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Speed, Agility and Quickness Training Versus Small-Sided Games: Effects on Physical and Cognitive Performance in Preadolescent Pickleball Players – A Randomised Controlled Trial

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ABSTRACT:

Background: Pickleball participation among children is rising, yet little evidence guides how young players should train agility and perceptual skills. A four-week trial in preadolescent footballers found comparable gains from speed, agility and quickness (SAQ) training and small-sided games (SSG), but its sample was small.

Objective: To compare an eight-week SAQ programme with an equivalent SSG programme for physical (5 m sprint, 20 m sprint, 90° change of direction, COD90) and cognitive (Flanker and visual search reaction time) performance in preadolescent pickleball players.

Methods: In this two-arm parallel randomised controlled trial, 82 club-level players aged 8–12 years (41 per group) were allocated by block randomisation. Both groups completed two supervised 25-minute sessions weekly for eight weeks alongside usual club training. Outcomes were measured at baseline, week 4 and week 8. Groups were compared with independent t-tests at each time point, and change over time within groups with omnibus F-tests and Bonferroni-adjusted comparisons.

Results: Groups were comparable at baseline and did not differ at week 4. At week 8 the SAQ group was faster on all measures: 5 m sprint (mean difference -0.14 s), 20 m sprint (-0.30 s), COD90 (-0.49 s), Flanker reaction time (-38 ms) and visual search reaction time (-48 ms), all $p = .001$, with between-group effect sizes of $d = 1.04$ – 1.44 . From baseline, SAQ participants improved by 10–17% across outcomes compared with 2–4% in the SSG group, whose cognitive scores did not change significantly.

Conclusion: Within eight weeks, SAQ training produced larger physical and cognitive gains than SSG in young pickleball players, with advantages emerging only in the second half of the programme. Findings support adding cue-based agility work to youth pickleball training, pending replication.

1. INTRODUCTION

Pickleball, a paddle sport that borrows elements from tennis, badminton and table tennis, has spread rapidly across the world, and India has seen similar growth since the pandemic years. Research has not kept pace with participation. Syntheses of the wellbeing literature show that published work is concentrated among adults over 50 years of age, even though children and adolescents make up a growing share of players (Lauxtermann & Stubbs, 2025). The movement profile of the sport is presumed to resemble other racket games, with repeated short accelerations and decelerations, lateral shuffling and abrupt direction changes (Cádiz-Gallardo et al., 2023). That presumption is borrowed, however, because the physiological evidence for racket sports comes mainly from tennis, badminton and squash. The clearest pickleball-specific evidence concerns injury: lower-limb, lower-back and upper-limb soft-tissue strains dominate (Prayudho et al., 2024), which are the regions loaded by braking, lateral travel and overhead reaching. Training that improves controlled deceleration and redirection is therefore of interest to coaches and to sports physiotherapists alike, both for performance and, potentially, for reducing injury risk in young players whose musculoskeletal systems are still developing.

Agility is the physical quality most often linked with racket-sport success, but the term covers two distinct abilities. Change-of-direction speed is a pre-planned movement task, whereas reactive agility adds perception of, and response to, an unpredictable stimulus, and the two are largely independent skills (Young et al., 2015). Reviews of team-sport testing indicate that tests containing a genuine decision component separate player of different standards better than closed course tests (Paul et al., 2016), and that most current tests still rely on simple, binary choices that under-challenge the information processing of skilled athletes (Morral-Yepes et al., 2020). Evidence on how agility develops and responds to training in children is thinner still, and the paediatric literature is dominated by male football samples, with reactive-agility and cognitively loaded protocols under-represented (Thieschäfer & Büsch, 2022). Findings from other sports therefore cannot simply be assumed to hold for young pickleball players.

Cognitive processes are equally central in externally paced sport. Athletes must inhibit irrelevant cues, locate relevant information quickly and select a response within fractions of a second. Systematic reviews of dual-task work in athletes show that combining a motor task with a cognitive demand carries an acute performance cost, but that sustained training under these conditions reduces the cost and improves attentional control and working memory (Moreira et al., 2021; Wu et al., 2024). Whether exercise itself improves cognition in children is less settled. A meta-analysis found benefits of acute and chronic exercise across executive-function domains in young people (Liu et al., 2020), yet effects vary between studies. One influential explanation is that the qualitative character of the activity, particularly how much cognitive engagement it demands, matters more than its intensity or duration (Pesce, 2012).

