Development of the IS-PARD Training Model to Improve Sprint Running Speed of Para-Athletics Athletes with Physical Disabilities in Papua, Indonesia

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HOW TO CITE:
Baharuddin Hasan, Sumaryanti, Sigit Nugroho, Arrahman, Muhammad Teguh Prasetyo (2026). Development of the IS-PARD Training Model to Improve Sprint Running Speed of Para-Athletics Athletes with Physical Disabilities in Papua, Indonesia. International Journal of Special Education, 41(10s), 738-748

ABSTRACT:
Sprint performance is the principal determinant of success in para-athletics sprint events, yet speed-training models for athletes with physical disabilities (tuna daksa) remain scarce and are frequently adapted ad hoc from programmes designed for non-disabled athletes. This study aimed to (1) develop an integrated speed-training model IS-PARD (Interval Sprint, Plyometric, and ABC Running Drill) for physically disabled sprinters; (2) evaluate its feasibility; and (3) test its effectiveness. A Research and Development (R&D) design following the Borg and Gall procedure was used. Validation involved four content experts and one media expert; product trials were conducted on a small scale (10 athletes) and a large scale (30 athletes), and effectiveness was tested on 30 para-athletics sprinters (10 women, 20 men) of the Papua National Paralympic Committee over 16 training sessions, with sprint speed assessed by a 30-m sprint test. Content validity (Aiken's V) and inter-rater reliability (ICC) were examined; effectiveness was analysed using a paired-samples t-test (SPSS 29). The model yielded a guidebook containing nine IS-PARD training variations. Feasibility was rated as feasible by content experts (87.50%) and the media expert (92.30%). The model significantly improved sprint speed ($t(29) = 12.89$, $p < 0.001$; Cohen's $dz = 2.35$), with mean 30-m sprint time decreasing from 4.84 s to 4.42 s overall (8.64% improvement; men 8.23%, women 9.29%). The IS-PARD model is a feasible and effective disability-specific tool for developing sprint speed in tuna daksa para-athletes.

Keywords: IS-PARD training model; sprint speed; para-athletics; physical disability; Research and Development.

1. Introduction

Equality is a foundational value of modern sport, and the gap between non-disabled and disabled athletes in recognition, funding, infrastructure, and opportunity continues to require attention (Brittain, 2016). Athletes with disabilities frequently receive less financial support than their non-disabled counterparts, which constrains training quality and athlete welfare (Misener & Darcy, 2014), while sponsorship for disability sport events remains considerably lower than for mainstream events (Cottingham, 2016). Facility accessibility also remains a barrier, as many venues are designed without considering the needs of users with diverse disabilities (Paramio-Salcines & Kitchin, 2013). At the same time, scientific classification systems Tweedy & Vanlandewijck, (2011) and assistive technology (Burkett, 2010, 2013) have progressively narrowed the performance gap, underscoring that disability is not an obstacle to high-level athletic achievement.

In Indonesia, the development of disability sport must be integrated with a high-performance coaching system grounded in sport science (Donny et al., 2025; Liu et al., 2025). Para-athletics and swimming are among the leading sports of Papua Province (Kurdi et al., 2025). However, achievement in para-athletics has fallen short of targets: at Peparpenas XVI (2021), 65 athletics gold medals were targeted but only 26 were obtained, and at Peparnas 2021 and 2024 Papuan athletes predominantly secured silver and bronze relative to provinces such as West Java. Field observation indicates that the sprint capability of Papuan tuna daksa athletes remains suboptimal, partly because of underdeveloped biomotor components especially speed and because the training models applied are standard, monotonous, and insufficient in intensity and frequency.

Physical disability (tuna daksa) refers to impairment of the muscles, bones, joints, and nerves arising from disease, accident, or congenital conditions, which reduces the capacity to perform certain movements (Kadek et al., 2022; Parapat et al., 2023; Zumratun, 2023). Within para-athletics, sprinters compete across short- to long-distance events under a functional classification system. Because speed is the dominant determinant of sprint performance (Iriani et al., 2025; Zenk et al., 2025), and because step length and step frequency are governed by force production, neural recruitment, and limb morphology, disability-specific approaches to speed development are essential.

