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**The nature of formative physical activities and sports in the development of senior
volleyball players**

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Abstract

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This study characterized developmental sporting activities undertaken by volleyball players between ages of 6 to 12 years. Highly skilled (n=30) and less skilled (n=30) players participated in retrospective interviews to identify the nature of their formative enrichment experiences (formal adult-led and informal child-led activities) and types of sports practised (team or individual sports). All participants reported involvement in multiple formal sport activities and informal child-led activities, confirming that they did not specialize early in volleyball. Highly skilled male players reported being involved in more formal, adult-led activities, generally, and more formal team sports. In contrast, highly skilled and less skilled female players participated in equal amounts of formal adult-led and informal child-led activities. Results partially supported the value of an early diversified sport involvement to develop functional behavioural adaptability needed to specialise later in sports like volleyball. Findings highlighted the importance of considering the nature and types of early enriching play and practice activities to better understand possible complementary transfer of training effects during specialization. Data also emphasized relevance of considering sex differences in future analyses of player developmental pathways.

Key-words: practice, play, expertise, youth sports, talent development, sex differences

1. Introduction

22
23 Developmental activities and experiences of athletes are a key factor in acquiring
24 expertise in sport, due to transfer effects and impact of early enrichment experiences on
25 athlete development and later performance levels¹⁻⁴. The question of which types, and
26 amounts, of (specific and varied) sport experiences and physical activities can lead to
27 long-term development and progress towards exceptional performance has been debated
28 for some years^{5,6}.

29 Some approaches to acquiring expert performance⁷ have concluded that
30 expertise is predicated on early investment in intense, highly structured, specific and
31 effortful activities, which are not inherently enjoyable, defined as *deliberate practice*. A
32 monotonic relationship has been proposed between a higher performance level, and a
33 requisite amount of aggregated deliberate practice, deemed to take an average of 10,000
34 hours (over 10 years) to achieve. In order to acquire this proposed average level of
35 deliberate practice in one domain, an early identification, selection and start was needed
36 to maximise benefits of specialised practice⁷. As Ericsson et al.⁷ noted, ‘individuals
37 who start early and practice at the higher levels will have a higher level of performance
38 throughout development than those who practice equally hard but start later’ (p. 392).
39 These ideas gained prominence in the sport sciences in the late 1990s and early 2000s,
40 driving an early specialisation approach to athlete development in talent pathways.

41 In recent years, clear evidence continues to emerge demonstrating that the
42 developmental pathways of many elite performers may *not* require an average of 10,000
43 hours of deliberate, highly specialised practice and training⁸⁻¹⁰. Indeed, evidence from
44 performance trajectories of many elite athletes indicates the value and benefit of diverse
45 youth sport activities in both coach-led, structured and organised practice (in sport
46 clubs, high-school sports or sport academies). Many studies have also signalled the

47 value of peer-led, unstructured and non-formally-organised activities, in both the
48 athlete's primary sport as well as other sports ^{1, 11-13}.

49 Accordingly, two contrasting developmental pathways to expert performance in
50 sport have emerged in the literature: "early specialisation" and "early diversification" ⁵,
51 ^{14, 15}. They differ in exclusivity of early, sport-specific practice (one sport or multiple
52 sports), type of practice (structured/formal or unstructured/informal) and level of
53 engagement (expressed as hours of practice) ^{5, 15}. Early specialisation (reflected in the
54 framework of Deliberate Practice ⁷) includes identification and selection of potential
55 elite athletes at an early start age in a single sport, followed by early investment in
56 focused intensive training, framed as deliberate practice. While this is currently a
57 common pathway in sports where peak performance is achieved before
58 adulthood/maturity (e.g. gymnastics, figure skating), some researchers have
59 documented negative consequences associated with this approach to training, such as
60 overuse injuries, decreased sport enjoyment, boredom, burnout and dropout ¹⁵⁻¹⁷. In
61 early diversification, on the other hand, children 'sample' a wide range of sporting
62 activities (involving high levels of deliberate play and low levels of deliberate practice)
63 primarily for enjoyment and, as a by-product, enrichment of functional athletic
64 development, before specialising in a target sport. This approach is reflected in the
65 Developmental Model of Sport Participation (DMSP) ¹⁸, indicated as an alternative to
66 the early specialization pathway. It was argued that a more diversified sport engagement
67 would avoid or reduce negative consequences associated with early specialization. An
68 early diversified sport involvement was suggested because it may provide rich and
69 varied experiences in a number of different physical, cognitive, affective and
70 psychosocial dimensions. It is also suggested that diversification promotes several
71 benefits that aid performance, and personal and social development ¹⁸⁻²¹.

72 Notwithstanding, the existing literature shows that each approach may be correlated
73 with performance outcomes reported in some studies, but not in others ³.

74 There is a need for more research on these athlete developmental trajectories,
75 partially due to the varied and ambiguous nature of the sporting activities that
76 characterise these pathways, which impacts on direct empirical investigation ¹⁵.
77 Previous research has clarified that formal, adult-led activities provide positive
78 formative experiences throughout the athlete's development ²²⁻²⁴. Formal, adult-led
79 activities include all kinds of formally-organized, adult-led training and competitive
80 experiences, including instructed practices, designed to improve performance (specific
81 structured practice, specific pedagogical games, formal competitions and tournaments)
82 ^{1, 5}. On the other hand, informal, child-led activities include spontaneous games and play
83 activities that are undertaken by children in their free time in environments like
84 backyards, parks or streets with siblings and friends. These unstructured games and
85 activities are typically characterized by their intrinsic values of enjoyment, play, and
86 skill development ^{1, 5, 13, 25, 26}. Informal, child-led activities are widely recognized in the
87 literature as important and complementary experiences in the course of personal and
88 athletic development. Moreover, studies have shown evidence of benefits of informal
89 child-led activities on the development of elite and highly skilled performers in many
90 sports ^{12, 24, 26}. For example, in the study by Strafford and colleagues ¹² experienced
91 Parkour Traceurs were interviewed, discussing the importance of the powerful role of
92 unstructured practice and exploratory activities in their learning and development. Many
93 of them considered that the most enriching learning experiences and opportunities
94 emerged during unstructured exploration and practice with peers, without a coach
95 present to 'lead' the sessions, continually intervene with feedback and more. While
96 there is a strong theoretical basis in motor learning theory for positive effects ^{14, 27}, there

97 is a need for more data on specific benefits that may allow a better understanding of the
98 role of these activities on skill acquisition and athlete/talent development.