This raises a practical question about how young players should be trained. Speed, agility and quickness (SAQ) programmes use short, non-sport-specific drills with progressively richer cues, while small-sided games (SSG) embed movement inside tactical, sport-specific play. The closest precedent randomised preadolescent footballers to four weeks of either format and reported comparable improvements in sprinting, inhibitory control and perceptual speed, with no group-by-time interaction (Trecroci et al., 2022). That study used a small sample and a brief intervention, leaving open whether a longer programme, a larger sample or a different sport would separate the two approaches. No trial has yet compared these formats in pickleball players, whose sport combines rapid footwork with continuous perceptual decision-making. Both formats are cognitively

demanding, but by different routes: SAQ through externally cued, non-sport-specific stimuli of increasing complexity, and SSG through the tactical and perceptual demands embedded in game-like play. Whether these different loads translate into different physical and cognitive adaptations is the central empirical question.

We therefore conducted a randomised controlled trial in preadolescent pickleball players comparing eight weeks of SAQ training with an equivalent volume of SSG. We hypothesised that SAQ training would yield greater improvement in sprinting and change-of-direction performance, and in inhibitory control and perceptual speed, than SSG, and that these differences would become detectable with longer exposure than the four weeks used previously.

2. METHODS

2.1 Trial design and reporting

This was a two-arm, parallel-group randomised controlled trial with a 1:1 allocation ratio, reported in line with the CONSORT 2010 statement (Schulz et al., 2010). A parallel design was preferred to a crossover design because motor learning from one programme could carry over into the other. Testing took place at three points: baseline (one day before training), post-test 1 (end of week 4) and post-test 2 (end of week 8). No important changes to the protocol occurred after the trial began. Ethical approval was granted by the Institutional Ethics Committee of Madhav University (reference MU/IEC/24/03, 16 August 2024), and written informed consent from a parent or guardian and assent from each child were obtained before enrolment.

2.2 Participants and setting

Participants were preadolescent pickleball players of both sexes, aged 8–12 years, recruited through the coaching staff of a talent academy in Mumbai, India. Families of eligible players received an information sheet and could ask questions before agreeing; no payment or other incentive was offered. To be included, a child had to have trained at club level for at least one year, attending three two-hour sessions per week. Exclusion criteria were a recent limb injury (acute sprain, strain or fracture), congenital limb deformity such as uncorrected clubfoot or arthrogryposis, structural scoliosis, recent surgery, an acute infection such as pneumonia, and a break in training exceeding 60 days because of a major health problem. Physical testing was performed on a rubber gym surface to limit slipping, and cognitive testing in a quiet, separate room.

2.3 Sample size

The sample was calculated a priori in G*Power for a repeated-measures ANOVA with a between-subjects factor. Input values were a medium-to-small effect size ($f = 0.20$), $\alpha = .05$, power of .80, two groups and an assumed correlation of .20 among repeated measures. This returned a minimum total of 82 participants (critical $F = 3.96$), so 41 children were required per group. The reference trial reported no significant interaction after four weeks; the intervention period was therefore doubled to eight weeks in the hope of a clearer separation between groups.

2.4 Randomisation and blinding

Allocation used block randomisation to keep group sizes equal and to balance age and sex across arms. Randomisation followed a short familiarisation session so that every child understood the test procedures. All eligible children were enrolled first and were then assigned according to the schedule, yielding two arms of 41. A formal allocation-concealment procedure, such as sealed opaque envelopes, was not documented, and the research team both enrolled and allocated participants. Children and coaches could not be blinded because drill content was obvious. Outcome assessors were blinded to group membership, and the cognitive tasks were scored automatically by software.

2.5 Interventions

Both arms attended two supervised sessions per week for eight weeks while continuing their normal club training, so neither lost regular practice time. Sessions were held at the start of a training day and began with a ten-minute warm-up of light jogging and dynamic stretching. Each programme then consisted of two ten-minute blocks separated by five minutes of light movement, followed by a brief cool-down, giving about 25 minutes of programme content. A qualified coach delivered every session from a fixed written and pictorial protocol, and attendance was recorded at each session. Weekly content for both arms is summarised in Table 1.

