



ADVANCE SOCIAL SCIENCE ARCHIVE JOURNAL

Available Online: <https://assajournal.com>

Vol. 4 No. 02 Oct-Dec 2025. Page#. 5023-5035

Print ISSN: [3006-2497](#) Online ISSN: [3006-2500](#)

Platform & Workflow by: Open Journal System

<https://doi.org/10.5281/zenodo.22856697>

Impact of Resistance Training on Strength, Speed, Agility, and Sports Performance among University Athletes

Muhammad Javed Bajwa

Lecturer, Department of Physical Education & Sports Sciences, Government College University
Lahore, Punjab, Pakistan

javed.bajwa@gcu.edu.pk

Abstract

University athletes are required to express high levels of force, to apply that force quickly, and to change direction under time pressure while they also manage academic work and congested competitive calendars, and resistance training is widely recommended as the method most likely to develop those physical qualities. This article examines the impact of resistance training on strength, speed, agility, and sports performance in university athletes by integrating systematic reviews, meta-analyses, and applied experimental studies and by specifying a feasible campus-based research design. The reviewed evidence indicates that progressive resistance training produces the most consistent and largest gains in maximal and explosive strength, that linear speed and especially change-of-direction ability improve when heavy loading is combined with high-intent and sport practice, and that sport-specific performance is more responsive in national-collegiate and university cohorts than in already world-class athletes whose residual adaptive room is smaller. Strength is treated as the parent quality from which acceleration, cutting, jumping, and many event actions draw, while transfer to the field is shown to depend on load, velocity intent, exercise selection, and the continuation of skill practice rather than on gymnasium volume alone. A problem is identified in the gap between the general reputation of resistance training and the uneven, often under-dosed manner in which it is delivered on campus. Three objectives and three research questions follow from that problem. An eight-week, three-session, daily undulating methodology is then described, after which three sections discuss strength development, speed and agility, and sports performance. The article concludes that university programmes should protect supervised strength work, measure the qualities they claim to develop, and treat the campus athlete as a distinct performer rather than as a smaller professional or a larger schoolchild.

Keywords: Resistance Training; University Athletes; Muscular Strength; Linear Speed; Agility; Change Of Direction; Sports Performance; Strength And Conditioning

Introduction

University sport occupies a distinctive place in the contemporary athletic landscape because it brings together young adults who are expected to combine demanding academic schedules with competitive training, intervarsity fixtures, and, in many cases, the pursuit of semi-professional or professional pathways, and it is within this crowded environment that the capacity to produce high levels of force, to express that force rapidly, and to redirect the body under time pressure becomes decisive for both individual excellence and team success. Resistance training, understood as the systematic application of external loads through free weights, machines, body-mass exercises, and related modalities in order to improve the ability of the neuromuscular system to generate force, has long been regarded as a foundational method for developing the physical qualities that underpin these actions, yet its precise contribution to the multi-factorial

profile of the university athlete remains a matter of continuing scholarly and practical interest. Strength is not merely an isolated gymnasium quality; rather, greater muscular strength is strongly associated with improved force-time characteristics and with more effective performance of jumping, sprinting, and change-of-direction tasks that recur across field, court, and combat sports (Suchomel, Nimphius and Stone, 2016). International consensus statements have likewise treated well-supervised resistance training as a safe and effective component of athletic development when programmes are progressed according to competency rather than according to fashion (Lloyd, Faigenbaum, Stone, Oliver, Jeffreys, Moody, Brewer, Pierce, McCambridge, Howard, Herrington, Hainline, Micheli, Loosemore, Whiteley, Thorborg, Leiva, Lo, Rumpf, Chai and Myer, 2014; Faigenbaum and Myer, 2010). At the same time, university athletes differ from both developing school-aged competitors and full-time professional squads in training history, recovery opportunity, nutritional support, and the residual effects of prior sport-specific practice, and these differences make it unsafe to assume that effect sizes reported in elite or youth meta-analyses will transfer, without qualification, to campus populations.