99 Past research has provided extensive information by recording participants’
100 reported involvement in formal organised sporting activities through retrospective
101 analysis (only structured, adult-led activities). But less information is available
102 concerning the variations in sports practised (sport-specific and non-sport specific play
103 and practice) ²⁵. Pedagogical approaches, like the Constraints-Led Approach (CLA) and
104 the Athletic Skills Model (ASM) ^{19, 27} are predicated on documented evidence from
105 actual practitioner interventions undertaken hourly, daily and weekly in sports
106 organisations. For example, the ASM documents outcomes of the relationship between
107 rich and varied sports experiences and skill acquisition in specialised sports training
108 programmes, capturing the effectiveness of experience in multiple sports and “donor
109 sports” and expertise acquired in a target sport. *Donor sports* include complementary
110 sport activities that enrich athletes by promoting transfer of varied and specific
111 movement skills and behaviours across a range of non-specific and specific practice
112 environments which support performance functionality at the specific moment of
113 specialisation ^{28, 29}. Abilities deemed critical to athlete development can be “*donated*”
114 by performance and experience in selected sports that share adjacent fields of an
115 affordance landscape including an extensive range of opportunities for action that can
116 support skills transfer from a donor sport to a target sport ^{19, 28}. An ecological dynamics
117 rationale explains that the enrichment process that learners undergo in a donor sport or
118 play activity (i.e. not necessarily formalised training in a sport), helps them to use
119 perception, action and cognition more effectively and efficiently in practice and
120 performance of their main sport. For example, it was proposed by Strafford et al. ²⁸ how
121 participation in donor sports can enrich functional performance behaviours (e.g.,

122 cognition, perception and action) of learners. This theoretical rationale was supported
123 by data of Oppici and colleagues³⁰. They found that participation in futsal games led to
124 three times the amount of recorded visual exploratory activity (scanning behaviours for
125 information away from the ball) compared to football participation in the observations.
126 These data were explained in the rationale of Travassos and colleagues³¹ who discussed
127 the potential skills transfer between futsal (acting as a donor sport) and Association
128 Football (Soccer), exemplifying how general transfer could occur between these two
129 sports.

130 Accordingly, informal child-led activities may also provide an important
131 contribution to skill acquisition and expertise development^{1, 13, 20, 21}. Although requiring
132 more empirical evidence to complement the vast amount of practical information
133 supporting the idea¹⁵, these experiences may comprise a high degree of novelty and
134 variability, exposing children to new physical, social and emotional situations, allowing
135 them to explore their independence and enhance their organization and leadership skills
136^{18, 20, 21}. Furthermore, flexibility in the structure and form of games may provide
137 children with the freedom to drive their own learning, innovate games, adapt actions,
138 and negotiate rules. Less structured play could engage children in developing
139 characteristics of importance for behavioural development and performance in sport,
140 such as innovation, resilience, self-regulation, creativity, adaptability, and flexibility^{15,}
141^{21, 32, 33}. These features are considered the hallmark of adaptive skilled behaviour or
142 dexterity^{34, 35}. Despite the obvious functional relevance of informal, child-led activities
143 in athletic development, more attention in the motor learning literature is needed to be
144 given to their potential significance.

145 To summarise, early diversification of sport experiences and play/practice and
146 performance environments (both formal and informal) might promote skills transfer by

147 exploiting affordance fields shared between sports and activities. More varied and
148 ‘donated’ activities could develop functional behavioural adaptability needed to
149 enhance foundational athletic capabilities, prior to specialisation³⁶. A careful, nuanced
150 and continuous transition between generality (non-target sports and activities) and
151 specificity (engaging with various forms of a target sport) of transfer is needed in talent
152 development^{28,36}. This approach seems to be particularly important in the early years of
153 athlete development (6-12 years) characterised as a sensitive period for effective motor
154 learning, in which children are able to learn very quickly and easily, with movements
155 effectively and rapidly modelled and skills acquired efficiently¹⁹.

156 The present study extends our analysis of the development of volleyball players¹
157 by re-analysing the data reported in our previous study and focusing on a specific period
158 of age (i.e. 6-12 years). Our intention was to scrutinize at what age players differ in their
159 perceptions of the number and type of activities they reported experiencing when aged
160 6, 7, 8, 9, 10, 11 and 12 years. By recording and comparing participant reports of annual
161 experiences of activities from 6-12 yrs of age, we sought to provide a more detailed
162 description of year-to-year variations in quantity and nature of sporting activities
163 experienced. These reported insights from participants could offer more concrete and
164 specific evidence about sport participation trajectories in such an important
165 developmental period for motor learning, skill acquisition and athlete development.
166 Therefore, the purpose of this study was to examine the developmental sporting
167 activities undertaken by highly skilled and less skilled volleyball players during the
168 development period of 6 to 12 years of age. Specifically, in this study we examined the
169 nature of the developmental sporting activities (i.e. formal adult-led and informal child-
170 led activities) and the types of sports practised (i.e. team or individual sports) during the
171 early years of development (6-12 years) of highly skilled and less skilled volleyball

172 players. The study also explored the potential sex differences in this characterization of
173 sport participation in early years.

174

175 **2. Materials and Methods**

176 **2.1. Participants**

177 The athletes analysed in this study correspond to the sample of athletes being tracked by
178 Coutinho and colleagues ¹. In that previous study we provided an initial global analysis
179 of the sports participation histories of Portuguese volleyball players, taking into account
180 three developmental stages: 6-12 years, 13-16 years, and 17-20 years. Our aim in the
181 current study was to re-analyse the data reported in our previous study and undertake an
182 in-depth analysis of the age period 6-12 years, scrutinizing what happened in the sport
183 participation history of these volleyball players in each year of that developmental stage
184 (i.e. when aged 6, 7, 8, 9, 10, 11 and 12 years). Accordingly, the original sample
185 included highly skilled (HS; n=30) and less skilled (LS; n=30) volleyball players (15
186 males and 15 females in each group) (descriptive statistics for each of the four
187 subsamples are presented in Table 1). Participants were selected using both purposive
188 and convenience sampling criteria. Hence, they were chosen because they were
189 considered information-rich in terms of having specialist knowledge and experiences
190 concerning the research topic being investigated, as well as due to their capacity and
191 willingness to participate in the study. Moreover, they were selected based on specific
192 inclusion criteria, which are described in detail below. Generally, participants were
193 selected based on two main criteria: being no younger than 23 years old (peak
194 performance in volleyball is achieved in the mid to late twenties ³⁷), and having
195 extensive experience of competitive participation (e.g., >7 yrs) in volleyball, but with
196 no prior specification of the number of reported hours spent in sport participation.