SAQ group. Drills comprised split-steps, line drills, lateral hops, ladder patterns and short sprints combined with sudden direction changes. Auditory and visual cues were layered onto the drills to add a decision component, following the dual-stimulus logic

of the reference protocol (Trecroci et al., 2022). Each drill was performed for three to four sets of six to eight repetitions, with about 90 seconds between sets and 30 seconds between repetitions. Difficulty rose across the programme through longer sprint distances, more turns and more complex cues, moving from simple stop-go signals to combined audio-visual cues and finally moving-target reaction drills.

SAG group. Children practised pickleball-specific skills: dinking, ground strokes and volleys. The first block was technical, using three to four sets of eight to ten repetitions with 90 seconds between sets. The second block used small-sided game formats, with continuous rally play and a short water break about every three minutes. Content progressed from dinking fundamentals to live serve-and-return play on the same eight-week timeline. Session length, frequency and rest structure were matched to the SAG arm so that training content was the main difference between groups.

Table 1: Weekly progression of the two eight-week programmes (both: two sessions per week, about 25 minutes of content per session).

Weeks	SAQ: focus and content	SAQ: cognitive load	SSG: focus and content	SSG: game element
1–2	Foundational footwork: split-steps, line drills, lateral hops, 5 m sprints	Simple auditory stop-go cues	Dinking fundamentals: target, cross-court and random dinking	Basic serve and return drills
3–4	Ladder agility: skipping, hopscotch, in-and-out steps; 1–3 turns of 30°–45° over 10 m	Fixed visual cone targets	Ground-stroke coordination: wall-rally hand-eye drills, forehand–backhand alternation	Live ground-stroke rallies
5–6	Advanced footwork: foot exchange, shuffles, hip-twist patterns; 3–5 turns up to 90° over 10 m	Combined auditory–visual cues	Volley development: quick-hand volley drills	Combined serve and return practice
7–8	Integrated agility: basic and advanced footwork over 15 m	Moving-target reaction drills	Match-style integration: serve accuracy and return placement	Live small-sided serve-and-return play

2.6 Outcome measures

Physical performance. Three timed field tests were used: a 5 m sprint, a 20 m sprint and a change-of-direction test with 90° turns (COD90). For COD90, children started behind line A, sprinted to B, and then followed a fixed path of seven legs with alternating right and left 90° turns before finishing at H; this format has been used to evaluate agility in young footballers (Sporiš et al., 2010). Sprints began from a stationary standing start on a signal, with maximal effort requested. Times were recorded with a stopwatch. Each child completed three trials per test and the fastest trial was analysed. Testing followed a ten-minute standardised warm-up, with ten minutes of rest between tests and a five-minute re-warm-up before each new test.

Cognitive performance. Two computer tasks were run in PsyToolkit (version 3.6.5) on a standard keyboard. The Flanker task, based on the paradigm of Eriksen and Eriksen (1974), presented a central arrow flanked by four arrows that were either congruent or incongruent with its direction. Children pressed the key matching the central arrow within two seconds; the 100 trials lasted about 3 min 20 s. The visual search task, derived from work on target detection among distractors (Treisman, 1977), required participants to press the space bar when an orange letter T appeared among blue T and inverted orange T distractors, and to withhold a response otherwise. Display sizes were 5, 10, 15 and 20 items, with four seconds per trial and 100 trials in about 6 min 40 s. For both tasks the outcome was mean reaction time (RT) on correct trials, and lower values indicate better performance.

All participants were familiarised with the procedures beforehand and avoided strenuous activity for two days before each testing session. Procedures and equipment were identical at all three time points.

2.7 Data management and statistical analysis

Data were logged automatically for cognitive tasks and entered into a coded spreadsheet for timed tests, with names replaced by numeric codes held separately by the research team. Entries were checked against source records, and implausible values were re-verified. Analyses were run in SPSS with a two-sided significance level of .05. Baseline age, BMI and years of club experience were compared with independent t-tests, and sex and hand dominance with chi-square tests. Normality of each outcome was examined by group and time point using Kolmogorov–Smirnov and Shapiro–Wilk tests, histograms and Q–Q plots. Because distributions were approximately normal, groups were compared at each time point with independent t-tests, using the Welch correction where Levene's test indicated unequal variances. Change over time within each group was tested with an omnibus F-test across the three test periods, followed by Bonferroni-adjusted pairwise comparisons. Standardised between-group and within-group differences (Cohen's d, based on the pooled standard deviation) were calculated by the authors from the reported means and standard deviations.