The rationale for placing resistance training at the centre of university conditioning is both physiological and competitive. High-intensity running, rapid accelerations, decelerations, and cutting manoeuvres impose large mechanical demands on the lower limbs and trunk, and athletes who can produce greater peak and rapid force are better placed to meet those demands while also reducing the relative intensity of each action as a proportion of their maximal capacity (Suchomel, Nimphius, Bellon and Stone, 2018; Cormie, McGuigan and Newton, 2011). Meta-analytic work in younger athletic cohorts has shown moderate effects of resistance training on muscle strength and vertical jump performance together with smaller, though still positive, effects on linear sprint, agility, and sport-specific tests, and these findings have been used to argue that programmes built around fewer repetitions and higher intensities are particularly efficient for performance-oriented development (Lesinski, Prieske and Granacher, 2016; Granacher, Lesinski, Büsch, Muehlbauer, Prieske, Puta, Gollhofer and Behm, 2016). More recent syntheses that have focused on elite and high-level athletes have reported large overall effects of resistance training on sport-specific performance, although the magnitude of benefit appears to vary with competitive level, the locality of the performance outcome, and the sex composition of the sample (Makaruk, Starzak, Tarkowski, Sadowski and Winchester, 2024). Strength training in team-sport settings has also been associated with improvements in sprinting, jumping, and high-intensity running, and with a contribution to injury-risk reduction when it is coached with technical quality (Silva, Nassis and Rebelo, 2015; Lauersen, Bertelsen and Andersen, 2014). University programmes sit between these literatures: many campus athletes already possess several years of sport experience, yet few enjoy the volume of supervised strength work that characterises professional environments, and it is this intermediate status that makes a focused treatment of resistance training in the university setting both timely and necessary.

Literature Review

The literature on muscular strength and athletic performance has become increasingly coherent over the past decade in arguing that strength is a parent quality from which many sport actions draw, rather than a narrow gymnasium outcome that remains confined to the squat rack or the bench press. In a widely cited narrative review, Suchomel, Nimphius and Stone (2016) assembled evidence that higher levels of maximal strength are associated with superior rate of force development, more effective stretch-shortening cycle function, and better performances in jumping, sprinting, and change-of-direction tasks, and they further suggested that stronger athletes tend to express sport-specific skills more effectively while also showing a more favourable injury-risk profile. The companion paper by Suchomel, Nimphius, Bellon and Stone

(2018) extended this argument into the domain of training design by emphasising that strength is underpinned by both morphological factors, including muscle cross-sectional area and architecture, and neural factors, including motor-unit recruitment, rate coding, and reduced neuromuscular inhibition, and that programming choices such as load, intent, eccentric emphasis, and periodisation model determine whether those adaptations actually appear in time-constrained sporting actions. Cormie, McGuigan and Newton (2011) provided a complementary account of maximal power by showing that ballistic, plyometric, and weightlifting exercises, loaded according to the force-velocity demands of the task, are among the most potent methods for converting a raised force ceiling into high-velocity output. This theoretical frame is important for university settings because many campus programmes still treat resistance training as a generic hypertrophy block rather than as a sequenced process that must move athletes along the force-velocity spectrum from high-force, low-velocity work toward high-velocity expressions of the same qualities.

Quantitative reviews have given this framework a numerical shape. Lesinski, Prieske and Granacher (2016), pooling forty-three studies of youth athletes, reported moderate weighted standardised mean differences for muscle strength and vertical jump and smaller effects for linear sprint, agility, and sport-specific performance, and their dose-response analysis indicated that programmes lasting more than twenty-three weeks, using five sets of six to eight repetitions at approximately eighty to eighty-nine percent of one-repetition maximum with three to four minutes of inter-set rest, were most effective for strength development. Granacher, Lesinski, Büsch, Muehlbauer, Prieske, Puta, Gollhofer and Behm (2016) placed those effects inside a long-term athlete-development model and concluded that free-weight, complex, and plyometric methods are well suited to improving muscular fitness and athletic performance when they are matched to developmental stage. Behm et al. (2017) compared traditional strength training with power training in youth and found that strength training produced consistently large changes in lower-body strength, whereas power training was relatively more helpful for jump height, a result that supports the inclusion of both high-load and high-velocity sessions rather than the substitution of one for the other. Although university athletes are older than the youth samples that dominate these reviews, the dose-response pattern remains instructive because it cautions against the short, low-intensity circuits that are sometimes adopted on campus for reasons of time economy, and it is consistent with position statements that treat resistance training as a long-term developmental method rather than as a brief pre-season novelty (Lloyd et al., 2014; Faigenbaum and Myer, 2010).

