

# The effect of one year of unstructured table tennis participation on motor coordination level among young recreational players

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Received: 04.10.2017  
Accepted: 02.01.2018

## Summary

**Purpose:** The aim of this study was to estimate the effect of unstructured table tennis participation on motor coordination level in young recreational players.

**Method:** A retrospective quasi-experimental study, with ex post facto design, was conducted. Sample was extracted from a population of 207 students aged 12 to 15 years enrolled in a public full-time school. Experimental (n=18) and control (n=18) groups were formed, resulting in a final sample of 36 participants (17 girls, 19 boys). Table tennis participation was experienced inside the school of the participants and consisted of an unstructured activity in which the subjects played recreationally during 30-40 minutes, 3 to 5 times per week, during one year. Post-intervention measures were performed within one week after one-year of table tennis participation. Motor coordination level was assessed using the Körperkoordinationstest für Kinder. Repeated measures analysis of variance was used to examine between- and within-subjects differences.

**Results:** Both groups showed higher values of motor coordination level over one-year. Tennis table participation group had significantly higher motor coordination levels than control group across both time periods ( $F=12.483$ ,  $p=0.01$ ). However, the interaction effect between tennis table participation and time was not significant ( $F=1.552$ ,  $p=0.221$ ).

**Conclusion:** Motor coordination levels of young recreational players were not improved due to unstructured table tennis participation, even after one year of regular practice. The lack of adequate opportunities for practice may have led to these findings. Additional research involving both structured and unstructured practice of this sport should be pursued.

## Key words:

Motor coordination.  
Table tennis.  
Sport participation.  
Adolescents.

## El efecto de un año de la participación no estructurada del tenis de mesa en el nivel de coordinación motora entre los jóvenes jugadores recreativos

### Resumen

**Objetivo:** El objetivo de este estudio fue estimar el efecto de la participación no estructurada del tenis de mesa en el nivel de coordinación motora en jóvenes jugadores recreativos.

**Método:** Se realizó un estudio retrospectivo cuasi-experimental. Se extrajo una muestra de una población de 207 estudiantes de 12 a 15 años matriculados en una escuela pública a tiempo completo. Se formaron un grupo experimental (n=18) y control (n=18), resultando una muestra final de 36 participantes (17 chicas y 19 chicos). La participación en tenis de mesa se llevó a cabo dentro de la escuela de los participantes y consistió en una actividad no estructurada en la que los sujetos jugaban recreativamente durante 30-40 minutos, 3 a 5 veces por semana, durante un año. Las medidas post-intervención se realizaron una semana después de completar un año de participación en el tenis de mesa. El nivel de coordinación motora se evaluó utilizando el Körperkoordinationstest für Kinder. El análisis de la varianza de medidas repetidas se utilizó para examinar las diferencias entre los sujetos.

**Resultados:** Ambos grupos mostraron mayores valores de coordinación motora a lo largo de un año. El grupo de participación en tenis de mesa tuvo niveles de coordinación motora significativamente más altos que el grupo control en ambos períodos de tiempo ( $F=12.483$ ,  $p=0,01$ ). Sin embargo, el efecto de interacción entre la participación en tenis de mesa y el tiempo no fue significativo ( $F=1.552$ ,  $p=0,221$ ).

**Conclusión:** Los niveles de coordinación motora de los jugadores jóvenes recreativos no mejoraron debido a la participación no estructurada en el tenis de mesa, incluso después de un año de práctica regular. La falta de oportunidades adecuadas para la práctica puede haber llevado a estos hallazgos. Debería llevarse a cabo una investigación adicional que incluya tanto la práctica estructurada como la no estructurada de este deporte.

## Palabras clave:

Coordinación motora.  
Tenis de mesa.  
Participación deportiva.  
Adolescentes.

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## Introduction

Motor coordination is the harmonious functioning of body components involving synchrony of gross and fine motor control and motor planning<sup>1</sup>. As a measurable phenomenon, there are different assessment tools which can be used for estimating motor coordination levels. Among these tools, there are those which use gross and fundamental movement skills performance for estimating motor coordination levels in children and adolescents, such as the widely used M-ABC, BOT-2, TGMD-2 and KTK tests<sup>2</sup>.

