Effects of a 10-week detraining period on gross motor skills in young tricking practitioners

Efectos de un período de desentrenamiento de 10 semanas sobre las habilidades motoras gruesas en jóvenes practicantes de tricking

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Abstract

Tricking has emerged as a martial arts sport that combines acrobatics, gymnastics, kicks and jumps to create multiple visually striking movements. The effects of a period of detraining in young tricking practitioners still unclear. The main objective of this study was to verify the effect of a 10-week detraining period on different motor skills in young tricking practitioners. A group of 17 children (age: 10.18 ± 0.98 years) tricking practitioners were analyzed in a pre-detraining period and a post-detraining period using agility test, vertical impulse test, horizontal impulse test and push-up test, sit-up test. The agility and sit-ups variables show significant differences of large effect (Δ = 6.82, *p* = .001, *d* = 2.80; Δ = -13.76, *p* = .003, *d* = 1.27) respectively. Vertical impulse and push-ups showed significant differences between training phases a moderate effect (Δ = -5.13, *p* =

Resumen

Tricking se ha convertido en un deporte de artes marciales que combina acrobacias, gimnasia, patadas y saltos para crear múltiples movimientos visualmente impactantes. En realidad, los efectos de un período de desentrenamiento en los jóvenes practicantes de trucos aún no están claros. El objetivo principal de este estudio fue verificar el efecto de un período de desentrenamiento de 10 semanas en diferentes habilidades motoras en jóvenes practicantes de trucos. Se analizó un grupo de 17 niños (edad: 10.18 ± 0.98 años) practicantes de trucos en un período previo al desentrenamiento y un período posterior al desentrenamiento mediante test de agilidad, test de impulso vertical, test de impulso horizontal y test de flexión de brazos, test de abdominales. Las variables agilidad y abdominales muestran diferencias significativas de gran efecto (Δ = 6.82, *p* = .001,

.007, d = .85; Δ = -8.37, p = .006, d = 1, 13). Results showed that agility and abdominal strength test sit ups were those that decreased to a greater extent in these subjects with a large effect, being the vertical jump as well as the push up, the motor tests that decreased moderately, while the horizontal jump did not vary significantly.

Key words: Extreme sports, youth, agility, strength, vertical jump.

d = 2.80; Δ = -13.76, p = .003, d = 1.27) respectivamente. El impulso vertical y las flexiones mostraron diferencias significativas entre las fases de entrenamiento con un efecto moderado (Δ = -5.13, p = .007, d = 0.85; Δ = -8.37, p = .006, d = 1.13). Los resultados mostraron que las pruebas de agilidad y fuerza abdominal fueron las que más disminuyeron en estos sujetos con gran efecto, siendo el salto vertical al igual que las flexiones, las pruebas motrices que disminuyeron moderadamente, mientras que el salto horizontal no varió. significativamente.

Palabras clave: Deportes extremos, jóvenes, agilidad, fuerza, salto vertical.

