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# A Comparison of Developmental Coordination Disorder Prevalence Rates in Canadian and Greek Children

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**Abstract** We examined whether lifestyle differences between Canadian and Greek children may be reflected in Developmental Coordination Disorder (DCD) prevalence rates. Data revealed that the relatively inactive Greek children demonstrated higher DCD prevalence rates compared to the Canadian sample and exhibited a greater risk for clinical obesity and low cardiorespiratory fitness. 

*Keywords:* Motor deficits; Clinical obesity; Cardiorespiratory fitness

Developmental coordination disorder (DCD) pertains to the unaccountable failure of children to acquire age-appropriate motor skills [1]. Recent research has demonstrated that, for Canadian children, DCD is associated with reduced levels of physical activity, which may contribute to clinical obesity ($_{CL}$OB) and low cardiorespiratory fitness ($_{L}$CF) [2]. Relative to children from other Western countries, such as Canada, Greek children lead a more inactive lifestyle [3,4], exhibiting risk for $_{CL}$OB and $_{L}$CF [5]. Therefore, the main aim of this study was to examine whether lifestyle differences between Canadian and Greek children may also be reflected in differences in DCD prevalence rates.

## Methods

The design of this study, including sample size estimations, is described in detail elsewhere [2]. The current study was approved by the Canadian and Greek educational authorities, as well as by the Brock and Wolverhampton Universities Research Ethics Boards.

### *Participants*

Participation was voluntary and included children from five Canadian and five Greek elementary schools from two provincial cities of fairly similar size. The Canadian sample (n = 591) consisted of 322 males and 269 females with an average age of 11.46 years. Response rate was 63.6%. The Greek sample (n = 329) consisted of 175 males and 154 females with an average age of 11.3 years. Response rate was 67.9%.

### *Anthropometry*

Body mass was measured electronically to the nearest .1 kg. Percent body fat was estimated using bioelectrical impedance analysis. $_{CL}$OB was confirmed at body fat values ≥ 25% and ≥ 30% for males and females, respectively [6].

### *The BOTMP-SF*

The short-form version of the Bruininks-Oseretsky Test of Motor Proficiency (BOTMP-SF), an individually administered test, was used to assess children's motor function.

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This 14-item test examines general motor skills and has been previously validated for use with school-age children [7]. Assessed parameters include running speed and agility, balance, bilateral coordination, strength, upper-limb coordination and dexterity, and response speed. DCD was identified using the cut-off point of ≤ 12 (percentile rank) for both males and females [7]. This test has not been validated for use with Greek children. However, the BOTMP-SF has been normed on U.S children [7] .

*Cardiorespiratory fitness (CF)*

The shuttle run test was used to assess CF. In brief, pupils run up and down a 20-m track at a steadily increasing pace (0.5 km/h every minute), controlled by signals from a standardized tape recording. The maximal speed attained during the final stage of the test was subsequently used to calculate CF [8]. The demarcation point for $_{L}$CF was set at 40 and 35 ml $\cdot$ kg$^{-1}$ $\cdot$ min$^{-1}$ for males and females, respectively [9].

Table 1
Sample characteristics of anthropometry, physical fitness and motoric competence (mean [SD])

| | Canadian[a] | Greek |
|---|---|---|
| Number of participants | | |
| Entire sample | 591 | 329 |
| Males | 322 | 175 |
| Females | 269 | 154 |
| Age (years) | | |
| Entire sample | 11.7 (10.2–13.2) | 11.3 (10.4–12.2)[b] |
| Males | 11.7 (10.2–13.2) | 11.3 (10.4–12.2)[b] |
| Females | 11.7 (10.2–13.2) | 11.3 (10.4–12.2)[b] |
| Mass (kg) | | |
| Entire sample | 45.5 (32.3–58.7) | 43.0 (33.1–52.9)[b] |
| Males | 45.8 (32.2–59.4) | 43.9 (33.2–54.6) |
| Females | 45.2 (33.5–56.9) | 42.1 (33.3–50.9)[b] |
| Body fat (%) | | |
| Entire sample | 16.1 (5.8–26.4) | 22.9 (15.2–30.6)[b] |
| Males | 11.4 (3.2–19.6) | 22.6 (14.4–30.8)[b,c] |
| Females | 21.9 (12.4–31.4) | 23.3 (16.3–30.3)[c] |
| Fat-free mass (kg) | | |
| Entire sample | 37.5 (28.4–46.6) | 32.8 (26.9–38.7)[b] |
| Males | 39.9 (30.0–49.8) | 33.4 (27.0–39.8)[b,c] |
| Females | 34.4 (27.6–41.2) | 32.1 (26.7–37.5)[b,c] |
| $VO_{2max}$ (ml $\cdot$ kg$^{-1}$ $\cdot$ min$^{-1}$) | | |
| Entire sample | 37.3 (29.7–44.9) | 35.6 (29.8–41.4)[b] |
| Males | 38.9 (31.0–46.8) | 37.6 (31.4–43.8)[c] |
| Females | 35.3 (28.6–42.0) | 33.5 (29.2–37.8)[b,c] |
| BOTMP-SF (Standard score) | | |
| Entire sample | 55.3 (42.5–68.1) | 49.6 (37.0–62.2)[b,] |
| Males | 58.1 (46.7–69.5) | 51.9 (38.7–65.1)[b,c] |
| Females | 52.3 (38.7–65.9) | 46.9 (35.4–58.4)[b,c] |