Motor coordination levels estimated through these tests were firstly used in clinical setting for assessing neurological or functional status, as well as developmental delays, in children. In the last years, however, the usefulness of motor coordination level as a measure is not restricted to solely clinical assessments<sup>3</sup>. There is a scope of evidence supporting a range of correlates of global motor coordination level<sup>4</sup>, such as health outcomes<sup>4,5</sup>, academic achievement<sup>6,7</sup> and sport-related attributes<sup>8,9</sup>.

Sport participation is one of sport-related attributes that have been examined as a correlate of motor coordination level<sup>1,8-12</sup>. Previous studies have suggested a positive effect of structured sport activities on motor coordination level in children and adolescents<sup>1,9,13</sup>. Although unstructured sport activities have been recommended for acquisition of skill<sup>14,15</sup> and expertise<sup>16-19</sup> in sport, there is no evidence supporting these activities have a positive effect on motor coordination level when they are experienced singly, that is, without the concomitance of structured sport activities.

While structured sport activities involve formal adult led-sport activities that include all kinds of organized training<sup>19</sup>, unstructured sport activities include informal youth-led activities, developed in play environments like backyard or street games<sup>19</sup>. Thus, a possible effect on motor coordination level may also vary due to organization of sport practiced, that is, structured or unstructured sport activity.

Nevertheless, even in unstructured activities is possible to experience adequate opportunities for practice. Therefore, the hypothesis that unstructured sport activities may also have a positive effect on motor coordination level cannot be ruled out. Indeed, individuals may develop their motor skills in an incidental manner<sup>20</sup>, such as in unorganized active physical recreation<sup>21</sup>.

Among several sports to be studied in the topic approached in this study, table tennis seems to be very interesting due to different reasons. First, table tennis is a massively popular sport<sup>22</sup> with nearly 40 million competitive table tennis players around the world and countless millions playing recreationally<sup>23</sup>. As a popular sport, it is important to know what are the benefits of table tennis participation across different populations, mainly among those who play recreationally. Second, table tennis is an open and complex motor task<sup>24</sup> marked by high ball speed and dynamically changing, unpredictable and externally paced environment<sup>25</sup>; also, evidence suggests that performance in table tennis is associated with different kinds of motor skills<sup>24,26-29</sup> in young players. Due these characteristics and evidence, it seems plausible to expect that table tennis participation has a significant effect on motor coordination level. Finally, In order to disseminate the table tennis participation among children and adolescents as well as to foment the so called Olympic legacy, before last Olympic Games was promoted an unstructured practice of this sport

around public schools of Rio de Janeiro city. Among other things, it was emerged an opportunity to estimate the effect of unstructured table tennis participation on motor coordination level.

Understanding the benefits of unstructured table tennis participation on motor coordination level in young who play recreationally is a matter of public health, since motor coordination is associated with a range of health outcomes<sup>4,5</sup>. Therefore, the aim of this study was to estimate the effect of unstructured table tennis participation on motor coordination level in young recreational players.

## Material and method

A retrospective quasi-experimental study, i.e. with ex post facto design, was conducted considering the period between July 2013 and July 2014. The sample was extracted from a population of 207 students, aged 12 to 15 years, enrolled in a public full-time school in the city of Rio de Janeiro, Brazil. Among these students, 53 had table tennis participation at least one time per week and 154 did not practice table tennis in the period. All students, including those who did not practice table tennis, had physical education classes one or two times per week.

Inclusion criteria required subjects to be under 15 years old with no history of injury or disease that could affect motor performance. Exclusion criteria consisted of students who were enrolled in regular sport participation outside school within July 2013 and July 2014. Additionally, from 53 students with table tennis participation, those who played table tennis less than three times per week for two or more weeks were also excluded. Based on these criteria, 59 subjects were excluded, being 35 with and 24 without table tennis participation.