Introduction

Around the world there has been a growing interest among young people in extreme motor activities (i.e., parkour, gimbarr, crossfit, skateboarding, rollerblading, snowboarding) (Batuev & Robinson, 2018; Green et al., 2018; Stratford, 2015). In recent years, tricking has emerged as a martial arts sport that combines acrobatics, gymnastics, and various kicks and jumps to create an elaborate and visually stunning display of movement (Hnitetska et al., 2017). Tricking usually involves complex and dynamic movements, including aerials, backflips, kicks, corkscrews and other acrobatic maneuvers (Grassie, 2017; Witfeld et al., 2013). This sport incorporates a wide range of movements, in which the practitioner can choose and combine movements based on their preferences and aptitudes, allowing for creativity and personal expression (Rodrigo et al., 2023). Practitioners are encouraged to develop their unique style and incorporate personal creativity into their routines. There are no strict rules or prescribed sequences, allowing individuals to express themselves through the flow and composition of movements (Tamm et al., 2022). Therefore, it is common for gymnastics or other similar disciplines to be present during the training process (Knapik et al., 2015). Tricking is constantly evolving, with practitioners continually pushing the limits of what is possible, creating new combinations, moves and variations. The modality's technical actions are fundamentally based on various movement disciplines, especially disciplines such as Taekwondo, Wushu and Capoeira, as many of its fundamental kicks and techniques are derived from these martial arts (O'Connor et al., 2022). Due to the demanding typology, practitioners of this modality are required to present high levels of strength, agility and coordination, which must be constantly optimized during training and practice (Chatinyan & Avetisyan, 2022; Hnitetska et al., 2017). Additionally, the tricking training should include static and dynamic stretching routines to improve flexibility and range of motion, especially in the legs, hips, and back, which are crucial for executing kicks and acrobatics. Also, the trampoline training to practice aerial awareness, flips, and spins in a controlled environment, tumbling exercises (e.g., cartwheels, round-offs, handsprings) to develop acrobatic skills and air sense and plyometric exercises (e.g., box jumps, burpees) to enhance explosive power can also be used (Hadlow et al., 2018). However, as in other sports, periods of detraining may occur. Detraining periods are characterized as periods of time during which an individual decreases or completely stops physical training or exercise (Girardi et al., 2020; Izquierdo et al., 2007). Detraining can occur due to many reasons such as injury, illness, vacations, lookdown periods, end-of-season, changes in schedule or lifestyle (Ammar et al., 2021; Vandoni et al., 2021; Vassilis et al., 2019).

During a period of detraining, the body gradually loses some of the adaptations and gains gained from regular exercise and training (Branquinho et al., 2020; Ratel et al., 2012; Suarez-Arrones et al., 2019) Previous studies have reported that muscle strength, cardiovascular endurance and flexibility may decrease over time with reduced physical activity (Dasso, 2019; Guo et al., 2022; Nuzzo, 2021). Still, the length of the detraining period and the degree of fitness loss can vary depending on a number of factors, including the individual's initial fitness level, the type of exercise or training being performed, and the time since the last training session (Blasco-Lafarga et al., 2020; Psilander et al., 2019; Ribeiro et al., 2017).

Previous investigations have reported that young people tend to experience less decline in physical fitness during a detraining period compared to adults (Carter & Horvat, 2016; Chaouachi et al., 2019; Gavanda et al., 2020). This is due to the fact that young people have greater capacity for physical adaptation due to their higher levels of natural growth and development (Howard et al., 2019; Maughan & Little, 2017). This is particularly due to the windows of opportunity and the greater trainability for learning specific sports-based motor skills, especially when it comes to a multifaceted sport like tricking. Overall, young people seem to have an advantage when it comes to staying fit during periods of training or reduced activity. However, the detraining is also easier due to lack of experience and morpho-functional changes (Malm et al., 2019).

To the best of our knowledge, so far no study has investigated the effects of a period of detraining in young tricking practitioners and therefore this issue still needs to be broadly clarified. The main aim of this study was to verify the effect of a 10-week detraining period on different motor skills in young Tricking practitioners. The study hypothesis is that there may be losses in physical fitness (i.e., upper and core strength, agility, vertical and horizontal impulse) as a result of a detraining period of this duration.

Method

Participants

A group of 17 children (Mean ± *SD* age: 10.18 ± 0.98 years old; Height: 138.54 ± 7.82 Kg; Weight: 34.74 ± 7.66 Kg) tricking practitioners volunteered to participate in the study. The sample calculation was performed using Software G*Power 3.1 according to a previous protocol (Kang, 2021). An priori analysis was performed that determined that 13 subjects would be needed for the study (Effect size *dz*: 0.7, ***α*** error probability: 0.05, power: 0.95). Additionally, four element was added to the sample as a matter of convenience as there were 17 volunteers to participate in the study. The inclusion criterion for the participants was to be tricking practitioners, be young and/or a child (i.e. 10 to 17 years old), practice federated tricking and have taken part in all the evaluation research stages, while no exclusion criteria was applied. Prior to the start of the study, all participants and the trainer were informed of the objectives and requirements of the study as well as known health risks and were informed that they could withdraw from the study at any time even after it had started. All guardians filled out an informed consent where they authorized the voluntary participation of their children in the study. All procedures followed guidelines of the Declaration of Helsinki for research in humans. The research was validated by the Scientific Board of the Higher Institute of Educational Sciences of the Douro (PMTF:2;24.9.2018).