Chaabene, Prieske, Moran, Negra, Attia and Granacher (2020) isolated change-of-direction speed as an outcome and found a large overall effect of resistance training across youth and young physically active and athletic adults, with larger effects in males than in females and in younger than in older subgroups, and with two sessions per week appearing at least as productive as three. These findings matter for university coaches because change-of-direction ability is among the most frequently tested and most competitively relevant qualities in campus team sports, and they suggest that a modest but consistent allocation of weekly resistance work can still move this quality even when academic calendars compress the available training week. Work that has compared training modes rather than treating resistance training as a single homogeneous intervention has added further nuance. Oliver, Ramachandran, Singh, Ramirez-Campillo and Lloyd (2024) synthesised thirty-four studies of high-level male youth soccer players and concluded that strength, plyometric, and combined training all improved strength, jump, horizontal power, acceleration, and change-of-direction speed to a moderate degree, while linear speed improved only to a small degree, and that strength and combined programmes were

superior to plyometric training specifically for lower-body strength. In a six-week randomised comparison among youth professional soccer players, Ribič, Pleša, Ujaković and Kozinc (2025) reported that strength-focused, speed-focused, and mixed resistance approaches all improved sprint split times and force-velocity-power profile characteristics, with the strength group showing notable advantages in the maximal ratio of horizontal-to-resultant force and in maximal horizontal power relative to controls, even though maximum velocity itself did not change substantially. Taken together, these studies indicate that resistance training influences the mechanical ingredients of speed more reliably than it transforms top-end velocity in already trained athletes, a distinction that university practitioners must keep in view when they promise speed gains from the weight room alone.

Transfer from the weight room to the field has been examined most carefully in relation to lower-body strength and sprinting. Seitz, Reyes, Tran, Saez de Villarreal and Haff (2014) concluded in a systematic review with meta-analysis that increases in lower-body strength transfer positively to sprint performance and that the relationship is large enough to be of practical value for coaches in speed-dependent sports. Complementary applied work has shown that increases in maximal squat strength during preseason training are reflected in faster five-metre, ten-metre, and twenty-metre sprint times in rugby league players, and that relative squat strength is associated with short-sprint performance in both athletes and recreationally trained men (Comfort, Haigh and Matthews, 2012; Comfort, Bullock and Pearson, 2012). Styles, Matthews and Comfort (2016) further demonstrated that relatively short periods of heavy squat training can improve both squat strength and short-sprint times in soccer players who already possess a substantial training history. Silva, Nassis and Rebelo (2015), reviewing strength training in soccer, likewise argued that well-designed resistance work improves the physical determinants of match running and explosive actions when it is integrated with, rather than substituted for, sport practice. These observations sit comfortably with the broader claim that resistance training improves sport-specific performance in competitive athletes, a claim that Makaruk, Starzak, Tarkowski, Sadowski and Winchester (2024) quantified as a large overall standardised mean difference of 1.16 across thirty-five studies of elite athletes, while also noting that national-level athletes gained more than international-level athletes and that local, task-specific outcomes improved more than global, whole-body outcomes.

For university departments this pattern is encouraging, because most campus athletes resemble national or sub-elite rather than world-class performers and therefore occupy the competitive band in which resistance training appears to retain a large residual effect. At the same time, the same literature warns that transfer is not automatic: heavy and light loads can both contribute to sport-specific change when they are organised intelligently, and hypertrophy that is excessive relative to the mass that must be accelerated may, under some conditions, complicate rather than assist high-velocity expressions of performance (Suchomel, Nimphius and Stone, 2016; Cormie, McGuigan and Newton, 2011; Makaruk et al., 2024). University-specific evidence, although thinner than the youth and elite literatures, is beginning to accumulate and generally points in the same direction. Hameed (2025), working with volleyball players from two Pakistani universities across an eight-week scientifically structured resistance programme, reported significant pre-to-post improvements in forty-metre sprint time and in one-repetition-maximum squat, thereby illustrating that even a relatively brief and well-supervised intervention can shift both strength and linear speed in a campus cohort that must also manage academic load. Broader reviews of strength training in team sports have associated structured resistance work with improvements in sprint speed, jump height, muscular strength, and change-of-direction ability, and they have treated these physical changes as part of a wider strategy that also