Three training methods are individually well supported for speed development. Interval sprint training short, near-maximal sprints interspersed with recovery enhances anaerobic capacity, maximal running velocity, and VO_2max. (Almeida et al., 2016; Boullosa et al., 2022). Across many trials and meta-analyses, short, near-maximal or maximal interval sprints with recovery reliably enhance VO_2max, anaerobic capacity, and maximal running/sprint performance. SIT, RST, and HIIT are all well-supported options; choice of work duration and recovery mainly shifts the balance between central aerobic gains and anaerobic/speed adaptations. Plyometric training exploits the stretch-shortening cycle to increase muscular power, jump height, sprint speed, and agility (Kons et al., 2023; Xu et al., 2025). ABC running drills (acceleration, balance, coordination) improve running technique, coordination, and sprint times (Mustika et al., 2020).

Despite this evidence, these methods have largely been studied in isolation and in non-disabled populations; integrated, disability-specific speed-training models for tuna daksa para-sprinters are lacking, particularly in the Papuan context. The present study addresses this gap by combining and adapting interval sprint, plyometric, and ABC running drills into a single integrated model IS-PARD designed for the postural characteristics and functional limitations of physically disabled athletes. Accordingly, the study aimed to: (1) develop the IS-PARD model; (2) assess its feasibility; and (3) test its effectiveness in improving sprint running speed.

2. Methods

2.1 Research design

This study employed a Research and Development (R&D) design using a modified Borg and Gall procedural model adapted to the development of a disability-specific training product. The procedure comprised seven sequential stages: (a) needs analysis (interviews, field observation, and theoretical review); (b) initial product development; (c) expert validation (content and media) and first revision; (d) small-scale trial and revision; (e) large-scale (field) trial and revision; (f) finalisation of the product; and (g) effectiveness testing.

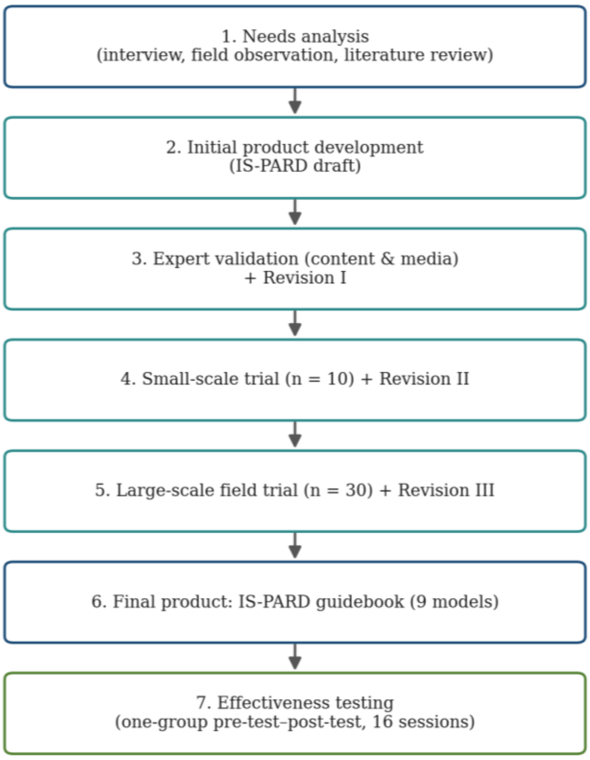

Figure 1. The R&D procedure for developing the IS-PARD model (modified Borg & Gall).

2.2 Participants

The population comprised 283 athletes of the Papua National Paralympic Committee (NPCI). Purposive sampling was used to select athletes with physical disabilities (tuna daksa) competing in athletics sprint events, all within ambulant (standing) sprint classes. Validation involved four content experts (academics and athletics practitioners) and one media expert. The small-scale trial involved 10 athletes and 4 coaches (Peparpenas athletes); the large-scale trial involved 30 athletes and 8 coaches (Peparnas athletes). The effectiveness test was conducted on 30 athletes (10 women and 20 men).