Instruments

This descriptive study evaluated the variations in the agility test, vertical impulse, horizontal impulse, Push-ups and Sit-ups along 10 weeks of interruption of training in tricking practitioners. The tests were performed on different days to mitigate the potential effects of fatigue (Branquinho et al., 2021). The tests were performed in the following order, Day one: Agility Test and Vertical Impulse; Day two: Horizontal Thrust, Push-ups and Sit-ups.

In sit-ups assessment, the participant lies on their back with knees bent at a 90-degree angle and feet flat on the ground. The hands are placed behind the head or crossed over the chest. The number of correctly performed sit-ups within the set time or until failure is counted. In push-ups assessment the participant starts in a plank position with the body in a straight line from head to heels. Repeat the movement for a specific number of repetitions or until failure to maintain proper form. The number of correctly performed push-ups was counted (Ferraz et al., 2020).

To measure agility, the Agility T-Test was used according to a previously validated protocol (Munro & Herrington, 2011). Participants were instructed to remain behind the starting line with both supports on the ground until the start. The test consists of rapid accelerations between four cones that must be touched at the base and that are placed at different distances. The test must be carried out in the following order: i) sprint from cone one to cone two placed 9.14 m from the starting line; ii) lateral displacement for cone three placed 4.57 m to the left of cone two; iii) return to cone two; iv) lateral displacement for cone four placed 4.57 m from cone two; v) return to cone two; vi) finally they must run backwards as quickly as possible towards cone one. The time required to complete the test was used as a performance result and was evaluated with an electronic timing system (Microgate SARL, Bolzano, Italy)

To assess vertical jump, the participant begins by standing on a measuring device with feet shoulder-width apart (Granacher et al., 2011). After a countermovement squat, they explosively jump vertically, reaching as high as possible, and the highest point reached was recorded (Gavanda et al., 2020). Vertical Jump was recorded using a linear transducer (Celesco, Toronto, ON, Canada), connected to the BioPacMP100 data capture system (BioPac Systems, Inc.).

For the horizontal jump, the participant starts behind a marked line, performs a counter movement and then moves forward, jumping as much as possible. The distance from the starting line to the landing point was measured to determine the jump distance. The horizontal displacement of the jump was measured using a tape measure and straight ruler. Both assessments evaluate the power and explosiveness of an individual's lower body (Chaouachi et al., 2019; Fathi et al., 2019). All tests were carried out indoors, to eliminate the potential effect of environmental conditions.

Procedures

Five specific variables were analyzed with adaptations of previously used protocols: agility test (Hammami et al., 2018), vertical impulse test (Nogueira et al., 2020), horizontal impulse test (Nassau et al., 2006) and push-up test (Baumgartner et al., 2002), sit-up test (Diener et al., 1995). Participants were evaluated in two distinct phases: before the detraining period (i.e., pre-detraining period) and after the detraining period (i.e., post-detraining period). The values of each test were recorded for later analysis. The anthropometric variables of height and body mass were measured for each subject, on a leveled platform scale (Año Sayol, Barcelona, Spain), with precision of .001 m and 0.01 Kg, respectively (Marques et al., 2016).

Statistical analysis

The calculation of means, standard deviations with 95% confidence intervals (95% *CI*) was performed using standardized statistical methods. The normality of the distribution was examined using the Shapiro-Wilk test ($n < 30$) and, depending on the condition of normality, parametric or non-parametric tests were adopted for analysis. To compare the variations between the two analyzed moments, a t-test and the corresponding non-parametric Wilcoxon test were used. The level of statistical significance found was $p \leq .05$. Effect sizes (ES) were calculated based on Cohen's d and classified as: 0.2, trivial; 0.6, small; 1.2, large; and > 2.0, very large (Cohen, 2013; Hopkins, 2019). The percentage changes between baseline (pre) and post-term (post) assessment [(post-training - pre-training) / pre-training) x 100] were also calculated. IBM SPSS Statistics for Windows, Version 27.0 (Armonk, NY: IBM Corp.) was used for all statistical analyses. The data visualization was computed by GraphPad Prism (GraphPad Software, CA, USA).