3. RESULTS

3.1 Participants and baseline comparability

All 82 enrolled children (41 per group) completed the trial and the three test sessions; no participant withdrew. The two groups were similar at baseline in age, BMI, years of club experience, sex distribution and hand dominance (Table 2), so later differences are unlikely to reflect initial imbalance. Baseline scores on the five outcomes also did not differ significantly (all $p > .14$). Distributions were approximately normal (Shapiro–Wilk $p > .30$ for the physical outcomes and Flanker RT, with histograms and Q–Q plots supporting normality for visual search RT), which justified parametric testing.

Table 2: Baseline characteristics of the SAQ and SSG groups.

Characteristic	SAQ (n = 41)	SSG (n = 41)	Test statistic	p
Age, years, M (SD)	10.07 (1.01)	10.20 (1.33)	$t(80) = -0.47$	0.641
BMI, kg/m ² , M (SD)	17.63 (1.54)	17.22 (2.32)	$t(80) = 0.94$	0.351
Club experience, years, M (SD)	2.24 (0.61)	2.29 (0.74)	$t(80) = -0.31$	0.758
Sex, male / female, n	24 / 17	22 / 19	$\chi^2(1) = 0.20$	0.656
Hand, right / left, n	39 / 2	37 / 4	$\chi^2(1) = 0.72$	0.396

3.2 Between-group comparisons

Between-group results are given in Table 3 and Figures 1 and 2. At baseline and at week 4 the groups did not differ significantly on any outcome ($p = .086$ – $.335$). At week 8, the SAQ group was significantly faster than the SSG group on every measure (all $p = .001$). The mean advantage was 0.14 s for the 5 m sprint ($t = -6.29$), 0.30 s for the 20 m sprint ($t = -5.54$) and 0.49 s for COD90 ($t = -6.50$), the largest standardised difference ($d = -1.44$). For cognition, the SAQ group responded 38 ms faster on the Flanker task ($t = -4.69$) and 48 ms faster on visual search ($t = -4.76$). All week-8 effect sizes were large ($d = -1.04$ to -1.44).

Table 3: Between-group comparison of outcomes at each test period (independent t-tests, $df = 80$). Negative t and d indicate lower (better) values for SAQ.

Outcome	Period	SAQ M (SD)	SSG M (SD)	t	p	d
5 m sprint (s)	Pre	1.378 (0.126)	1.341 (0.109)	1.45	0.15	0.32
	Post 1	1.296 (0.111)	1.337 (0.112)	-1.67	0.099	-0.37
	Post 2	1.148 (0.091)	1.284 (0.104)	-6.29	0.001	-1.39
20 m sprint (s)	Pre	4.551 (0.362)	4.462 (0.260)	1.28	0.204	0.28

	Post 1	4.238 (0.249)	4.336 (0.260)	-1.74	0.086	-0.38
	Post 2	4.003 (0.233)	4.300 (0.253)	-5.54	0.001	-1.22
COD90 (s)	Pre	7.848 (0.439)	7.714 (0.397)	1.46	0.149	0.32
	Post 1	7.510 (0.384)	7.660 (0.397)	-1.73	0.087	-0.38
	Post 2	7.044 (0.298)	7.530 (0.374)	-6.50	0.001	-1.44
Flanker RT (ms)	Pre	612.9 (47.0)	599.3 (41.7)	1.38	0.17	0.31
	Post 1	591.6 (40.4)	602.2 (41.8)	-1.17	0.247	-0.26
	Post 2	547.3 (32.6)	585.4 (40.5)	-4.69	0.001	-1.04
Visual search RT (ms)	Pre	736.1 (57.5)	719.4 (51.6)	1.39	0.169	0.31
	Post 1	708.9 (50.5)	719.7 (50.8)	-0.97	0.335	-0.21
	Post 2	654.2 (39.9)	701.7 (49.9)	-4.76	0.001	-1.05

Note. M = mean; SD = standard deviation; d = Cohen's d (calculated from reported means and SDs). p-values are as printed by the statistics package.