197 Additional criteria to select HS participants included: playing in the Portuguese premier
198 league³⁸, belonging to the Portuguese senior national team³⁹ and being ranked amongst
199 the best volleyball players of the country by national team coaches²³. The LS
200 participants were selected based on the following criteria: playing in the Portuguese
201 third league (the lowest competitive level, considered as recreational level volleyball)
202 and had never been part of a senior or youth national team. Participants that do not meet
203 all these criteria were not included in the sample. All procedures followed the
204 guidelines stated in the Declaration of Helsinki and were approved by the ethics
205 committee of the first author's institution. Participants were contacted personally and
206 were provided with an overview of the study, with 100% participation agreement. Prior
207 to the beginning of the study, all players were given information sheets that informed
208 them about the purpose of the study and signed consent forms. Anonymity of the
209 participants throughout the study was always assured.

210

211 * Please insert table 1 around here *

212

213 ***2.2. Data Collection***

214 An adapted version of the retrospective interview procedure originally proposed by
215 Côté, Ericsson and Law⁴⁰ was specifically designed to examine the sport participation
216 histories of these volleyball players. The interview design sought to gain an in-depth
217 understanding of participants' general patterns of activity involvement between 6 to 12
218 years of age. The concept "activities" included both sports (i.e. formal adult-led
219 activities) and play (i.e. informal child-led activities), and includes: (i) the quantity
220 (number of activities, both formal and informal); (ii) the nature (formal adult-led – FAL
221 – and informal child-led – ICL); and (iii) the type of these activities (team and

222 individual sport). Team sports included activities practised by more than one person,
223 involving cooperation between all members of the team/group and having shared
224 competitive goals, or, in other words, team game sports – e.g., football, handball,
225 basketball, volleyball, water polo. Volleyball (the main sports considered in this study)
226 is included in this category and was not analysed separately. Individual sports included
227 other activities rather than team game sports, in which they were practised by just one
228 person, involving personal goals – example: gymnastic, track and field, tennis,
229 swimming).

230

231 *** Please insert table 2 around here ***

232

233 Data were collected and presented in a series of tables and charts to provide an
234 accessible and intuitive profile for both the primary researcher and the athlete.
235 Interviews were conducted in a quiet area, familiar to participants and free from
236 distractions, in a face-to-face format, and took approximately 2 hours to complete. All
237 interviews were audio recorded and transcribed verbatim.

238

239 **2.3. Data Analysis**

240 Descriptive statistics were used to calculate frequencies, percentages, means and
241 standard deviation values. The requirements of normality and homogeneity of variance
242 were examined through the Kolmogorov-Smirnov test and Levene's test. Log
243 transformations were conducted on some variables due to signs of non-normality
244 (skewed data distribution). All variables examined from a developmental perspective
245 used a 4 x 7 (groups x ages) analysis of variance with repeated measures (RM
246 ANOVA). We considered four groups (highly skilled male, highly skilled female, less

247 skilled male and less skilled female) and seven different ages (6 years, 7 years, 8 years,
248 9 years, 10 years, 11 years and 12 years). Post hoc analyses were conducted using
249 Bonferroni tests (Bonferroni adjusted alpha of $p = .001$) and effect sizes were
250 determined using eta partial squared values (η^2_p). Greenhouse-Geisser adjustments were
251 applied to mediate violations of the sphericity assumption for the RM variable. To
252 assess the reliability of the information provided by participants in this study, follow-up
253 interviews were conducted with 25% of the sample (15 players - three HS male, four
254 HS female, four LS male, and four LS female) by the first author one month after the
255 first period of data collection. Pearson product-moment correlations were calculated
256 between the information collected at time one and time two. The reliability analysis was
257 conducted separately for male and female participants. A total of twelve correlation
258 coefficients were calculated as function of the nature (i.e., FAL and ICL) and type (i.e.,
259 general, team and individual) of sport activities from 6 to 12 years of age. The reliability
260 assessment of male players showed high correlation coefficients for general ($r = 0.968$),
261 team ($r = 0.984$) and individual ($r = 0.7$) FAL activities. Similarly, high correlation
262 coefficient values were found in the analysis of general ($r = 0.974$), team ($r = 0.978$) and
263 individual ($r = 1$) ICL activities practised by male players. Regarding female players,
264 the reliability assessment revealed also high correlation coefficients for general ($r =$
265 0.992), team ($r = 1$) and individual ($r = 0.978$) FAL activities, as well as for general ($r =$
266 0.938), team ($r = 0.905$) and individual ($r = 0.916$) ICL sport activities. All the
267 reliability coefficients aforementioned were statistically significant ($p < 0.000$).

268

269

3. Results

270 *3.1. Number and type of FAL activities*

271 Descriptive statistics for number and type of FAL activities experienced by HS and LS
272 male and female players are presented in Table 3. A significant effect for age ($F_{(4,1)} =$
273 $8,849, p < 0,000, \eta^2_P = 0,240$) and expertise level ($F_{(4,1)} = 0,736, p = 0,003, \eta^2_P = 0,274$)
274 on the male players' reported number of general FAL activities was found. Male players
275 reported being involved in more general FAL activities at the ages of 10, 11 and 12
276 years ($p = 0,003, p < 0,000, p < 0,000$, respectively). The HS male players were
277 involved in more FAL activities during this period compared to LS male players ($p =$
278 $0,003$). Regarding the number of team FAL activities experienced, a significant effect
279 for age ($F_{(3,1)} = 7,128, p < 0,000, \eta^2_P = 0,333$) and expertise level ($F_{(3,1)} = 4,124, p =$
280 $0,05, \eta^2_P = 0,128$) was found. Male players reported being involved in more team FAL
281 activities at the ages of 10, 11 and 12 years ($p < 0,000, p < 0,000, p < 0,000$,
282 respectively). The HS male players were involved in more team FAL activities during
283 this period, compared to LS male players ($p = 0,05$). There were no significant main
284 effects for age and expertise level on players' reported number of individual FAL
285 activities experienced.