Results

The results indicate that in the comparison between the pre-detraining and post-detraining evaluation moments, statistically significant differences with large effects are verified for agility (Δ = 6.82, p = .001, d = 2.80) and sit-ups (Δ = -13.76, p = .003, d = 1.27) variables (Table 1. ang Figure 1.).

Significant differences were found with a moderate effect for the vertical impulse (Δ = -5.13, p = .007, d = 0.85) and push-ups variables (Δ = -8.37, p = 0.006, d = 1.13) (Table 1. ang Figure 1.). On the other hand, no differences were found between the evaluations for the horizontal impulse variable (Δ = -2.48, p = 0.209, d = 0.78), although there seems to be a trend of negative effects that can be associated with the detraining period (Table 1. ang Figure 2.).

Table 1. Mean differences between the comparison between the Pre-Detraining Period and the Post-Detraining Period elit

VARIABLES	ANALYSED MOMENTS		INFERENCE			
	Pré-Detraining	Post-Detraining	Δ (%)	*p*	*d*	Qualitative
Agility Test (s)	13.19 ± 0.29	14.09 ± 0.35	6.82	.001***	2.80	Large
Vertical Impulse (cm)	25.88 ± 1.47	24.55 ± 1.62	-5.13	.007**	0.85	Moderate
Horizontal Impulse (cm)	149.17 ± 3.29	145.47 ± 5.76	-2.48	.209	0.78	Moderate
Push Ups (n)	30.94 ± 2.68	28.35 ± 1.82	-8.37	.006**	1.13	Moderate
Sit-Ups (n)	32.47 ± 3.80	28.00 ± 3.20	-13.76	.003**	1.27	Large

Table footer - Δ= Percentage Changes; *p*= p-value*; d=Cohens d;* ** indicates P < 0.01 and *** indicates P < .001.

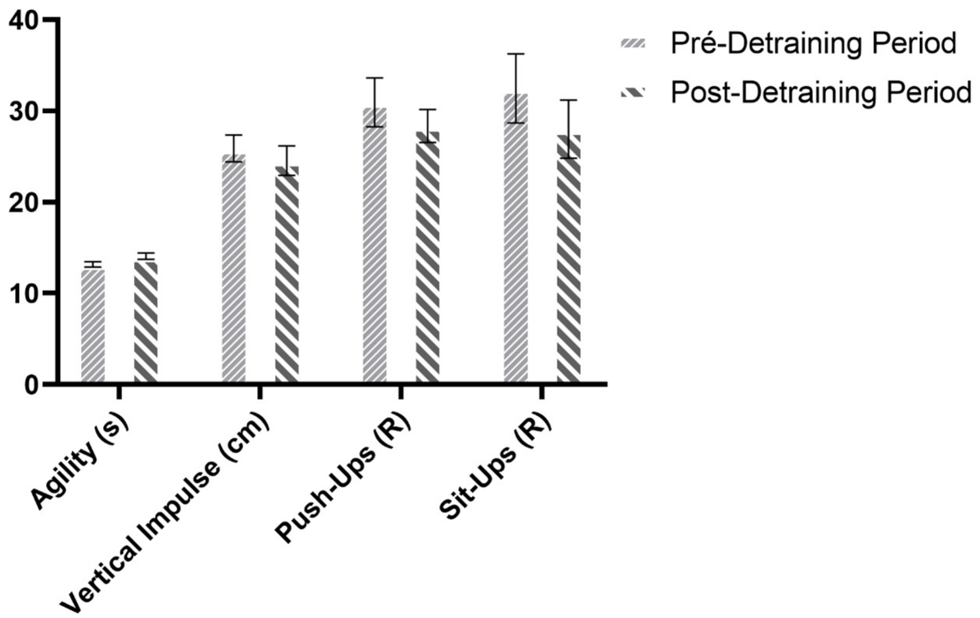

Figure 1. Mean differences between the comparison between the Pre-Detraining Period and the Post-Detraining Period for the variables that present significant differences (Agility, Vertical Impulse, Push-ups and Sit-ups)