2.3 Instruments

Data were collected through observation, semi-structured interviews, and questionnaires. The expert and user questionnaires used a four-point modified Likert scale (4 = very good; 3 = good; 2 = poor; 1 = very poor). The content-expert questionnaire comprised 15 items across material, content, and language adequacy; the media-expert questionnaire comprised 13 items across size, cover design, and content design; and the coach/athlete questionnaire comprised 17 items across physical, design, and usability aspects. Sprint speed was measured with a 30-m sprint test adapted to the athletes' needs.

2.4 Validity and reliability

Content validity of the instruments was analysed using the Aiken's V coefficient, $V = \Sigma S / [n(C - 1)]$, where $S = r - lo$, lo is the lowest rating category, C is the highest rating category, and r is the rating assigned by each judge; values were interpreted against the standard critical threshold for the number of judges and rating categories used. Inter-rater reliability was assessed using the Intraclass Correlation Coefficient (ICC) to estimate agreement among experts for each instrument indicator. The convergent feasibility evidence obtained from the expert assessments is reported in Section 3.2.

2.5 Data analysis

Quantitative data from expert and user assessments were summarised using descriptive statistics and interpreted with a rating scale: 75 < score ≤ 100 = feasible; 50 < score ≤ 75 = fairly feasible; 25 < score ≤ 50 = less feasible; 0 ≤ score ≤ 25 = not feasible. Percentages were computed as (Σ obtained score / Σ ideal score) × 100%. Because the effectiveness phase used a one-group pre-test–post-test (within-subject) design, the normality of the difference scores was first confirmed with the Shapiro-Wilk test, after which the difference between pre-test and post-test means was analysed with a paired-samples t-test. The magnitude of change was quantified with Cohen's dz and 95% confidence intervals. All inferential analyses were performed in SPSS version 29 and verified by recomputation from the raw data.

2.6 Effectiveness procedure

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The design of the effectiveness phase was based on a random assignment of subjects into a control or treatment group and involved using a pretest-posttest control group design. Pretest was determined by the use of a 30 meter sprint test; subjects completed the IS-PARD program four days per week over a period of 16 training sessions; posttest was completed under the same conditions. All training sessions were supervised by coaches as well as documented as part of the research study by the research team.

Ethics: The study was conducted according to the ethical principles outlined in the Declaration of Helsinki, including obtaining written consent from subjects (and guardians when applicable) and maintaining confidentiality of subject's information through a secure system. Ethical approval was received for conducting this study.

3. Results

3.1 The IS-PARD product

The needs assessment revealed that weight (muscle) gain is important to conduct improved sprinting, and as such, the traditional methods (non-adative) used by athletes who are sprinters has been proven to not be acceptable for this group. Based on the findings of the needs assessment and extensive literature review; and the current speed results from the respective groups (men's results were 4.46s; women's results 5.61s), an initial prototype product was created. The initial product is a guidebook called "The I S-PARD Model for Improving Speed with Disabled Athletes in Athletics" including 9 modified sprint training plans to improve performance and develop the 3 areas identified in table one (Component #1, Weight, #2, Form, #3, Strength) .

Table 1. The nine IS-PARD training models

No	Component / Model	Prescription (intensity, sets/reps, recovery)
1	Interval Sprint - Model 1 (30 m)	80–100% intensity; target 4.3–4.9 s; 4–6 reps × 3 sets; recovery 45–60 s between reps, 5–7 min between sets
2	Interval Sprint - Model 2 (20 m)	80–100% intensity; target 3.5–4.0 s; 6–8 reps × 3 sets; recovery 45–60 s / 5–7 min
3	Interval Sprint - Model 3 (10 m)	80–100% intensity; target 2.0–2.5 s; 8–12 reps × 3 sets; recovery 45–60 s / 5–7 min