286 Concerning the number of general FAL activities reported by female players, a
287 significant effect for age ($F_{(3,1)} = 6,788, p = 0,015, \eta^2_P = 0,123$) was found. Female
288 players reported being involved in more general FAL activities at the ages of 10, 11 and
289 12 years ($p = 0,002, p = 0,003, p = 0,002$, respectively). Regarding the number of team
290 FAL activities undertaken, a significant effect for age ($F_{(3,1)} = 8,453, p < 0,000, \eta^2_P =$
291 $0,232$) was observed. Female players were involved in more team FAL activities at the
292 ages of 10, 11 and 12 years ($p = 0,025, p = 0,001, p = 0,001$, respectively). Reports of
293 the number of individual FAL activities undertaken revealed a significant effect for age
294 ($F_{(3,1)} = 2,947, p = 0,05, \eta^2_P = 0,095$). Female players were involved in more individual
295 FAL activities at the ages of 9 and 10 years ($p = 0,005, p < 0,000$, respectively).

296

297 * Please insert table 3 around here *

298

299 **3.2. Number and type of ICL activities**

300 Descriptive statistics for number and type of ICL activities experienced by HS and LS
301 male and female players are presented in Table 3. A significant effect for age ($F_{(2,1)} =$
302 $8,131$, $p = 0,001$, $\eta^2_P = 0,225$) on male players' reported number of general ICL
303 activities was found. Male players reported being involved in more general ICL
304 activities at the ages of 10, 11 and 12 years ($p = 0,002$, $p = 0,001$, $p = 0,001$,
305 respectively). Regarding the number of team ICL activities undertaken by male players,
306 a significant effect for age ($F_{(2,1)} = 7,916$, $p = 0,001$, $\eta^2_P = 0,220$) was found. Male
307 players were involved in more team ICL activities at the ages of 10, 11 and 12 years (p
308 $= 0,005$, $p = 0,003$, $p = 0,003$, respectively). There were no significant main effects for
309 age and expertise level on male players' reported number of individual ICL activities.

310 Concerning the number of general ICL activities experienced by female players,
311 a significant effect for age ($F_{(2,1)} = 4,289$, $p = 0,020$, $\eta^2_P = 0,133$) was found. Female
312 players reported being involved in more general ICL activities at the ages of 9, 10, and
313 11 years ($p = 0,014$, $p = 0,006$, $p = 0,018$, respectively). Regarding the number of team
314 ICL activities experienced, a significant effect for age ($F_{(2,1)} = 4,041$, $p = 0,019$, $\eta^2_P =$
315 $0,126$) was found. Female players were involved in more team ICL activities at the ages
316 of 9, 10, 11 and 12 years ($p = 0,032$, $p = 0,018$, $p = 0,028$, $p = 0,017$, respectively).
317 There were no significant main effects for age and expertise level on the number of
318 reported individual ICL activities.

319

320

4. Discussion

321 This study compared the developmental sporting activities undertaken by HS and LS
322 volleyball players, at each year, between the ages of 6 to 12 years, specifically
323 considering the nature of these formative experiences and types of sports experienced.
324 We also explored potential sex differences in this characterization of early sport
325 participation. Globally, results indicated that both HS and LS participants were involved
326 in multiple FAL activities and ICL activities, demonstrating that they did not specialize
327 early in volleyball. Conceptually, reported experiences of both groups corresponded to
328 the “early diversification” pathway reflected in the DMSP¹⁸, characterized by sampling
329 different sports during the early years of athletic development and involvement in both
330 FAL and ICL play and practice activities^{18,41}. This pathway has been associated with
331 several benefits, including a well-documented reduced health-related risk (later
332 emergence of overuse injuries)^{17,42,43} and hypothesized positive effects on prolonged
333 engagement, enjoyment, reduced burnout, healthy psychological and social
334 development^{15,18,41,44}. These ideas are clearly aligned with theoretical proposals that
335 talent development in young sport participants is predicated on two phases: one of early
336 enrichment of athletic capacities before the secondary specialization period of dedicated
337 practice in a target sport^{19,45}.

338 Specifically considering participation in FAL activities, HS male participants
339 were involved in more activities compared to their LS counterparts. These findings are
340 consistent with the theoretical tenets of the DMSP¹⁸ and numerous retrospective studies
341 on team sports that empirically evidenced that elite players engage extensively in
342 various sports, before specializing in the main sport^{1,25,46-48}. The findings also support
343 the theoretical proposal of Côté and colleagues^{16,18} suggesting that early diversification
344 does not hinder elite sport participation in sports where peak performance is reached
345 after maturation, as observed in the majority of team sports. These findings also

346 highlighted sex specificities and differences, with participation in FAL activities being a
347 differentiating factor only between male players. This could indicate a greater
348 involvement, commitment to the sport and consistency in coach-led practice throughout
349 time by male players (in particular HS male players), which consequently could be
350 reflected in their performance enhancement. Also, social influences, with female players
351 having fewer opportunities for practising sports, could be reflected here. Regarding the
352 type of sports practised, although some caution is needed in interpreting these results
353 (particularly effect size values), the HS male participants indicated a greater
354 involvement in team sports compared to individual sports. Accordingly, it is possible
355 that team sports could have acted here as complementary *donor sports* to provide varied
356 and specific experiences across a range of non-specific and specific practice
357 environments which support performance functionality at the moment of specialization
358 ^{12, 19, 28, 29}. Team sports share adjacent areas or fields of an *affordance landscape* ⁴⁹ that
359 include an extensive range of opportunities for action which can transfer functional
360 performance behaviours. Here, transfer of learning could have emerged in differing
361 ways shaped by use of more general movement behaviours, perceptual and contextual
362 similarities, and opportunities for expression of cognitive functions (i.e. problem-
363 solving and decision making under pressure) and physical conditioning capacities. For
364 example, participating in other team sports may have helped players in enriching and
365 refining motor coordination (players developed patterns of coordination that best suit
366 different contextual demands), a better spatial orientation (players developed the skill of
367 maintaining orientation across a wide variety of circumstances - distances, number of
368 players, type of the game, etc.), an enhanced capacity for decision making (players have
369 to decide differently based on time and space restrictions, characteristics of the sport -
370 invasion / non-invasion - number of players involved, etc), enriched athleticism and