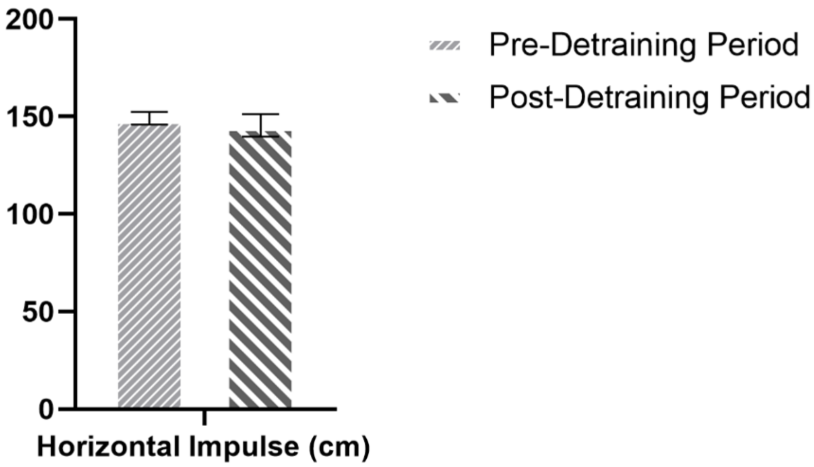

Figure 2. Mean differences between the comparison between the Pre-Detraining Period and the Post-Detraining Period for the variables that do not present significant differences (Horizontal Impulse)

Discussion

In this study we analyzed the detraining of motor skills in young tricking athletes over a 10-weeks period. It was found that agility and the abdominal strength test sit ups were those that decreased to a greater extent in these subjects with a large effect, being the vertical jump as well as the push up, the motor tests that decreased moderately, while the horizontal jump did not vary significantly.

As expected, most motor skills declined after a 10-week detraining period, as other authors have found (Carter & Horvat, 2016; Chaouachi et al., 2019; Gavanda et al., 2020). Even young subjects tend to show lower levels of detraining, due to factors such as adaptive capacity and their own development and growth (Howard et al., 2019; Maughan & Little, 2017). In any case, it must be considered that in relation to detraining, a wide variety of factors and circumstances can affect it.

There are even authors who claim that upper and lower body muscle strength can be maintained in children and adolescents for 12 weeks, in adolescents trained through a combined programs of resistance and aerobic endurance or exclusively through resistance (Santos et al., 2011) or even 16 weeks (Faigenbaum et al., 2013; Gavanda et al., 2020; Santos et al., 2011). While others speak of decreases at four weeks (Chaouachi et al., 2019; Fathi et al., 2019), seven weeks (Granacher et al., 2011) eight weeks (Faigenbaum et al., 2013) and 12 weeks (Ingle et al., 2006). In these studies, some motor skills decrease to a greater or lesser extent, or no significant changes are seen.

One of the problems of comparing detraining in children and adolescents may be that they are usually more active even if they are not practicing the sport in which they train, for example in physical education classes or other activities (Chaouachi et al., 2019; Santos et al., 2011), which could be a limitation of the study as in this case, where physical activity has not been controlled in these 10 weeks. Skills are maintained through regular practice, and detraining leads to reduced motor learning and skill retention. The proficiency in complex motor skills, techniques, and movement patterns deteriorates, affecting sports-specific skills. Indeed, movements requiring a full range of motion, agility, or flexibility may be compromised (Faigenbaum et al., 2013; Gavanda et al., 2020). The skills are maintained through regular practice, and detraining leads to reduced motor learning and skill retention (Howard et al., 2019; Maughan & Little, 2017).