No	Component / Model	Prescription (intensity, sets/reps, recovery)
4	Plyometric - Model 4 (Bounds)	Single-leg alternating forward bounds; 8–10 reps × 2–3 sets; recovery 60–90 s between sets
5	Plyometric - Model 5 (Lateral bounds)	Alternating forward then lateral bounds (3× right, 3× left); 8–10 reps × 2–3 sets; recovery 60–90 s
6	Plyometric - Model 6 (Jump squat)	Jump squats around markers, clockwise/counter-clockwise; 8–10 reps × 4 sets; recovery 60–90 s
7	ABC Running - Model 7 (Ankle drill)	Hip-height knee lift emphasising active ankle action; 5 reps × 2 sets; recovery 60–90 s
8	ABC Running - Model 8 (Butt kick)	Heel-to-buttock kicks; 5 reps × 2 sets; recovery 60–90 s
9	ABC Running - Model 9 (Cycling drill)	Combined A+B cyclical leg action (full circular motion); 5 reps × 2 sets; recovery 60–90 s

Note. Movements are adapted to athletes' postural characteristics and functional limitations; supports may be used where required.

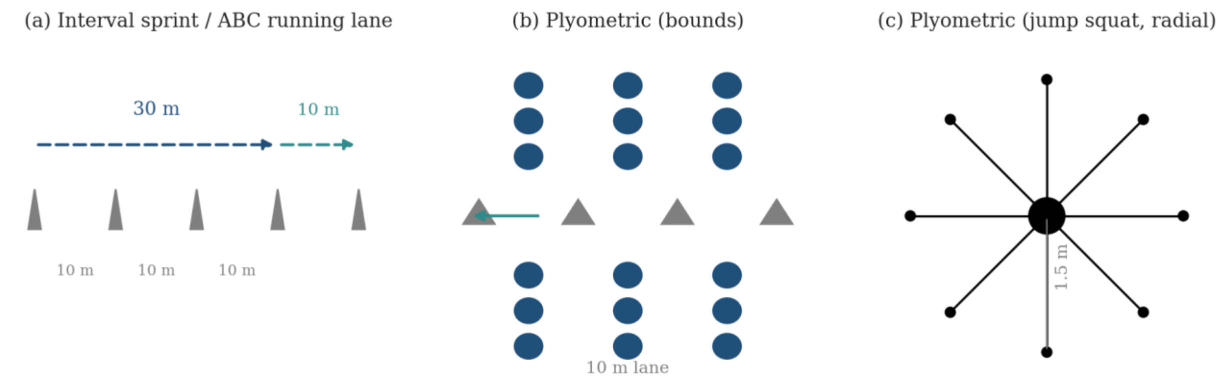

Figure 2. Representative IS-PARD drill layouts: (a) interval sprint / ABC running lane; (b) plyometric bounds; (c) plyometric jump-squat (radial).

3.2 Feasibility (expert validation)

Content experts rated the material aspect at 93.75%, content at 83.33%, and language at 87.50%, for an overall 87.50% (feasible). The media expert rated book size at 100%, cover design at 87.50%, and content design at 93.75%, for an overall 92.30% (feasible) (Table 2). All scores fell within the feasible category, and the product was deemed suitable for trialling after revision.

Table 2. Expert validation results

Evaluator	Aspect	Max	Obtained	% (Category)
Content experts	Material adequacy	16	15	93.75 (Feasible)
	Content adequacy	24	20	83.33 (Feasible)
	Language adequacy	16	14	87.50 (Feasible)
	Overall	**56**	**49**	**87.50 (Feasible)**
Media expert	Book size	4	4	100.0 (Feasible)
	Cover design	16	14	87.50 (Feasible)
	Content design	32	30	93.75 (Feasible)
	Overall	**52**	**48**	**92.30 (Feasible)**