Thus, the experimental group (i.e. with regular table tennis participation) was composed of 18 subjects (n=18). Of the 130 students remaining without table tennis participation, eighteen were randomly selected and assigned to the control group (n=18), resulting in a final sample of 36 participants (N=36). Ethical approval for this study was obtained from the University's Ethics Committee and parental consent and child assent were obtained prior to participation.

Table tennis participation was experienced inside the school of the participants and all the materials used for its practice were standardized following the International Table Tennis Federation recommendations. Body mass was measured to the nearest 0.1 kg using an electronic scale with participants wearing their school uniform. Standing height was measured while unshod with a meter wall to the nearest 0.1 cm. Motor coordination level was assessed using the Körperkoordinationstest für Kinder (KTK). Baseline measures were performed within one week before the start of table tennis participation. Post-intervention measures were performed within one week after one-year of table tennis participation. All measures were performed by a single trained physical educator as routine assessment of students in the physical education program of school.

Table tennis is a sport played with remarkably high speed which requires accurate timing and perceptual skills when practiced for expert players<sup>30</sup>. However, our investigation was conducted with non-athletes, young recreational players. Moreover, in this study was only experienced unstructured table tennis practice. Thus, sport performance was not focused and table tennis specific skills were not assessed. Instead,

motor coordination level was estimated using the KTK, a generic, non-specific test.

The KTK is appropriated to assess motor coordination level of participants because it is a reliable and valid instrument, with a test-retest reliability coefficient of 0.97<sup>31</sup>. KTK is one of most used tools for assessing children’s motor coordination<sup>2</sup> and has been applied in different research topics, such as health outcomes<sup>3,5</sup>, academic achievement<sup>6,7</sup> and sport-related attributes<sup>8,9</sup>. KTK consists of four test items. The first is walking backwards along balance beams (3 m length) of decreasing width (6, 4.5 and 3 cm). Each beam was crossed three times where a maximum of eight steps per trial were allowed (72 steps overall); the sum of steps in all trials determined score 1. The second involved one-legged hopping over an obstacle, formed by an increasing pile of pillows (pillow size 60 cm × 20 cm × 5 cm; the maximum was 12 pillows or a height of 60 cm). Only three trials were allowed for each obstacle and three, two, or one point(s) were/was awarded for successful performance on the first, second, or third try, respectively. Therefore, a maximum of 39 points (including a ground level trial) could be scored for each leg; the points were summed to determine score 2. The third task was two-legged sideways jumping across a wooden slat (60 cm × 4 cm × 2 cm) for 15 s as quickly as possible. The number of jumps performed correctly was summed over two trials to determine score 3. The final task involved moving sideways on wooden boards (25 cm × 25 cm × 5.7 cm) as many times as possible in 20 s. One point was awarded for each time the plate was transferred and one more for stepping on it. The number of relocations was counted and summed over two trials to determine score 4. KTK takes into account motor coordination level is gender and age-related. Thus, the four scores acquired in each item test were gender and age-adjusted in according to KTK normative database. Finally, the motor coordination level for each participant was derived from the sum of the four adjusted scores obtained in the tests.

Table tennis participation consisted of an unstructured sport activity in which the participants played recreationally during 30-40 minutes for 3 to 5 times per week. The practice was exclusively individual and game-based. They had the opportunity to engage in table tennis participation daily together with their classroom colleagues, resulting in subgroups of 5-8 subjects for each one of two table’s tennis available in the school. Due to school calendar, there was a recess of 45 days between the sixth and seventh months in which the subjects of experimental group did not play table tennis.

Descriptive statistics were determined for all variables. The Kolmogorov-Smirnov test confirmed acceptable normality of the data distribution. Repeated measures analysis of variance (ANOVA) was used to examine between- and within-subjects differences. A significance level of 5% ( $\alpha = 0.05$ ) was adopted in all statistical tests. Data analysis was executed using Statistical Package for Social Sciences (SPSS ver. 22.0 software, IBM, USA).