Moving on to a more specific analysis of the gross motor skills, we find that not many studies have analyzed agility in motor performance tests compared to detraining (Fazelifar et al., 2013) found in obese children aged 11-13 years that agility decreased after four weeks. The greater decline in agility in our study could be associated with neural mismatch more typical of agility than muscle strength testing. It is possible that increases in corticospinal excitability, decreased corticomotor inhibition and reduced interhemispheric inhibition affecting motor neuron recruitment and frequency coding may disappear or partially return to basal functioning during a period of detraining in young people (Chaouachi et al., 2019). This could be associated with the fact that coordination in children is lower due to experience and dexterity than in adults (Behm et al., 2017). Detraining, also known as deconditioning, refers to the partial or complete loss of training-induced adaptations following a period of reduced or discontinued training. This can affect various motor skills and physiological parameters. The observed effects of detraining on different motor skills are primarily due to several interrelated physiological and neuromuscular mechanisms, such as muscle atrophy, neuromuscular adaptation, cardiorespiratory fitness decline, inefficiency and capacity of energy systems and loss of flexibility and range of motion (Carter & Horvat, 2016). Also, the lack of training can lead to a reduction in motivation, confidence, and mental preparedness. Psychological factors can influence performance and affect decision-making, reaction time, and overall execution of motor skills.

On the other hand, in our studies, vertical jumping decreased moderately, but not horizontal jumping. This coincided with the results of Ingle et al. (2006), in 12-year-old boys, who found after 12 weeks of training and 12 weeks of detraining, a decrease in vertical jump but not in horizontal jump. Fathi et al. (2019) found small decreases in vertical jump using the Counter Movement Jump (CMJ) Test or the Squat Jump Test in adolescent volleyball players trained for 16 weeks. In the case of the study by Santos et al. (2011), no significant decrease was observed in either of the two jump tests in children aged 11 to 13 years after 12 weeks following the end of the resistance training to which the adolescents were subjected. On the other hand, in another study (Chaouachi et al., 2019), no effect of detraining on the CMJ was found in children aged 10 to 13 years after four weeks, as well as after seven weeks in adolescents aged 16 years on average after a physical education training program, (Granacher et al., 2011) or in professional handball players (Marques & González-Badillo, 2006). A possible explanation for these contradictory results with our study could be that this maintenance of performance in the CMJ test occurs because it is a coordinative movement that involves the whole body, to a greater extent than other isometric tests used in other studies and that the subjects were in a phase of motor learning improvement (Chaouachi et al., 2019). This contrasts with the previous approach (Behm et al., 2017), which argued for a decline in the agility test. The mechanisms responsible for the effect of detraining on anaerobic performance characteristics have not yet been elucidated, although in the case of dynamic strength performance, reduced motor unit activation and losses in motor coordination have been suggested (Van Praagh & Doré, 2002).

In relation to abdominal tests, Faigenbaum et al. (2013) found no decreases in the curl up test in seven-year-old children, trained in physical education classes in strength and after a detraining period of eight weeks, but in those who continued with their usual physical education classes. In the same study, a decrease in horizontal jumping was found. Fazelifar et al. (2013) found in obese children aged 11-13 years that abdominal strength measured by Crunch tests decreased less than agility.

To maintain standing long jump performance, it appears that children must repeatedly produce adequate levels of lower body power to effectively train this movement. It is also possible that participation in traditional physical education games and activities throughout the training and detraining period may have influenced these observations (Faigenbaum et al., 2013). Another possible explanation could be associated with agility and abdominal strength and to a lesser extent vertical jump and push-ups are motor skills specific to the tricking modality, so their detraining suffers a more significant decrease than for example horizontal jump, the more they are related to the training process that is carried out in the sport modality of Tricking. Mitigating the effects of detraining is crucial to maintaining and enhancing their skills and performance. Detraining can occur due to injuries, extended breaks, or other life circumstances (Faigenbaum et al., 2013). Encourage regular maintenance training with lower intensity training during breaks to maintain fundamental skills, strength, flexibility and conditioning. Integrate complementary activities such as gymnastics, martial arts, dance or parkour to maintain or improve flexibility, strength and coordination during periods of reduced trick training (Santos et al., 2011). Cross-training can help minimize losses in agility, balance and general fitness (Granacher et al., 2011).

Conclusions

Current research confirmed that detraining in young tricking practitioners has a large effect on agility and abdominal strength test sit ups, being the vertical jump as well as the push up, the motor tests that decreased moderately, while the horizontal jump did not vary significantly. Thus, the young tricking practitioners should develop a training program for strength, power, agility and coordination to ensure the appropriate development of motor skills, avoid detraining and ensure tricking performance.

Conflict of interest

Nothing to declare.

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