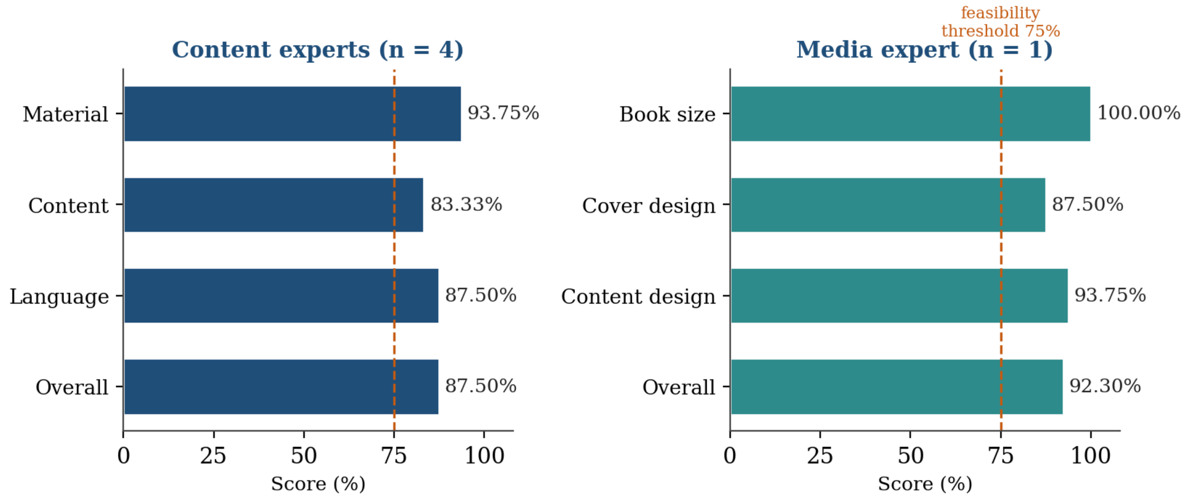

Figure 3. Expert validation scores for the IS-PARD model (dashed line = 75% feasibility threshold).

3.3 Product trials

Coaches evaluated the product positively in both trials. In the small-scale trial, ratings were 87.50% (physical), 91.67% (design), and 93.75% (usability), for an overall 91.18% (feasible). In the large-scale trial, ratings were 93.75% (physical), 94.44% (design), and 93.75% (usability), for an overall 92.16% (feasible) (Table 3). Expert and user suggestions-e.g., ensuring safety protocols, adapting each model to the athlete's disability category, using less technical language in the practical guide, adding photo/video demonstrations, specifying intensity (sets, repetitions, recovery), and using colour and proportional layout-were incorporated in revisions.

Table 3. Coach assessment in the small- and large-scale trials

Aspect		Small scale (%)	Large scale (%)
Physical		87.50	93.75
Design		91.67	94.44
Usability		93.75	93.75
Overall (Feasible)		**91.18**	**92.16**

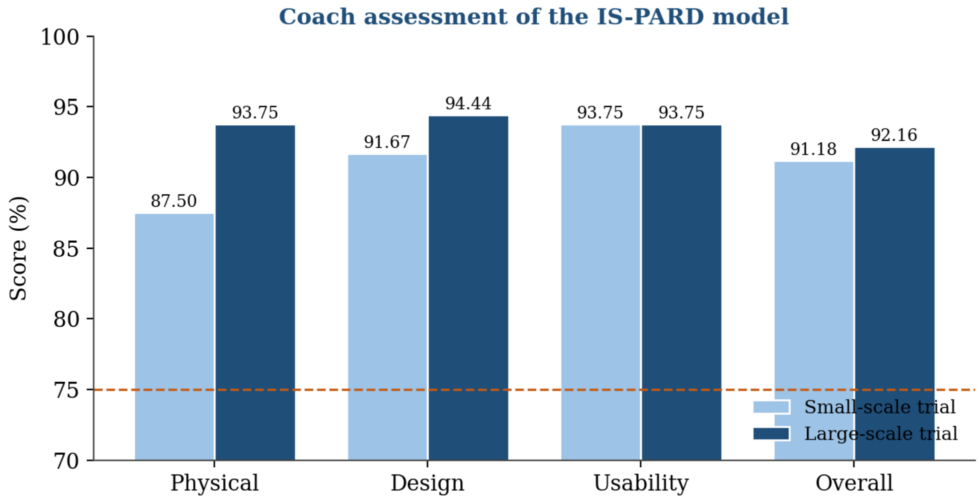

Figure 4. Coach assessment of the IS-PARD model in the small- and large-scale trials.

