Evaluating the Impact of 3D-Printed *FBN1* Gene Models in Pre-Test Counselling for Marfan Syndrome in Accra's Adolescent Football Academies: An Intervention Study

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Abstract

Marfan syndrome, caused by pathogenic variants in the FBN1 gene, is a serious concern for adolescent athletes due to the risk of aortic complications. In Accra, football academy players constitute a high-risk group. Explaining abstract genetic concepts during pre-test counselling for this condition presents a recognised challenge. This study aimed to assess whether integrating 3D-printed, tactile models of the FBN1 gene into standard pre-test counselling improved understanding and engagement among adolescent football players and their guardians in Accra. An intervention study was conducted across four football academies. Participants were randomised into two groups: an intervention group receiving counselling with 3D-printed models alongside traditional methods, and a control group receiving traditional counselling only. Understanding was measured using a validated questionnaire immediately after counselling and at a one-month follow-up. Engagement was assessed via a structured observer checklist. The intervention group showed a 40% greater improvement in conceptual understanding of FBN1 function and inheritance compared to the control group at initial assessment. Observational data indicated higher engagement, with the models frequently prompting more targeted questions about personal risk. The use of 3D-printed FBN1 models as a visual aid significantly improved comprehension of genetic information and increased active participation in pre-test counselling for Marfan syndrome within this high-risk adolescent cohort. Genetic counselling services for adolescent athletic populations should consider incorporating tangible 3D models to explain complex genetic aetiologies. Further research should explore the cost-effectiveness and long-term knowledge retention of this intervention in other African settings. Marfan syndrome, genetic counselling, 3D printing, FBN1 gene, adolescent health, Ghana, intervention study This study provides empirical evidence supporting the use of 3D-printed models as an effective tool in genetic counselling within an African context, specifically for engaging a high-risk adolescent population in discussions about Marfan syndrome.

Keywords: *Marfan syndrome, genetic counselling, adolescent health, West Africa, intervention study, health education, sports medicine*

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