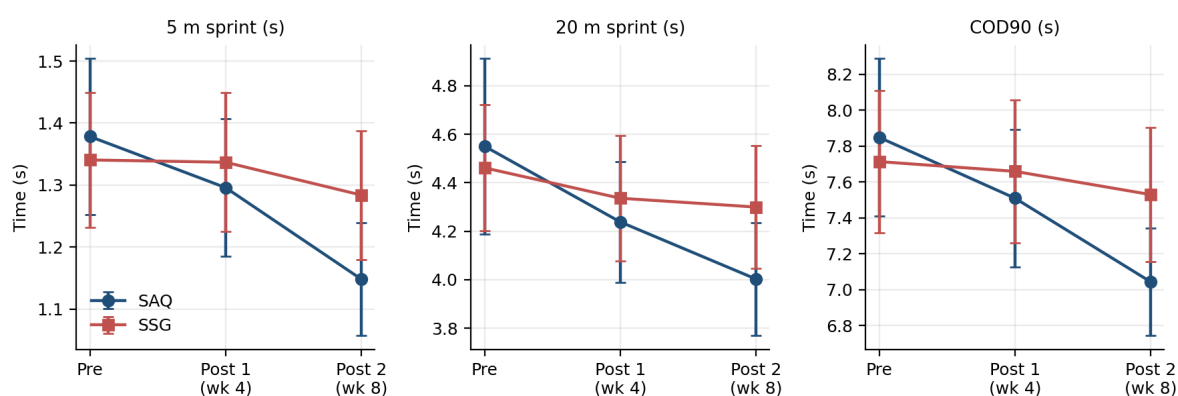


Figure 1: Mean ($\pm$ SD) 5 m sprint, 20 m sprint and COD90 times for the SAQ and SSG groups at baseline, week 4 and week 8.

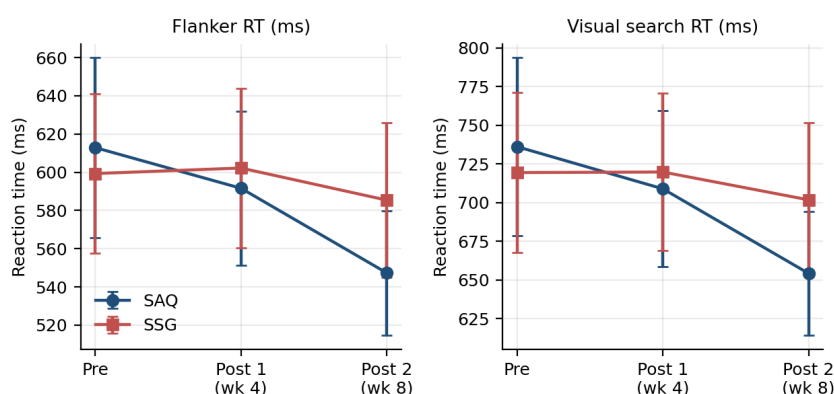


Figure 2: Mean ($\pm$ SD) Flanker and visual search reaction times for the SAQ and SSG groups at baseline, week 4 and week 8.

3.3 Within-group change

Table 4 summarises change across the three test periods. In the SAQ group the omnibus test was significant for all five outcomes ($F = 28.05$ – 46.66 , all $p = .001$). Every pairwise comparison was significant for the three physical measures and for visual search, whereas the baseline-to-week-4 Flanker change narrowly missed significance ($p = .056$) but was clear by week 8. Overall, SAQ participants improved by 10–17% from baseline, with within-group effect sizes of $d = 1.6$ – 2.1 .

The SSG group showed smaller changes (2–4%; $d = 0.3$ – 0.6). Omnibus tests were significant for the physical variables (5 m sprint $p = .033$, 20 m sprint $p = .014$, COD90 $p = .045$), but the only significant pairwise contrasts were baseline to week 8 for the 20 m sprint ($p = .016$) and COD90 ($p = .047$). Neither cognitive outcome changed significantly (Flanker $p = .149$; visual search $p = .190$).