## Results

At the baseline, participants (N=36) showed mean values of age, body weight, height and motor coordination level as 13.2y ( $\pm 0.5$ ), 47.8 kg ( $\pm 13.6$ ), 1.56 m ( $\pm 0.1$ ) and 88.4 ( $\pm 27.2$ ), respectively. After one year, mean

values were 14.3 y ( $\pm 0.4$ ), 53.7kg ( $\pm 14.0$ ), 1.62 m ( $\pm 0.1$ ) and 100.8 ( $\pm 28.2$ ). Descriptive statistics of the baseline and after one-year of table tennis participation of experimental (n=18, 11 boys and 6 girls) and control (n=18, 6 boys and 11 girls) groups are provided in Table 1.

Both control and table tennis participation groups showed higher values of motor coordination level after one year (Figure 1) and ANOVA revealed which this difference was significant ( $F=55.138$ ,  $p<0.0001$ ).

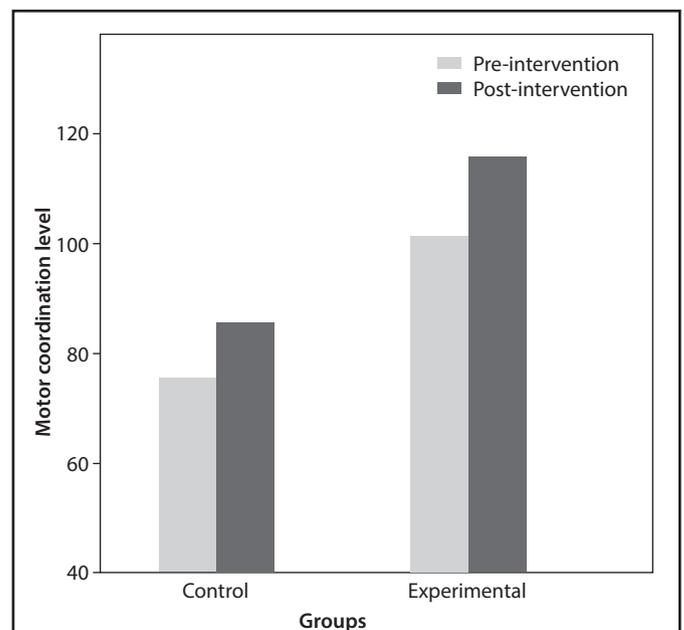
There was an overall difference in the motor coordination levels between groups. The mean of motor coordination level was 80.7 with a 95% of confidence interval between 69.3 and 92.0 for control group. For table tennis participation, the mean of motor coordination level was 108.5 with a 95% confidence interval between 97.2 and 119.9. Statistical analysis revealed that table tennis participation group had significantly higher motor coordination levels than control group across both time periods ( $F=12.483$ ,  $p=0.01$ ). The power of this comparison was 0.929.

The interaction between factors, that is, table tennis participation and time, was not significant ( $F=1.552$ ,  $p=0.221$ ). Therefore, these data

**Table 1. Descriptive statistics (mean ± standard deviation) of the control group (CG) and table tennis participation group (TT) including age, anthropometry and motor coordination (MC) level at the baseline (pre-intervention) and after one-year (post-intervention).**

	Baseline (pre-intervention)		After one-year (post-intervention)	
	CG	TT	CG	TT
Age (years)	13.0±0.4	13.3±0.5	14.1±0.4	14.4±0.5
Body weight (kg)	52.5±16.1	43.0±8.7	57.5±17.7	50.1±8.0
Height (m)	1.57±0.1	1.55±0.1	1.61±0.1	1.64±0.1
MC level	75.5±32.8	101.3±9.6	85.8±33.0	115.8±8.8

**Figure 1. Motor coordination level at the baseline and after one-year in both control and experimental groups.**



suggest there is no a significant effect of table tennis participation on motor coordination level of participants. A small effect size was observed across comparisons (Cohen's  $d=0.31$ ).

