

## Karate training effect in balance control in children with developmental coordination disorder

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### Introduction

The developmental coordination disorder (DCD) is a motor disorder identified and recognized by the Diagnostic and Statistical Manual of Mental Disorders (DSM), which affects 6% of school-age children (Vaivre-Douret, 2014; Vaivre-Douret et al., 2011). DCD children reveal problems in their development of fine and/or global motor coordination, difficulty in the motor control and learning, and in the acquisition of new motor skills (Vaivre-Douret, 2014). These difficulties in motor control and learning are expressed in many ways, such as a delay in achieving motor milestones, clumsiness, poor balance, difficulties in writing and drawing (Chang & Yu, 2010), poor postural control (Geuze, 2005), and difficulties in space and temporal organization (Wilson & McKenzie, 1998). All of that affects the daily life of the children and, consequently, brings more problems and new difficulties such as academic delay or social isolation (Joshi et al., 2015; Vaivre-Douret, 2014). One of the most prevalent problems is the postural control deficit, affecting 73 to 87% of the DCD children (Macnab, Miller, & Polatajko, 2001).

An early diagnosis accompanied by an early intervention may help to decrease the negative effects of DCD and provide a better life quality (Smits-Engelsman et al., 2013).

The regular practice of martial arts such Karate and Taekwondo improve children motor skills, including postural control and balance abilities (Fong et al., 2014; Truszczyńska, Drzał-Grabiec, Snela, & Rachwal, 2015). These benefits are also present in children with DCD, recent studies revealed an improve in sensory organization and standing balance (Fong, Tsang, & Ng, 2012), and also an increase in isokinetic knee muscle strength at 180° and in static single-leg standing balance in DCD children undergo a 3 months of intensive taekwondo practice (Fong, Chung, Chow, Ma, & Tsang, 2013).

children is the poor postural control, and that the intensive practice of taekwondo has proved to improve balance. We pretend to verify if regular and continuous karate practice also improve balance in DCD children.

### Methodology

The study will take place in city of Rio Maior including all primary schools. In the first phase, during the first school period, it will be identified the children with probable

DCD and in risk of developing DCD, that's a transition zone where the child doesn't have the disorder but has motor impairments. The identification will be made through the application of MABC-2 battery test, which allows to identify and describe the motor impairment in children (Henderson & Sugden, 2007).

After the identification it will be randomly made training and control groups by school, incorporating the probable DCD, in risk children and typical children paired by sex and age. It will be only included children without intellectual disability, visual impairment and neurological condition that affects movement.

The intervention phase will run during the second and third school periods, approximately 6 months. According previous studies trainings groups will have one hour weekly session (Fong et al., 2013, 2012), that will be conducted by a black belt in Karate. Beyond this session children of trainings groups will have a prescribed set of karate home exercises to reinforce what they have learned in the class. Participants will be instructed to do the home exercises daily. It will be given a book with the exercises, figures, explanations and a checklist for parents can help and control their sun's attendance to home training. The children in control groups will not receive training in this period. All groups, training and control, will pass by an initial, intermediate and final evaluation.

To evaluate the static balance control it will be used a unilateral stance test (UST) with a computerized dynamic posturography (CDP) machine, analysing both legs (dominant and non-dominant) thought sway velocity of the center of pressure (COP) captured by the CDP. The participants will be barefoot and will use a security belt. It will be conducted three trials of 10 seconds for each leg, participants should place arms by the side of trunk, eyes looking forward to a visual target, and the hip of the non-supporting leg flexed at 45° (Fong et al., 2013, 2012).

Data for COP sway velocity will be compared by group (probable DCD, in risk and typical) and between evaluative moments (initial, intermediate and final). It is expected, that in similarity with taekwondo studies, DCD children incorporated in training groups reveal an improvement in COP sway velocity with a significant decreased of values. We expect that these results also apply to in risk children group, revealing that karate can be a therapeutic leisure activity for DCD and in risk children population.