Table 4: Within-group change across the three test periods: omnibus F ($df = 2, 120$), Bonferroni-adjusted pairwise p -values, and percentage change from baseline to week 8.

Outcome	Group	F	p	Pre–Post 1	Pre–Post 2	Post 1–Post 2	Change, %
5 m sprint	SAQ	46.04	0.001	0.003	0.001	0.001	–16.7
	SSG	3.50	0.033	1.000	0.059	0.087	–4.2
20 m sprint	SAQ	37.56	0.001	0.001	0.001	0.001	–12.0
	SSG	4.45	0.014	0.088	0.016	1.000	–3.6
COD90	SAQ	46.66	0.001	0.001	0.001	0.001	–10.2
	SSG	2.40	0.045	0.887	0.047	0.407	–2.4
Flanker RT	SAQ	28.05	0.001	0.056	0.001	0.001	–10.7
	SSG	1.94	0.149	1.000	0.391	0.204	–2.3
Visual search RT	SAQ	28.73	0.001	0.044	0.001	0.001	–11.1
	SSG	1.69	0.190	1.000	0.355	0.333	–2.5

Note. Negative change indicates faster (better) performance.

3.4 Summary of findings

Across the 15 pairwise comparisons per group (five outcomes, three contrasts), 14 were significant in the SAQ group but only two in the SSG group, and both of those needed the full eight weeks. The pattern was consistent: no group difference until week 8, then a large SAQ advantage on every measure.

4. DISCUSSION

In this randomised trial of preadolescent pickleball players, eight weeks of SAQ training produced larger improvements in sprinting, change of direction, inhibitory control and perceptual speed than an equivalent volume of pickleball-based small-sided games. Every between-group difference appeared only at week 8, and the effects were large. We consider below why the programmes diverged, why cognition followed the physical measures, and what this means for practice.

The physical results match the direction reported in the SAQ literature. In the closest comparison study, four weeks of SAQ improved 5 m sprint performance in young footballers while SSG did not, but the group-by-time interaction was not significant (Trecroci et al., 2022). Doubling the duration and enlarging the sample here converted a within-group trend into a clear between-group difference. This supports a cumulative-dose interpretation: if SAQ offers a modest per-session advantage for acceleration, four weeks may be too short for that advantage to exceed normal test variability, whereas eight weeks is sufficient. Adding structured speed sessions to a small-sided-game programme has been shown to improve sprint fitness beyond games alone (Castillo et al., 2021), implying that games seldom expose players to enough maximal-intent running.

The change-of-direction result is the most instructive. Trecroci et al. (2022) found no COD90 improvement in either group and, drawing on Lloyd et al. (2013), suggested that trainability of this quality may peak around 13–14 years of age, making it

hard to improve in younger children. Our participants had a mean age of about ten years, yet the SAQ group improved by roughly 10% and the between-group difference was the largest observed. Duration and progression probably account for the discrepancy. The present curriculum steadily increased the number and angle of turns, and repeated practice of the brake-and-redirect sequence loads the eccentric deceleration capacity on which a 90° cut depends. Preadolescent gains in speed are also thought to be predominantly neural, arising from better recruitment and coordination rather than muscle growth (Bloomfield et al., 2007), which is compatible with a response in only eight weeks. Reactive and pre-planned agility are separable (Sheppard & Young, 2006), and isolated drills of this kind have improved agility in under-11 players before (Trecroci et al., 2016). Taken together, this suggests that the age ceiling proposed for change-of-direction trainability reflects dose and duration more than an absolute developmental limit.

Specificity offers a further explanation. SAQ drills strip away technical and tactical demands, so each repetition targets acceleration or redirection. In small-sided games, sprints and turns occur at moments dictated by play and compete with ball control and opponent tracking. Games probably yield broader learning, but gains on any single isolated quality are likely to be slower. Our results are consistent with that trade-off and should not be read as evidence that games lack value; the SSG group did improve modestly on physical measures, and technical and tactical benefits were not measured.