371 physical conditioning skills, and rigorous attitude to improvement in training culture
372 (players know how to train, seeking to continually improve, understand how to respect
373 rules, and how to collaborate and accomplish goals within a team sport environment).
374 This finding is aligned with the ecological dynamics theoretical framework emphasizing
375 that talent development and learning in sport implies a nuanced transition between
376 generality and specificity of practice and transfer^{36, 45, 50, 51}. According to some
377 theoretical explanations, varied experiences might favour exploratory and adaptive
378 behaviours, inviting participants to satisfy different interacting constraints, educating
379 their attention and intentions to specify what needs to be achieved in a performance
380 context³⁶. These experiences may have provided HS male players with a rich landscape
381 of affordances that helped them to develop functional behavioural variability,
382 potentiating perceptual-motor exploration, considered a hallmark of skilled behavior
383 (termed ‘dexterity’ by Bernstein³⁴; see also Chow and colleagues¹⁴). Nonetheless,
384 there are still some questions regarding the role of *donor sports* that remain unanswered
385 and should be explored in future studies. According to the original concept of *donor*
386 *sports*, the beneficial effects of other sport experiences is moderated by the relatedness
387 between other sports and a target sport. However, several studies have also
388 demonstrated the importance of other “unrelated” sports for later performance
389 development (captured at the multisports phase in the ASM continuum). Also, the
390 possibilities of skill transfer have been examined between coach-led practice (i.e.
391 formal, coach-led sports), and there is a need for more research on the transfer between
392 child-led play (i.e. informal, child-led activities) and a target sport. While an ecological
393 dynamic framework, in line with concepts from the ASM/donor sports, has the potential
394 to advance our understanding on skill acquisition and talent development in sport,
395 further empirical research is needed to clarify these issues.

396 Considering involvement in FAL activities by female participants, HS and LS
397 participants reported participating in essentially the same number of these activities
398 (both general, team and individual activities), with an increased participation between
399 10 and 12 years of age. This type of diversified sport involvement could have *donated*
400 important capacities or skill components that facilitated their holistic development,
401 helped them to exploit functional patterns of coordination, as well as enhanced
402 cognition, perception and action, relevant requisites for supporting subsequent
403 performance in volleyball ^{19,36}. Moreover, more than recording the number of sports
404 experienced, it is important to contemplate the microstructure of daily practice
405 experiences (especially their nature and quality). This approach will help investigators
406 to understand whether practice tasks are functionally relevant and contain informational
407 constraints that promote exploration, discovery and adaptation in learners. This finding
408 also highlighted the importance of considering sex differences in analyses of
409 participants' developmental pathways. Female athletes are clearly underrepresented
410 across all topics of talent development research and results are extrapolated to females
411 without due consideration of the impact of that transfer ⁵². Therefore, failing to account
412 for the experiences of females in talent development research can result in excluding
413 and ineffective talent development systems and sub-optimal experiences for female
414 athletes ⁵²⁻⁵⁴.

415 Regarding participation in ICL activities, both groups (HS male, LS male, HS
416 female and LS female participants) were involved in several ICL activities (both
417 general, team and individual activities), with greater intensity between 10 and 12 years
418 of age. Although the involvement in ICL activities did not differentiate between groups,
419 the findings are consistent with empirical evidences of some previous studies on team
420 sports demonstrating that players were involved in ICL activities ^{1, 12, 25}. According to

421 theoretical explanations, involvement in this type of activity allows children to
422 experience sports in various contexts with freedom to invent, adapt, create, and
423 negotiate activities and rules to suit to their own wishes and needs^{18,21}. Their high
424 degree of novelty and variability expose children to new physical, technical, tactical and
425 cognitive situations, allowing them to develop important characteristics of expertise in
426 sport, such as innovation, creativity, adaptability, and flexibility^{20,21,32}.

427 Notwithstanding, although ICL activities and play was positively correlated with later
428 performance in some studies^{1,12,33}, the experience in these activities was not correlated
429 or was negatively correlated with later performance in other studies²². Our study
430 demonstrated that both HS and LS players (male and female) were involved in
431 considerable quantities of ICL activities between 6-12 years of age, but the quantity of
432 these experiences was not statistically correlated with their later performance.

433 Considering the majority of studies on this topic have tended to only examine *the*
434 *quantity* of these experiences, it is important for further studies to consider *the quality* of
435 informal child-led experiences in order to better understand the role of this type of
436 activities on enriching athlete and talent development.

437 Despite the important findings of this study, there are some limitations that
438 should be addressed. Although used widely in the literature, reliable and valid,
439 retrospective methodologies and data mining techniques only reflect interpretation of
440 records and participants' reports/perceptions of their previous sport experiences, which
441 need to be triangulated with other objective data regarding developmental patterns⁵⁵.

442 Further studies are needed to consider the potential of multi-year prospective and multi-
443 cohort designs to specifically examine the athletes' developmental sport experiences to
444 better understand the contributions of diversified sport activities to developing expertise
445 in sport. A detailed examination of the microstructure of practice and play could

446 provide relevant insights into how the specificity/generality of information could lead to
447 specificity/generality of skill transfer. Thus, contemporary research methods in sport
448 science and pedagogical science may need further evidence of participant perception of
449 the type of practice activities, as well as quantity of relevant units in their practice
450 histories, such as hours or number of activities undertaken. The selected methods,
451 therefore, need to go beyond mere data mining since researchers need to ensure that
452 they are not disrupting, nor distorting the perceptions of the lived experiences of
453 participants (whether coaches or athletes). Here, exploring the use of qualitative
454 research methods (such as in-depth interviews, engaging with focus groups, participant
455 observation, action research, ethnographic studies) may provide a more consistent and
456 deeper way to enrich understanding of the role of practice and play activities in
457 determining expertise achievement. These investigations are likely to help researchers
458 better understand how training transfer facilitates athlete development.

459

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467

468 **Declaration of conflicting interests**

469 None

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References

- 471
- 472 1. Coutinho P, Mesquita I, Davids K, et al. How structured and unstructured sport
473 activities aid the development of expertise in volleyball players. *Psychology of Sport
474 & Exercise* 2016; 25: 51-59. DOI: 10.1016/j.psychsport.2016.04.004.
- 475 2. Güllich A. Sport-specific and non-specific practice of strong and weak responders in
476 junior and senior elite athletics: A matched-pairs analysis. *Journal of Sports Sciences*
477 2018; 36: 2256-2264. DOI: 10.1080/02640414.2018.1449089.
- 478 3. Güllich A. “Macro-structure” of developmental participation histories and “micro-
479 structure” of practice of German female world-class and national-class football
480 players. *Journal of Sports Sciences* 2018; 37: 1347-1355. DOI:
481 10.1080/02640414.2018.1558744.
- 482 4. Rothwell M, Rumbold JL and Stone JA. Exploring British adolescent rugby league
483 players’ experiences of professional academies and dropout. *International Journal of
484 Sport and Exercise Psychology* 2018. DOI: 10.1080/1612197X.2018.1549579.
- 485 5. Davids K, Güllich A, Shuttleworth R, et al. Understanding environmental and task
486 constraints on athlete development: Analysis of micro-structure of practice and
487 macro-structure of development histories. In: Baker J, Cobley S, Schorer J, et al.
488 (eds) *Routledge handbook of talent identification and development in sport*. London:
489 Routledge, 2017, pp.192-206.
- 490 6. Phillips E, Davids K, Renshaw I, et al. Expert performance in Sport and the dynamics
491 of talent development. *Sports Medicine* 2010; 40: 271-283. DOI: 10.2165/11319430-
492 000000000-00000.
- 493 7. Ericsson KA, Krampe R and Tesch-Romér C. The role of deliberate practice in the
494 acquisition of expert performance. *Psychological Review* 1993; 100: 363-406. DOI:
495 10.1037/0033-295X.100.3.363.

