



Does a cycle training course improve cycling skills in children?



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ABSTRACT

Introduction: The aim of this study was to determine the short-term effects of cycle training on basic cycling skills in children from the 4th grade of elementary school. Furthermore, the influence of gender, socio-economic status (SES) and initial cycling skills level on the effects of the cycle training was investigated.

Methods: Five participating schools were randomly assigned to the intervention ($n=3$) or control condition ($n=2$). Children's cycling skills were assessed, using a practical cycling test, at baseline and immediately after the intervention. At baseline, all participating children received a short parental questionnaire on child's demographic and family factors. After the pre-test, cycle training took place only in the intervention schools. Repeated measure analyses were conducted to evaluate the effectiveness of the cycle training.

Results: The cycle training had a statistically significant effect on children's total cycling skill ($F=46.9$, $p<0.001$). On mounting the bicycle and start to cycle ($F=2.6$, $p=0.11$), cycling one handed ($F=2.0$, $p=0.16$), and cycling on a sloping surface ($F=1.5$, $p=0.23$), no statistically significant effects were detected. On all other cycling skills, time \times condition interaction effects were statistically significant. Gender, SES and initial cycling skills level had no significant influence on the effects of the cycle training. **Conclusion:** This study showed that a cycle training of only three sessions was effective to improve children's cycling skills at short term and that cycle training within a traffic-free environment seems to be a useful first step in the development of safe cycling behaviors.

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1. Introduction

Cycling is an enjoyable and accessible form of physical activity (Roberts et al., 1996) and for children the use of a bicycle is often the only way to cover greater distances at faster speeds. Consequently, most children commonly prefer cycling rather than walking (Shephard, 2008). However, bicycle-related accidents are among the most common causes of children's physical injuries (Briem et al., 2004; Lammar, 2005; Klin et al., 2009). In 2009, approximately 8100 cyclists were killed or injured in Belgium of which 12.3% were children between 10 and 14 years of age (Belgisch Instituut voor de Verkeersveiligheid, 2011). In the United States, bicycles were found to be associated with more childhood injuries than any other consumer product. About 21% of all bicycle-related deaths and roughly 50% of all bicycle-related injuries were related to children (5–14 years) (National SAFE KIDS Campaign, 2004).

Studies analyzing child cycling accidents found that a high percentage of these accidents were considered to be the cyclists' fault (Preston, 1980; Simpson and Mineiro, 1992; The Royal Society for the Prevention of Accidents, 2011). It was found that children often lose control of their bicycle without another vehicle being involved. Furthermore, other contributing factors that played a role in child cycling accidents were playing with the bicycle, doing tricks, cycling too fast, not looking properly and poor turn maneuvers (Simpson and Mineiro, 1992; The Royal Society for the Prevention of Accidents, 2011). In a study conducted by Simpson and Mineiro (1992), environmental factors (i.e., weather factors and hazards of the road surface) were also found to cause a small percentage of cycling accidents.

Since the ability of children to perform cycling skills is found to play an important role in bicycle-related accidents (Corden et al., 2005), various cycle training courses have been introduced (e.g., 'Master on your bike' from Belgium, 'Bikeability' from the UK, 'Cycle Skills for School Kids' from New Zealand, and 'Cycle for Health' from the USA). The over-arching aim of cycle training courses is to give children the skills and confidence to cycle safely. In order to achieve this goal, most programs include different training levels going from training taking place in a traffic-free environment (i.e., playground, closed car park) to training courses where cyclists get out on the roads. Within a traffic-free environment

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children learn to control their bicycle, so they learn to mount and dismount, to cycle in a straight line, to signal, to look, to cycle over obstacles without falling off, and to use the brakes. Once they mastered their bicycle, children get out on the roads and learn to interact with other travelers, to position themselves properly on the road, to use junctions and to observe and obey road signs.

Some studies investigated the effect of cycle training sessions on child cycling accidents. [Preston \(1980\)](#) investigated whether taking the Cycling Proficiency Training, consisting of five training sessions (one session/week) after school in the Summer Term, influenced the accident rate and it was found that boys (but not girls), aged 10 and 11, had a lower accident rate for a limited period after the training. A study conducted by [Colwell and Culverwell \(2002\)](#) failed to find a relationship between cycle training and accident rates. They also argued that cycling accidents occur too infrequently to be used as the criterion of evaluation. Alternatively, cycling behavior, attitudes and knowledge can be used as criterions to evaluate the effects of cycle training programs ([Organisation for Economic Co-operation and Development \(OECD\), 1986; Colwell and Culverwell, 2002](#)).