[a] Data from Faught et al, *Journal of Adolescent Health* (2005) (with permission).
[b] Significantly different between countries ($p < .05$).
[c] Significantly different between genders of the same country ($p < .05$).

Table 2
Prevalence rates [% (± 95% CI)] for clinical obesity ($_{CL}$OB) and low cardiorespiratory fitness ($_{L}$CF) in Canadian and Greek children with ($^{+}$DCD) and without DCD ($^{-}$DCD)

| | | DCD | $_{CL}$OB | $_{L}$CF |
|---|---|---|---|---|
| Canadian (n = 591) | $^{+}$DCD | 8 (6–10)[a] | 23 (22–24)[ab] | 83 (77–89)[ab] |
| | $^{-}$DCD | 92 (90–94)[a] | 12 (9–15)[ab] | 55 (52–58)[ab] |
| Greek (n = 329) | $^{+}$DCD | 19 (15–23)[a] | 48 (47–49)[ab] | 90 (86–94)[ab] |
| | $^{-}$DCD | 81 (76–86)[a] | 25 (20–30)[ab] | 65 (62–68)[ab] |

[a] Significantly different between countries ($p < .05$).
[b] Significantly different between $^{+}$DCD and $^{-}$DCD ($p < .05$).

*Statistical analyses*

Analysis of variance (ANOVA) was used to determine gender- and country-specific differences for each continuous parameter. Chi-square tests were conducted for prevalence rates comparisons, and accompanying confidence intervals were calculated for identified DCD ($^{+}$DCD), $_{CL}$OB, and $_{L}$CF in both Canadian and Greek samples. The level of significance was set at $p \leq .05$.

## Results

Table 1 depicts anthropometric, body fat, CF, and BOTMP-SF data from both samples. Significant gender- and sample-specific differences were detected in most parameters. Particularly, the Greek children demonstrated significantly higher body fatness and lower CF and BOTMP-SF scores than their Canadian peers.

Table 2 shows prevalence rates (% [± 95% confidence interval (CI)]) for Canadian and Greek children with ($^{+}$DCD) and without ($^{-}$DCD) Developmental Coordination Disorder in relation to $_{CL}$OB and $_{L}$CF. Specifically, significantly more Greek children were screened as $^{+}$DCD compared with their Canadian peers (19% vs. 8%). Similarly, $^{+}$DCD Greek children demonstrated greater prevalence rates for $_{CL}$OB and $_{L}$CF compared with the Canadian sample (48% vs. 23% and 90% vs. 83%, respectively). Greater prevalence rates for $_{CL}$OB and $_{L}$CF were also detected in the $^{-}$DCD Greek children compared with their Canadian peers (25% vs. 12% and 65% vs. 55%, respectively).

## Discussion

The purpose of this study was to investigate whether lifestyle differences between Canadian and Greek children are mirrored in DCD screening results. As compared with their Canadian peers, Greek children exceeded expected DCD prevalence rates for pediatric populations [1]. Further, Greek children with and without DCD demonstrated greater prevalence rates for $_{CL}$OB and $_{L}$CF relative to the Canadian sample. However, available data advocate that Greek children are relatively inactive compared with their peers from other countries [3,4]. This may have accounted for the significant $_{CL}OB$ and $_{L}CF$ differences found between the two samples. Nevertheless, limited physical activity may result in a decline in selected fitness-related parameters and deterioration in motor skills acquisition [10]. Hence, it is unlikely that relatively inactive children may acquire the necessary skills to adequately perform specific motor tasks. It could be, therefore, that existing lifestyle differences between Canadian and Greek children are echoed in the current DCD prevalence rates.

The highly significant difference in DCD prevalence rates between the two samples may not necessarily symbolize a failure of the Greek children to acquire age-appropriate motor skills. It may rather be a failure of the BOTMP-SF test to accurately discriminate between children who are truly identified as DCD cases and those who are simply inactive. Despite its extensive use in North America, the BOTMP-SF has never been previously employed in Greek children, highlighting the need for customized cut-off points for this population. However, it is concluded that lifestyle differences between samples are associated with differences in DCD prevalence rates. Increasing levels of physical activity may assist in reducing such prevalence rates in children.

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