- 496 8. Hambrick DZ, Owswald FL, Altmann EM, et al. Deliberate practice: Is that all it
497 takes to become an expert? *Intelligence* 2014; 45: 34-45. DOI:
498 10.1016/j.intell.2013.04.001.
- 499 9. Macnamara B, Moreau D and Hambrick D. The relationship between deliberate
500 practice and performance in sports: A meta-analysis. *Perspectives on Psychological*
501 *Science* 2016; 11: 333-350.
- 502 10. Macnamara BN and Maitra M. The role of deliberate practice in expert
503 performance: Revisiting Ericsson, Krampe & Tesch-Römer (1993). *Royal Society*
504 *Open Science* 2019; 6: 190327. DOI: dx.doi.org/10.1098/rsos.190327.
- 505 11. O’Sullivan M, Woods C, Rothwell M, et al. Conceptualising physical literacy
506 within an ecological dynamics framework. *Quest* 2020; 72: 448-462.
- 507 12. Strafford BW, Davids K, North J, et al. Designing parkour-style training
508 environments for athlete development: Insights from experienced Parkour Traceurs
509 *Qualitative Research in Sport, Exercise and Health* 2020. DOI:
510 10.1080/2159676X.2020.1720275.
- 511 13. Machado JC, Barreira D, Gallati L, et al. Enhancing learning in the context of Street
512 football: a case for Nonlinear Pedagogy. *Physical Education and Sport Pedagogy*
513 2019; 24: 176-189.
- 514 14. Chow JY, Davids K, Shuttleworth R, et al. Ecological dynamics and transfer from
515 practice to performance in sport. In *Skill Acquisition in Sport: Research, Theory and*
516 *Practice* (3rd Ed.). In: A.M.Williams and N.Hodges (eds) *Skill Acquisition in Sport:*
517 *Research, Theory and Practice* (3rd Ed) London: Routledge, 2020.
- 518 15. Coutinho P, Mesquita I and Fonseca AM. Talent development in sport: A critical
519 review of pathways to expert performance. *International Journal of Sports Science*
520 *and Coaching* 2016; 11: 279-293. DOI: 10.1177/1747954116637499.

- 521 16. Côté J, Lidor R and Hackfort D. ISSP position stand: To sample or to specialize?
522 Seven postulates about youth sport activities that lead to continued participation and
523 elite performance. *International Journal of Sport and Exercise Psychology* 2009; 9:
524 7-17. DOI: 10.1080/1612197X.2009.9671889.
- 525 17. Myer GD, Jayanthi N, DiFiori JP, et al. Sport specialization, part I: Does early
526 sports specialization increase negative outcomes and reduce the opportunity for
527 success in young athletes? *Sports Health* 2015; 7: 437-442.
- 528 18. Côté J, Baker J and Abernethy B. Practice and play in the development of sport
529 expertise. In: Eklund R and Tenenbaum G (eds) *Handbook of sport psychology*. 3rd
530 ed. Hoboken, NJ: Wiley, 2007, pp.184-202.
- 531 19. Wormhoudt R, Teunissen JW, Savelsbergh G, et al. *The Athletic Skills Model for*
532 *talent development - No specialists, but athletes with a specialization*. New York:
533 Routledge | Taylor & Francis, 2018.
- 534 20. Côté J and Erickson K. Diversification and deliberate play during the sampling
535 years. In: Baker J and Farrow D (eds) *Routledge handbook of sport expertise*.
536 London: Routledge, 2015, pp.305-316.
- 537 21. Côté J, Erickson K and Abernethy B. Play and practice during childhood. In: Côté J
538 and Lidor R (eds) *Conditions of children's talent development in sport*. Morgantown,
539 WV: FIT, 2013, pp.9-20.
- 540 22. Güllich A. Many roads lead to Rome: Developmental paths to Olympic gold in
541 men's field hockey. *European Journal of Sport Science* 2014; 14: 763-771. DOI:
542 10.1080/17461391.2014.905983.
- 543 23. Berry J, Abernethy B and Côté J. The contribution of structured activity and
544 deliberate play to the development of expert perceptual and decision-making skill.
545 *Journal of Sport & Exercise Psychology* 2008; 30: 685-708.

- 546 24. Phillips E, Davids K, Renshaw I, et al. Acquisition of expertise in cricket fast
547 bowling: Perceptions of expert players and coaches. *Journal of Science and Medicine*
548 *in Sport* 2014; 17: 85-90. DOI: 10.1016/j.jsams.2013.03.005.
- 549 25. Coutinho P, Mesquita I, Fonseca AM, et al. Patterns of sport participation in
550 Portuguese volleyball players according to expertise level and gender. *International*
551 *Journal of Sport Science & Coaching* 2014; 9: 579-592. DOI: 10.1260/1747-
552 9541.9.4.579.
- 553 26. Uehara L, Button C, Saunders J, et al. Malandragem and Ginga: Socio-Cultural
554 Constraints on the Development of Expertise and Skills in Brazilian Football.
555 *International Journal of Sports Science and Coaching* in press.
- 556 27. Renshaw I, Davids K, Newcombe D, et al. *The Constraints-Led Approach:*
557 *Principles for Sports Coaching and Practice Design* London: Routledge, 2019.
- 558 28. Strafford BW, van der Steen P, Davids K, et al. Parkour as a donor sport for athletic
559 development in youth team sports: Insights through an ecological dynamics lens.
560 *Sports Medicine - Open* 2018; 4. DOI: 10.1186/s40798-018-0132-5.
- 561 29. Savelsbergh G and Wormhoudt R. Creating adaptive athletes: the athletic skills
562 model for enhancing physical literacy as a foundation for expertise. *Movement &*
563 *Sport Sciences - Science & Motricité* 2018; 102: 31-38.
- 564 30. Oppici L, Panchuk D, Serpiello FR, et al. Long-term practice with domain-specific
565 task constraints influences perceptual skills. *Frontiers in Psychology* 2017; 8: 1387.
566 DOI: 10.3389/fpsyg.2017.01387.
- 567 31. Travassos B, Araújo D and Davids K. Is futsal a donor sport for football?:
568 exploiting complementarity for early diversification in talent development. *Science*
569 *& Medicine in Football* 2017; 2: 66-70. DOI: 10.1080/24733938.2017.1390322.