### **References**

- Chang, S.-H., & Yu, N.-Y. (2010). Characterization of motor control in handwriting difficulties in children with or without developmental coordination disorder. *Developmental Medicine & Child Neurology*, 52(3), 244–250. <http://doi.org/10.1111/j.1469-8749.2009.03478.x>
- Fong, S. S. M., Chung, J. W. Y., Chow, L. P. Y., Ma, A. W. W., & Tsang, W. W. N. (2013). Differential effect of Taekwondo training on knee muscle strength and reactive and static balance control in children with developmental coordination disorder: A randomized controlled trial. *Research in Developmental Disabilities*, 34(5), 1446–1455. <http://doi.org/10.1016/j.ridd.2013.01.025>

- Fong, S. S. M., Chung, J. W. Y., Ng, S. S. M., Ma, A. W. W., Chow, L. P. Y., & Tsang, W. W. N. (2014). Differential postural control and sensory organization in young tennis players and taekwondo practitioners. *Motor Control*, *18*(2), 103–111. <http://doi.org/10.1123/mc.2012-0117>
- Fong, S. S. M., Tsang, W. W. N., & Ng, G. Y. F. (2012). Taekwondo training improves sensory organization and balance control in children with developmental coordination disorder: A randomized controlled trial. *Research in Developmental Disabilities*, *33*(1), 85–95. <http://doi.org/10.1016/j.ridd.2011.08.023>
- Geuze, R. H. (2005). Postural Control in Children With Developmental Coordination Disorder. *Neural Plasticity*, *12*(2-3), 183–196. <http://doi.org/10.1155/NP.2005.183>
- Henderson SE, & Sugden DA. (2007). *Movement Assessment Battery for Children* (Second Edition). London (UK): Psychological Corporation;
- Joshi, D., Missiuna, C., Hanna, S., Hay, J., Faught, B. E., & Cairney, J. (2015). Relationship between BMI, waist circumference, physical activity and probable developmental coordination disorder over time. *Human Movement Science*, *40*, 237–247. <http://doi.org/10.1016/j.humov.2014.12.011>
- Macnab, J. J., Miller, L. T., & Polatajko, H. J. (2001). The search for subtypes of DCD: is cluster analysis the answer? *Human Movement Science*, *20*(1-2), 49–72.
- Smits-Engelsman, B. C. M., Blank, R., van der Kaay, A.-C., Mosterd-van der Meijs, R., Vlugt-van den Brand, E., Polatajko, H. J., & Wilson, P. H. (2013). Efficacy of interventions to improve motor performance in children with developmental coordination disorder: a combined systematic review and meta-analysis. *Developmental Medicine and Child Neurology*, *55*(3), 229–237. <http://doi.org/10.1111/dmcn.12008>
- Truszczyńska, A., Drzał-Grabiec, J., Snela, S., & Rachwal, M. (2015). Postural stability of children undergoing training in karate. *Archives of Budo*, *11*(0). Obtido de [http://archbudo.com/view/abstracts/issue\\_id/10480](http://archbudo.com/view/abstracts/issue_id/10480)
- Vaivre-Douret, L. (2014). Developmental coordination disorders: state of art. *Neurophysiologie Clinique = Clinical Neurophysiology*, *44*(1), 13–23. <http://doi.org/10.1016/j.neucli.2013.10.133>
- Vaivre-Douret, L., Lalanne, C., Ingster-Moati, I., Boddaert, N., Cabrol, D., Dufier, J.-L., ... Falissard, B. (2011). Subtypes of developmental coordination disorder: research on their nature and etiology. *Developmental Neuropsychology*, *36*(5), 614–643. <http://doi.org/10.1080/87565641.2011.560696>
- Wilson, P. H., & McKenzie, B. E. (1998). Information Processing Deficits Associated with Developmental Coordination Disorder: A Meta-analysis of Research Findings. *Journal of Child Psychology and Psychiatry*, *39*(6), 829–840. <http://doi.org/10.1111/1469-7610.00384>

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