## Discussion

The main aim of this study was to estimate the effect of unstructured table tennis participation on motor coordination level in young recreational players. Both control and table tennis participation groups significantly increased their motor coordination levels over one year. However, there was not significant interaction effect between time and table tennis participation on motor coordination level of participants. Therefore, our results suggest there is no a significant effect of unstructured table tennis participation on motor coordination level of young recreational players after one-year of regular practice.

Overall, the participants of this study increased their motor coordination levels over one year. Both control and table tennis participation groups had significantly higher motor coordination levels after one year. Thus, there was an effect of the time on motor coordination levels of participants, regardless of engagement on table tennis practice. These findings were expected due to effects of growth and maturation on adolescent's motor performance. Growth and maturation occurred during adolescence are associated with increases on muscular strength and motor performance<sup>32-35</sup> like jump, agility and balance. Besides the motor coordination by itself, these physical and skills components are also related to performance on KTK tasks<sup>36</sup>.

The main purpose of this investigation was to analyze the effect of unstructured table tennis participation on motor coordination level in young recreational players. Results indicated that table tennis participation group had significantly higher motor coordination levels than control group after one-year of regular practice. However, this finding cannot be explained by table tennis participation, because there was not significant interaction effect between sport participation and time. Therefore, our results suggest that difference between groups in motor coordination level after one-year of intervention was only due to effect of time, which it seems to be related to growth and maturation.

Besides growth and maturation, it is important to emphasize that opportunities for practice are a key factor for development of motor coordination level<sup>37-39</sup>. Therefore, the development of motor coordination among young table tennis players can be expected when adequate opportunities for practice are ensured for all individuals, as it is aimed in planned and structured activities<sup>40</sup>. Although individuals may develop their motor coordination in an incidental manner<sup>20</sup>, such as in unstructured sport activities, not all kind of engagement in sport can exert a positive effect on motor coordination level among players. For example, if players do not experience adequate opportunities for practice, they may not develop their motor coordination level due table tennis participation. Moreover, there are other conditions of the environment that play important roles in the degree to which motor coordination develops<sup>39</sup>, such as encouragement and constraints contained within the requirements of the movement tasks<sup>37,38</sup>.

Therefore, the absence of effect of unstructured table tennis participation on motor coordination level in young recreational players

can be related to characteristics of unstructured sport activities. These activities are not pedagogically planned<sup>19</sup> and, therefore, the conditions of the environment, such as opportunities for practice, may not have been adequate to the development of motor coordination level of table tennis participation group. As an individual and game-based practice, less skilled individuals tend to have less playing time and consequently fewer opportunities for practice when play against more skilled peers.

It's difficult to compare our findings with previous evidence due to paucity of studies on topic. While previous evidence has suggested significant associations between motor coordination and sport performance in children<sup>8,13,41</sup>, including table tennis<sup>24,26-29</sup>, little is known about the effect of table tennis participation on motor coordination level in children and adolescents. In this sense, two studies<sup>42,43</sup> found a significant effect of a 12-week table tennis exercise on motor skills in children. However, both studies examined children with attention deficit hyperactivity disorder and used structured table tennis participation.

As a limitation, only unstructured sport activities were investigated in this study. Also, there was an unbalanced male/female ratio of sample. Thus, possible differences between genders might have biased the results. Nevertheless, this study shed some light on the underexplored literature on the effectiveness of unstructured sport participation on motor coordination level in adolescents. To our knowledge, this was the first study to analyze the effect of unstructured table tennis participation on motor coordination level in young recreational players. As practical application, this study reinforces the assumption that not all kind of engagement in sport can exert a positive effect on motor coordination level among players, even when regularly practiced during one year.

## Conclusions

Motor coordination levels of young recreational players were not improved due to unstructured table tennis participation, even after one year of regular practice. Our results seem to be related to characteristics of unstructured sport activities, as the conditions of the environment that are not adequately ensured for all players. Thus, the lack of adequate opportunities for practice may have led to these findings. Additional research involving both structured and unstructured table tennis participation should be pursued.

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