- 570 32. Davids K, Araújo D, Seifert L, et al. Expert performance in sport: An ecological
571 dynamics perspective. In: Baker J and Farrow D (eds) Routledge Handbook of Sport
572 Expertise. London: Routledge, 2015, pp.273-303.
- 573 33. Memmert D, Baker J and Bertsch C. Play and practice in the development of sport-
574 specific creativity in team ball sports. *High Ability Studies* 2010; 21: 3-18. DOI:
575 10.1080/13598139.2010.488083.
- 576 34. Bernstein N. The co-ordination and regulation of movements. Oxford: Pergamon
577 Press, 1967.
- 578 35. Bernstein N. Dexterity and its development. Marwah, NJ: Erlbaum, 1996.
- 579 36. Seifert L, Papet V, Strafford BW, et al. Skill transfer, expertise and talent
580 development: An ecological dynamics perspective. *Movement & Sport Sciences -*
581 *Science & Motricité* 2019; 102: 39-49. DOI: 10.1051/sm/2019010.
- 582 37. Balyi I and Hamilton A. Long-term athlete development: Trainability in childhood
583 and adolescence. Windows of opportunity, optimal trainability. Victoria: National
584 Coaching Institute British Columbia & Advanced Training and Performance, Ltd.,
585 2004.
- 586 38. Low J, Williams AM, McRobert A, et al. The microstructure of practice activities
587 engaged in by elite and recreational youth cricket players. *Journal of Sports Sciences*
588 2013; 31: 1242-1250. DOI: 10.1080/02640414.2013.778419.
- 589 39. Hayman R, Polman R, Taylor J, et al. Development of elite adolescent golfers.
590 *Talent Development & Excellence* 2011; 3: 249-261.
- 591 40. Côté J, Ericsson KA and Law M. Tracing the development of athletes using
592 retrospective interview methods: A proposed interview and validation procedure for
593 reported information. *Journal of Applied Sport Psychology* 2005; 17: 1-19. DOI:
594 10.1080/10413200590907531.

- 595 41. Côté J, Murphy-Mills J and Abernethy B. The development of skill in sport. In:
596 Hodges N and Williams AM (eds) Skill acquisition in sport: Research, theory and
597 practice. New York: Routledge, 2012, pp.269-286.
- 598 42. DiSanti JS and Erickson K. Youth sport specialization: a multidisciplinary scoping
599 systematic review. Journal of Sports Sciences 2019. DOI:
600 10.1080/02640414.2019.1621476.
- 601 43. Kliethermes SA, Nagle K, Côté J, et al. Impact of youth sports specialisation on
602 career and task-specific athletic performance: a systematic review following the
603 American Medical Society for Sports Medicine (AMSSM) Collaborative Research
604 Network's 2019 Youth Early Sport Specialisation Summit. British Journal of Sports
605 Medicine 2019. DOI: 10.1136/bjsports-2019-101365.
- 606 44. Baker J, Cobley S and Fraser-Thomas J. What do we know about early sport
607 specialization? Not much! High Ability Studies 2009; 20: 77-89. DOI:
608 10.1080/13598130902860507.
- 609 45. Button C, Seifert L, Chow JY, et al. Dynamics of Skill Acquisition: An Ecological
610 Dynamics rationale (2nd Edition). . Champaign, Ill: Human Kinetics, 2020.
- 611 46. Coutinho P, Mesquita I, Fonseca AM, et al. Expertise development in volleyball:
612 The role of early sport activities and players' age and height. Kinesiology 2015; 47:
613 215-225.
- 614 47. Güllich A. International medallists' and non-medallists' developmental sport
615 activities: a matched-pairs analysis. Journal of Sports Sciences 2017; 35: 2281-2288.
616 DOI: 10.1080/02640414.2016.1265662.
- 617 48. Barth M, Güllich A, Raschndf C, et al. The path to international medals: a
618 supervised machine learning approach to explore the impact of coach-led sport-

619 specific and non-specific practice. PLoS ONE 2020; 15: e0239378. DOI:
620 10.1371/journal.pone.0239378.

621 49. Rietveld E and Kiverstein J. A rich landscape of affordances. *Ecological Psychology*
622 2014; 26: 325-352. DOI: 10.1080/10407413.2014.958035.

623 50. Davids K, Araújo D, Hristovski R, et al. Ecological dynamics and motor learning
624 design in sport. In: Hodges NJ and Williams AM (eds) *Skill acquisition in sport:
625 Researcher, theory and practice* (2nd edition). New York: Routledge, 2012.

626 51. Seifert L, Araújo D, Komar J, et al. Understanding constraints on sport performance
627 from the complexity sciences paradigm: An ecological dynamics framework. .
628 *Human Movement Science* 2017; 56: 178-180. DOI: 10.1016/j.humov.2017.05.001.

629 52. Curran O, MacNamara A and Passmore D. What about the girls? Exploring the
630 gender data gap in talent development. *Frontiers in Sports and Active Living* 2019.
631 DOI: 10.3389/fspor.2019.00003.

632 53. Bradley PS, Dellal A, Mohr M, et al. Gender differences in match performance
633 characteristics of soccer players competing in the UEFA champions league. *Human
634 Movement Science* 2014; 33: 159-171. DOI: 10.1016/j.humov.2013.07.024.

635 54. Phillipe RA and Seiler R. Sex differences on use of associative and dissociative
636 cognitive strategies among male and female athletes. *Perceptual and Motor Skills*
637 2005; 101: 440-444. DOI: 10.2466/pms.101.2.440-444.

638 55. Sosniak LA. Retrospective Interviews in the Study of Expertise and Expert
639 Performance. In: Ericsson KA, Charness N, Feltovich PJ, et al. (eds) *The Cambridge
640 Handbook of Expertise and Expert Performance*. New York: Cambridge University
641 Press, 2006, pp.287-301.

