Abstract

Innovative Polyamide-Stainless Steel Discus with Advanced Aerodynamics to Enhance Performance and Equity in Para Athletics

Abstract:
Background: Equipment innovation is crucial in elite Para athletics, impacting athlete performance and inclusion. Existing discus designs often have suboptimal aerodynamics or are made from brittle materials, limiting throw distances and competitive fairness.

Objective: This study aimed to design and validate a novel competition-grade discus (1kg, 1.5kg, 2kg) combining a CNC-machined stainless steel rim with a tapered edge (7.08mm, 6.8mm, 6.31mm thickness; 13° taper) and a durable injection-molded polyamide (Nylon) core to optimize flight dynamics and structural integrity.

Methods: The discus features a two-part polyamide body secured via a central screw and steel ring, precisely meeting official weight specifications. Aerodynamic properties were tested in a wind tunnel to quantify drag reduction and flight stability. Flight trials were conducted against conventional discuses to assess throwing distance and durability. Statistical analyses employed non-parametric tests due to sample size constraints.

Results: The novel discus achieved a 15% average reduction in aerodynamic drag and improved throwing distances by 7–10% compared to traditional designs. Flight stability increased, resulting in reduced trajectory deviations. The polyamide core resisted deformation and cracking after repeated impacts, unlike conventional wooden implements.

Conclusion: This innovative Polyamide-Stainless Steel discus significantly boosts flight performance and durability, promoting competitive equity and inclusion in Para athletics. By integrating advanced materials and aerodynamic design, it supports athletes in maximizing their potential and aligns with Paralympic values of excellence and fairness. This work underscores the transformative potential of engineered assistive sports technology.

Keywords: Para Athletics, Discus Throw, Assistive Technology, Aerodynamics, Polyamide, Performance.