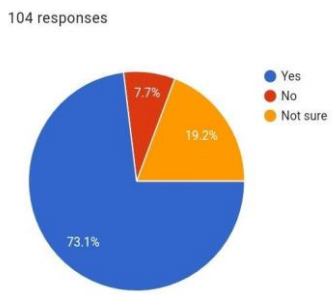


Fig.3 Complete dominance is when the phenotype of heterozygote cannot be distinguished from that of dominant parent

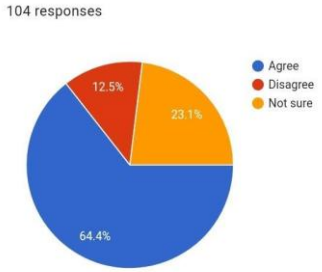


Fig.4 Are the terms " heterosis" and "complete dominance" similar as heterosis is the result of the masking of deleterious recessives by dominant allele.

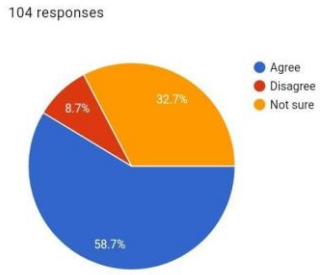
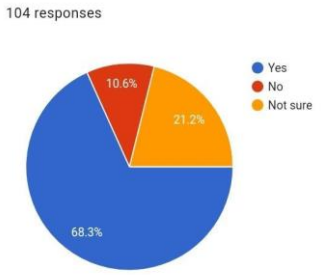


Fig.5 Is eye colour an example of complete dominance as Colours are based on the amount of melanin present in the iris.



4. Discussion:

In complete dominance, the effect of one allele in a heterozygous genotype completely masks the effect of the other. The allele that masks the other is said to be dominant to the latter, and the allele that is masked is said to be recessive to the former. It suppresses the expression or dominates the effects of the recessive gene (or allele), there is complete dominance when the phenotype of heterozygote cannot be distinguished from that of dominant parent[5] In this study, 87.3% of the participants were aware of complete dominance.

Natural selection plays with much greater force on the heterozygotes than on the homozygous mutants (because of the enormously greater relative abundance of the former); that the character of the heterozygote is subject to the action of modifying factors, and that in consequence of all these facts there will be a gradual drift of the heterozygote toward the wild type, not necessarily involving the homozygous mutant type to any great extent. [6] In the course of geologic time, this may bring about complete dominance of the wild type or dominance so nearly complete that the heterozygote is no longer subject to adverse selection.[7]

G. H. Shull is responsible for coining the word heterosis. He regarded this as a descriptive synonym for hybrid vigor. Heterosis can be the result of the masking of deleterious recessives by dominant or partially dominant alleles, each strain bringing to the hybrid a somewhat different collection of favorable dominants. The generally deleterious nature of recessives was first emphasized by Eugene Davenport as early as 1908.[8]

Complete dominance is well observed in the human eye color that is influenced by numerous genes These code for the six main eye colors: amber, blue, brown, green, gray, and hazel. These colors are based on the amount of melanin that is present in the iris.The brown-eye allele is always dominant over the blue and green-eyed alleles.[9,10] 68.3% of the participants were aware that eye colour in humans is an example of complete dominance. Thus indicating a moderate level of awareness among allied health science students about complete dominance.

Complete dominance is a genetic principle where a dominant allele completely masks the effect of a recessive allele at the same gene locus, meaning that in heterozygous individuals, only the dominant trait is expressed. In genetic oral diseases, complete dominance plays a crucial role in determining whether or not a disease manifests. For diseases linked to dominant alleles, only one copy of the mutated allele is needed for the disease to express itself, as seen in conditions like hereditary gingival fibromatosis. Conversely, in recessive oral diseases, the presence of a dominant normal allele can prevent the disease from manifesting, even if the individual carries one copy of the recessive mutated allele. These carriers, though asymptomatic, can still pass the recessive allele to their offspring, with a 25% chance of the disease manifesting if both parents are carriers. While complete dominance typically leads to a clear inheritance pattern, some dominant oral diseases may exhibit incomplete penetrance or variable expressivity, meaning not all individuals with the dominant allele express the disease, or the severity may vary among those who do. Understanding complete dominance is essential for predicting disease risk, diagnosing conditions, and providing genetic counseling in the context of genetic oral diseases.[10-15]

5. Conclusion:

There is a moderate awareness amongst allied health sciences students about complete dominance relationships. Enhanced awareness initiatives and allied health sciences educational programmes together with increased importance for curriculum improvements that further promote knowledge and awareness of complete dominance relationships.

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