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643 *Table 1 - Descriptive statistics (mean and standard deviation) for age, sport starting age, volleyball*
 644 *starting age and age of volleyball specialization of Highly Skilled and Less Skilled players (male and*
 645 *female)*

	HS Male	LS Male	HS Female	LS Female
Age	27,1 ± 3,1	26,3 ± 2,9	27,4 ± 3,5	26,7 ± 2,6
Sport Starting Age	6,6 ± 2,7	7,1 ± 2,6	8,1 ± 2,9	7,8 ± 3,1
Volleyball Starting Age	10,1 ± 3,7	10,6 ± 3,7	11,7 ± 2,5	10,9 ± 2,2
Age of Volleyball Specialization	10,1 ± 2,1	11,1 ± 3,3	13,9 ± 2,1	12,3 ± 1,7

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648 *Table 2 - Description of the nature and type of activities*

Formal adult-led activities	Informal child-led activities
- Activities in general (general activities)	- Activities in general (general activities)
- Team sports	- Team activities
- Individual sports	- Individual activities

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655 Table 3 – Descriptive statistics (mean and standard deviation) for number of formal adult-led and informal child-led activities experienced by Highly Skilled and Less Skilled
656 players (male and female)

Ages	Formal Adult-led Activities				Informal Child-led Activities			
	General				General			
	HS Male	LS Male	HS Female	LS Female	HS Male	LS Male	HS Female	LS Female
6 years	1,07 ± 0,59	0,50 ± 0,51	0,73 ± 1,03	0,73 ± 0,79	0,87 ± 1,12	0,73 ± 1,10	1,07 ± 1,03	1,33 ± 1,23
7 years	1,07 ± 0,45	0,80 ± 0,67	0,93 ± 0,96	1,00 ± 1,41	1,07 ± 1,22	0,93 ± 1,10	1,33 ± 1,17	1,33 ± 1,23
8 years	1,20 ± 0,67	0,73 ± 0,59	1,07 ± 1,10	1,07 ± 1,38	1,33 ± 1,39	0,93 ± 1,10	1,73 ± 1,03	1,67 ± 1,54
9 years	1,40 ± 1,05	0,80 ± 0,67	0,93 ± 0,96	1,60 ± 1,35	1,53 ± 1,40	1,00 ± 1,30	1,73 ± 1,16*	1,80 ± 1,69*
10 years	1,73 ± 1,10*	0,87 ± 0,64*	1,00 ± 0,92*	2,27 ± 1,87*	1,73 ± 1,53*	1,07 ± 1,43*	1,93 ± 1,10*	2,00 ± 1,85*
11 years	1,80 ± 1,14*	1,07 ± 0,59*	1,07 ± 0,79*	1,93 ± 1,48*	1,93 ± 1,62*	1,27 ± 1,66*	1,80 ± 1,14*	2,07 ± 1,79*
12 years	2,13 ± 0,99*	1,40 ± 0,73*	1,07 ± 0,88*	1,67 ± 1,44*	1,93 ± 1,58*	1,40 ± 1,76*	1,53 ± 1,24	1,93 ± 1,66
Ages	Team				Team			
	HS Male	LS Male	HS Female	LS Female	HS Male	LS Male	HS Female	LS Female
	6 years	0,53 ± 0,51	0,27 ± 0,45	0,20 ± 0,56	0,33 ± 0,61	0,67 ± 0,81	0,33 ± 0,61	0,27 ± 0,45
7 years	0,67 ± 0,48	0,53 ± 0,64	0,27 ± 0,59	0,40 ± 0,63	0,80 ± 0,86	0,40 ± 0,63	0,27 ± 0,45	0,47 ± 0,83
8 years	0,87 ± 0,51	0,53 ± 0,51	0,27 ± 0,59	0,27 ± 0,59	1,00 ± 1,06	0,40 ± 0,63	0,40 ± 0,50	0,67 ± 0,90
9 years	0,93 ± 0,88	0,60 ± 0,50	0,33 ± 0,61	0,53 ± 0,74	1,07 ± 1,03	0,47 ± 0,74	0,47 ± 0,64*	0,80 ± 1,01*
10 years	1,20 ± 0,77*	0,80 ± 0,56*	0,40 ± 0,63*	0,93 ± 0,96*	1,20 ± 1,01*	0,53 ± 0,91*	0,60 ± 0,63*	0,80 ± 1,01*
11 years	1,27 ± 0,70*	1,00 ± 0,53*	0,53 ± 0,64*	1,13 ± 0,83*	1,33 ± 1,17*	0,73 ± 1,16*	0,60 ± 0,63*	0,87 ± 0,99*
12 years	1,67 ± 0,97*	1,27 ± 0,59*	0,80 ± 0,67*	1,07 ± 0,70*	1,33 ± 1,17*	0,93 ± 1,33*	0,53 ± 0,64*	0,87 ± 0,83*
Ages	Individual				Individual			
	HS Male	LS Male	HS Female	LS Female	HS Male	LS Male	HS Female	LS Female
	6 years	0,53 ± 0,64	0,20 ± 0,41	0,33 ± 0,48	0,60 ± 0,98	0,20 ± 0,41	0,40 ± 0,63	0,80 ± 0,77
7 years	0,40 ± 0,73	0,27 ± 0,59	0,53 ± 0,51	0,60 ± 0,91	0,27 ± 0,59	0,53 ± 0,64	1,07 ± 0,88	0,87 ± 0,74
8 years	0,33 ± 0,61	0,20 ± 0,41	0,67 ± 0,72	0,80 ± 0,86	0,33 ± 0,61	0,53 ± 0,64	1,33 ± 0,81	1,00 ± 0,92
9 years	0,53 ± 0,64	0,20 ± 0,41	0,53 ± 0,74*	1,07 ± 0,79*	0,47 ± 0,64	0,53 ± 0,64	1,27 ± 0,88	1,00 ± 0,92
10 years	0,53 ± 0,83	0,13 ± 0,35	0,53 ± 0,64*	1,20 ± 0,94*	0,53 ± 0,74	0,53 ± 0,64	1,33 ± 0,81	1,20 ± 1,08
11 years	0,53 ± 0,91	0,13 ± 0,35	0,53 ± 0,64	0,73 ± 0,88	0,53 ± 0,64	0,60 ± 0,73	1,20 ± 0,86	1,20 ± 0,96
12 years	0,47 ± 0,64	0,20 ± 0,41	0,27 ± 0,45	0,60 ± 0,82	0,53 ± 0,64	0,53 ± 0,74	1,07 ± 0,88	1,07 ± 1,10

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