3.4 Effectiveness

The Shapiro-Wilk test confirmed that the difference scores were normally distributed in all groups (women: $p = 0.458$ and 0.333; men: $p = 0.283$ and 0.322; all $p > 0.05$), supporting the use of a parametric paired-samples t-test. Descriptive analysis showed faster 30-m sprint times after the 16-session intervention. Among women (n = 10), the mean time decreased from 5.61 ± 0.39 s (poor) to 5.09 ± 0.42 s (moderate), a reduction of 0.52 s (9.29%). Among men (n = 20), the mean decreased from 4.46 ± 0.39 s (moderate) to 4.09 ± 0.39 s (good), a reduction of 0.37 s (8.23%). For the pooled sample (n = 30), the mean decreased from 4.84 ± 0.67 s to 4.42 ± 0.62 s, a reduction of 0.42 s (8.64%) (Table 4).

Table 4. Descriptive pre-test and post-test 30-m sprint times (M ± SD)

Group	Pre (s)	Post (s)	Δ (s)	Improve-ment
Women (n = 10)	5.61 ± 0.39	5.09 ± 0.42	−0.52	9.29%
Men (n = 20)	4.46 ± 0.39	4.09 ± 0.39	−0.37	8.23%
Pooled (n = 30)	**4.84 ± 0.67**	**4.42 ± 0.62**	**−0.42**	**8.64%**

Note. Category labels follow the study's 30-m sprint norm; negative Δ indicates a faster (improved) time.

The paired-samples t-test indicated a statistically significant reduction in sprint time from pre-test to post-test in every group, with very large effect sizes (Cohen's dz ≥ 2.3). For the pooled sample, $t(29) = 12.89$, $p < 0.001$, mean difference = −0.42 s (95% CI [−0.49, −0.35]), Cohen's dz = 2.35 (Table 5). These results confirm that the IS-PARD model produced a significant and substantial improvement in sprint running speed.

Table 5. Paired-samples t-test, effect size, and 95% confidence interval

Group	t (df)	p	Cohen's dz	95% CI of Δ (s)
Women (n = 10)	8.55 (9)	< 0.001	2.70	[−0.66, −0.38]
Men (n = 20)	10.99 (19)	< 0.001	2.46	[−0.44, −0.30]
Pooled (n = 30)	**12.89 (29)**	**< 0.001**	**2.35**	**[−0.49, −0.35]**

Note. Normality confirmed by Shapiro-Wilk (all $p > 0.05$). Two-tailed paired-samples t-test, SPSS v29; values recomputed from the raw pre/post data.