The cognitive results were less expected, since ladders and cones seem far removed from a keyboard-based inhibition task. Yet the SAQ group responded faster on both tasks, and the SSG group showed no reliable change. One reading is that the cue-based structure of the later SAQ drills placed the programme closer to an open-skill activity than its label suggests. Children in open-skill sports have been reported to outperform those in closed-skill sports on incongruent Flanker trials, whereas simple reaction time is similar across sport types (Formenti et al., 2021; Nuri et al., 2013). Notably, both groups were already involved in an open-skill sport through their club, but only the SAQ group improved, so mere participation did not produce the change.

The cognitive-engagement account offers a mechanism. Pesce (2012) argued that exercise benefits cognition mainly through the mental effort it demands, not merely through physiological load. SAQ drills that require choosing among movement responses after a colour, sound or moving cue rehearse a conflict-resolution process akin to that measured by the Flanker task. Supporting evidence comes from primary-school children, where a cognitively engaging, coordination-based programme improved executive function while an aerobic programme of similar intensity did not (Schmidt et al., 2015). Broader reviews likewise identify coordination and cognitive challenge as active ingredients of exercise for executive function in childhood (Diamond, 2013; Diamond & Lee, 2011). Neurophysiological work points the same way: a nine-month physical activity trial in children increased P3 amplitude alongside better attentional inhibition (Hillman et al., 2014), and coordination training in older adults changed executive performance and neural processing more than cardiovascular training (Voelcker-Rehage et al., 2011). We collected no neural data, so these mechanisms remain inferences.

Why did games not shift cognition despite their decision-making load? Domain specificity is one answer. Perceptual-cognitive skill is shaped by the constraints under which it is practised (Roca et al., 2013), and meta-analyses report that generic laboratory tasks relate only weakly to sport expertise (Scharfen & Memmert, 2019; Voss et al., 2010). Decisions in a pickleball rally, embedded in a rich tactical setting, may transfer poorly to an abstract arrow task within eight weeks, whereas decontextualised SAQ drills with cues resemble the laboratory tasks closely enough for transfer to appear. Reactive agility depends on both physical and cognitive factors (Scanlan et al., 2014), and choice-based footwork training has improved agility in as little as four weeks (Galpin et al., 2008), which fits this view. Because physical and cognitive gains emerged together, we cannot separate them: the cognitive change may reflect the drills' decisional content or simply co-occur with physical improvement. The fact that SSG players also became fitter, yet showed no cognitive change, argues against a purely general-fitness explanation, but a design that manipulates the reactive component directly is needed to test it.

Several limitations qualify these conclusions. First, there was no inactive control group, so we cannot quantify maturational change; executive function improves steadily through middle childhood (Zelazo et al., 2004), although the unchanged SSG cognitive scores argue against maturation as the sole cause. Second, sprint and change-of-direction times were recorded by stopwatch, which is less precise than timing gates and vulnerable to reaction-time error, although blinding and the size of the effects make error an unlikely sole explanation. Third, the within-group omnibus tests used a one-way structure across time points rather than a model that accounts for repeated measurements on the same children, so their F-values may be inflated and should be re-estimated with repeated-measures or mixed-effects models. Fourth, allocation concealment was not documented, coaches were aware of group membership, and no correction was applied across the full set of tests. Fifth, the

sample came from a single academy of already active children, and cognitive tasks were laboratory measures whose transfer to match play is unknown. Retention and injury were not assessed.

For practice, the findings suggest that a short block of cue-based SAQ work, added to normal training, can improve speed, agility and reaction performance in young pickleball players without additional equipment beyond ladders and cones. Coaches should expect the advantage to appear after roughly eight weeks rather than four, and should treat SAQ as a complement to, not a replacement for, game-based practice. Sports physiotherapists may also consider such drills within injury-prevention programming, although this remains untested. Future trials should include an inactive control arm, objective timing, sport-specific decision tasks, retention testing and a comparison of fixed versus reactive SAQ content.

5. CONCLUSION

Eight weeks of SAQ training outperformed an equivalent volume of small-sided games for sprinting, change of direction, inhibitory control and perceptual speed in preadolescent pickleball players, with differences becoming evident only in the second half of the programme. Because the cognitive gains were confined to the group that trained with cues and choices, the decisional content of drills may be as important as their physical demands. Coaches can reasonably add a short cue-based agility block to practice, while confirmation in trials with inactive controls, objective timing and repeated-measures modelling is warranted.

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