However, only three studies could be located in the literature investigating the effect of cycle training on children's cycling behaviors. In a study conducted by [Savill et al. \(1996\)](#), 1566 British children were tested in the study conducted by [Savill et al. \(1996\)](#), children (12–13 years old), completed a practical test, to investigate the effect of eight different cycle training courses. This research confirmed that cycle training improved cycling skills and knowledge, and the effect lasted for at least two years after training. A study ([Macarthur, 1998](#)), conducted in 141 Canadian children (9–10 year), found that a training program of 90 min, consisting of two equipment stations (i.e., helmet/clothing check and bicycle check) and four bicycle handling stations, was not effective in improving safe cycling behaviors (i.e., straight line riding, coming to a complete stop, and shoulder checking before a left turn). In the Netherlands, a cycle training program based on the principles of modeling and a cycle training program build on the production rule approach were both found to be equally effective in teaching young cyclists (8–9 year) the required behavioral strategy for maneuvers at intersections. After the training session children slowed down more often while approaching an intersection, signaled more often and looked more often for other road users ([van Schagen and Brookhuis, 1994](#)).

The fact that only three studies could be located in the literature investigating the effect of cycle training on cycling skills is inconsistent with the high number of cycle training courses that can be found in the literature (e.g., 'Master on your bike' from Belgium, 'Bikeability' from the UK, 'Cycle Skills for School Kids' from New Zealand, and 'Cycle for Health' from the USA). For example, in Flanders, the Flemish part of Belgium, several cycling skill courses are implemented in schools ([Stichting Vlaamse Schoolsport, 2005; Vlaamse Stichting Verkeerskunde, 2009; Belgisch Instituut voor de verkeersveiligheid, 2009](#)), but the effectiveness of a cycle training course was never tested. This makes it also difficult to optimize cycle training courses. Furthermore, despite the fact that the pattern of development is different between boys and girls ([McIntyre, 2009](#)), none of the identified studies on cycle training programs ([van Schagen and Brookhuis, 1994; Savill et al., 1996](#)) studied a potential gender interaction effect. Additionally, socio-economic status (SES) was never taken into account even though some studies noted lower levels of motor coordination among children from low SES families ([Prätorius and Milani, 2004; Vandendriessche et al., 2012](#)). Consequently, the present study investigated gender and SES interaction effects.

Therefore, the aim of this study was to determine the short-term effects of a cycle training course on 12 basic cycling skills in Belgian

children from the 4th grade of elementary school. Furthermore, the influences of gender, SES and initial cycling skills level on the effects of the cycle training course were investigated.

2. Methods

2.1. Study protocol

In Flanders, Belgium a random sample of 10 schools was selected to participate. The school principals were sent a recruitment letter and afterwards contacted by phone. Five schools agreed to participate in the study and were randomly assigned to the intervention (3 schools) or control condition (2 schools). The other five schools showed no interest or indicated that they could not participate due to lack of time. The parents of all 128 children in 4th grade received an informed consent form in which authorization was asked for their child to participate in the study. Children from the 4th grade were chosen as most cycle training programs focus on children from 9 to 10 years ([Stichting Vlaamse Schoolsport, 2005; Belgisch Instituut voor de verkeersveiligheid, 2009](#)). Furthermore, at this age, children's motor and cognitive abilities are already sufficiently developed to ride a bicycle ([Briem et al., 2004](#)). Additionally, these children represent a critical age group for cycling accidents whereby the ability of children to perform cycling skills was found to play an important role ([Lammar, 2005; Corden et al., 2005](#)). Children's cycling skills were assessed, using a practical cycling test on the school playground, at baseline (December 2010) and immediately after the intervention (February 2011). Moreover, at baseline, all participating children received a short parental questionnaire on child's demographic factors (age, gender, height and weight) and family factors (parents reported their own and their partner's highest level of education as a proxy measure of household economic status). After the pre-test, a cycle training course took place only in the intervention schools. The post-test took place within one week after the last session. Control schools were asked to continue their normal routine. Complete data of 102 children (68 intervention, 34 control) were available, representing the number of children who were present at pre- and post-test and whose parents completed the questionnaire. Ethical approval was granted, by the Ethics Committee of the Ghent University.

2.2. Cycle training

The cycle training consisted of existing cycling exercises described in the literature ([Stichting Vlaamse Schoolsport, 2005; Vlaamse Stichting Verkeerskunde, 2009; Belgisch Instituut voor de verkeersveiligheid, 2009](#)), supplemented with exercises from an expert panel with large experience in cycle training in children. The cycle training was divided into three sessions (one session/week). Clustering of training content into three sessions was chosen in order to increase the feasibility for schools to schedule this cycle training course within their curriculum. All training sessions took place on the playgrounds of the schools. A session length of 45 min was chosen as the training sessions were organized during physical education school lessons, which were scheduled for 50 min. The first session included practical exercises on walking with the bicycle, mounting the bicycle, braking and dismounting the bicycle. In the second training session children practiced their steering skills (one-handed and two-handed) and tried to maintain their balance when cycling over various obstacles. Practical exercises on signaling and looking (left, right and over left shoulder) while cycling were presented in the last session. Each session included exercises from different levels of difficulty. As a session progressed, more complex exercises were offered. Furthermore, all three sessions contained many elements of play to make it pleasant for the

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