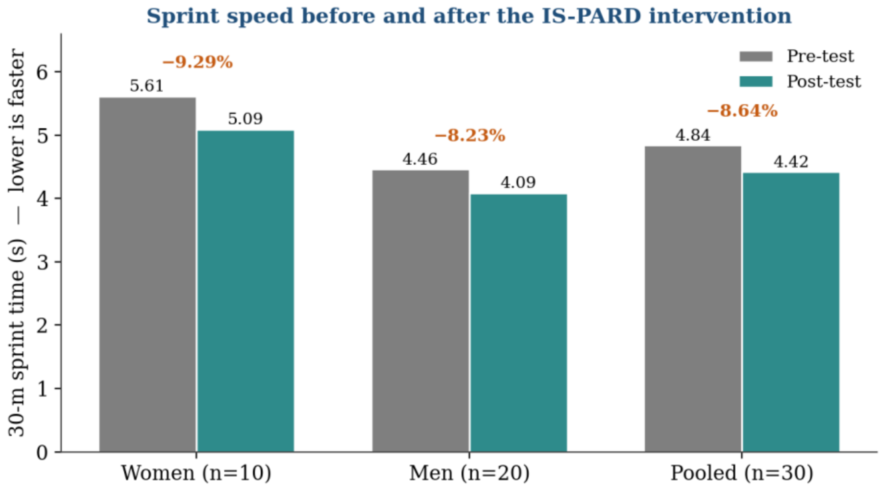

Figure 5. Mean 30-m sprint time before and after the IS-PARD intervention, with percentage improvement.

4. Discussion

The aim of this research was to establish and confirm an integrated speed training program (IS-PARD), designed specifically for para-athletes who run the 100 meters (T38), which can be used on a continual basis. This study was able to demonstrate that IS-PARD was effective as well as practical. The principal innovation of the current study lies not in the fitness components but rather in the specific integration and customisation of these components into one specific program for para-athletes running 100 metres.

The three main types of training that make up the IS-PARD are interval sprint training, plyometric training and ABC drills (Acceleration, Balance and Coordination running drills). Interval sprint training is designed to develop anaerobic capacity and maximal velocity, plyometric training is designed to develop power by using the stretch shortening cycle, and ABC drills are designed to develop both technical proficiency and coordination (Fang & Jiang, 2023; Skoglund et al., 2023; Song et al., 2023). These three components together develop both length of stride (force production) and frequency of stride (neural/coordinative) when combined in one personal training model (Khan et al., 2026; Nicholson et al., 2020; Zhang & Li, 2026).

The observed 8.64% improvement in 30-m sprint time (8.23% in men, 9.29% in women), accompanied by very large effect sizes (Cohen's dz = 2.35–2.70), is consistent with and somewhat larger than gains reported in comparable interval-sprint studies; for example, Koral et al., (2017) reported a 2.3% increase in maximal aerobic velocity in trained athletes, and Skoglund et al., (2023) noted 5-7% gains in maximal running velocity. The larger relative gain here is plausible given that the present participants began from a lower training baseline and that the intervention combined three complementary stimuli rather than one. The feasibility ratings (87.50% by content experts; 92.30% by the media expert) align with prior R&D studies of disability-specific training products, such as Mohammad et al., (2024) agility model for wheelchair-tennis athletes, which reported comparable expert ratings, and Setyantoko et al., (2019) game-based ABC running model, which improved 30-m sprint times in children.

The findings reinforce the argument that conventional, non-adapted training is suboptimal for tuna daksa athletes and that individualised, evidence-based programming-incorporating safety protocols, disability-appropriate loading, and clear visual instruction-can yield meaningful performance gains (Pisapia et al., 2019; Zahara et al., 2025). Practically, coaches can use IS-PARD as a structured set of speed-development variations, adjusting intensity, volume, interval, and recovery to the athlete's functional class.

4.1 Limitations

- The effectiveness phase used a one-group pre-test–post-test design without a control group, limiting causal inference; maturation and testing effects cannot be excluded.
- The sample was modest and drawn from a single province (Papua), and the heterogeneity of disability classifications was not fully controlled.
- Speed was assessed over 30 m rather than over competition distances (100–400 m); transfer to race performance was not directly evaluated.

5. Conclusion

The IS-PARD model-integrating interval sprint, plyometric, and ABC running drills-was successfully developed through a Borg and Gall R&D procedure, producing a guidebook with nine adapted training variations. The model was rated feasible by content experts (87.50%) and the media expert (92.30%), and it significantly improved sprint running speed in tuna daksa para-athletes ($t(29) = 12.89$, $p < 0.001$; 8.64% improvement; Cohen's dz = 2.35). IS-PARD is therefore recommended as a feasible, effective, disability-specific tool for sprint-speed development. Future research should employ controlled designs with larger, classification-stratified samples and evaluate transfer to competition distances.

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