contributes to injury-risk reduction when programmes are coached with technical quality (Harries, Lubans and Callister, 2012; Lauersen, Bertelsen and Andersen, 2014; Chaabene et al., 2020). What remains under-developed is not the general claim that resistance training works, but the more precise claim about how university constraints, mixed-sport squads, sex differences, and the coexistence of sport practice and academic stress moderate the size and the durability of those effects. The present article addresses that gap by organising the available evidence around strength, speed and agility, and sports performance, and by specifying a methodology through which university departments can test these relationships in their own populations.

Problem Statement

Despite the widespread belief among coaches that resistance training is indispensable for university athletes, many campus programmes continue to operate with incomplete diagnoses of what such training actually changes and what it does not change. Strength and conditioning provision in universities is frequently squeezed into two short sessions per week, sometimes delivered by under-resourced staff to mixed-sport groups whose members differ sharply in training age, injury history, and competitive calendar, and under these conditions it is common for programmes to drift toward general circuit work that produces modest local fatigue without systematically overloading the qualities that decide matches. At the same time, athletes and administrators often expect simultaneous improvements in maximal strength, linear speed, agility, and sport-specific output after a single mesocycle, an expectation that is rarely examined against a coherent set of measures and a properly described training dose. The result is a practical problem with academic consequences: departments cannot tell whether disappointing on-field performances reflect an inadequate resistance stimulus, an inappropriate exercise selection, a failure of transfer from the weight room to the sport task, or simply the interference created by examinations, travel, and fixture congestion. Without a clearly framed account of the impact of resistance training on strength, speed, agility, and sports performance in university athletes, coaches lack a basis for allocating scarce gymnasium time, researchers lack a basis for designing interventions that respect campus realities, and athletes lack a basis for understanding why they are lifting. The problem, therefore, is not the absence of any evidence that resistance training is useful, but the absence of an integrated, university-focused treatment that states what should be trained, what should be measured, and what questions must still be answered before campus programmes can claim that their work is both scientifically grounded and competitively efficient.

Objectives

1. To examine the impact of structured resistance training on maximal and explosive strength among university athletes participating in competitive intervarsity sport.
2. To determine the extent to which resistance training improves linear speed and agility, including change-of-direction ability, in university athletes across a defined training period.
3. To evaluate the contribution of resistance training to sports performance outcomes that are relevant to the athletes' primary competitive events and to describe how strength, speed, and agility changes relate to those outcomes.

Research Questions

1. What is the effect of a structured resistance training programme on maximal and explosive strength in university athletes when compared with habitual sport practice without a comparable resistance stimulus?
2. How does structured resistance training influence linear speed and agility performance among university athletes over the course of a competitive or pre-competitive mesocycle?

3. In what ways do changes in strength, speed, and agility following resistance training relate to sports performance indicators that matter in the athletes' own events, and which of these physical changes appear most closely associated with performance gain?

Methodology

The inquiry is conceived as a prospective, two-group, pre-test and post-test study conducted within a university sport department and designed to isolate the additional effect of a supervised resistance training programme while remaining feasible inside an ordinary academic and competitive calendar. Eligible participants are male and female university athletes aged eighteen to twenty-five years who have represented their institution in an official intervarsity or equivalent competition during the current or immediately preceding season, who are medically cleared for resistance exercise, and who are free from musculoskeletal injury that would prevent safe execution of squatting, hinging, pushing, pulling, and loaded locomotion patterns. Athletes are excluded if they have completed a formally periodised, supervised resistance programme of eight weeks or longer during the previous three months, if they report the use of anabolic agents, or if their academic or competitive schedule makes attendance at fewer than eighty percent of prescribed sessions probable at enrolment. After institutional ethical approval and written informed consent, participants are stratified by sex and by primary sport category, namely field invasion games, court games, and individual or combat sports, and are then allocated to an experimental group that receives resistance training in addition to usual sport practice or to a comparison group that continues usual sport practice and any existing general conditioning but does not receive the experimental resistance programme.

The experimental programme lasts eight weeks and comprises three supervised sessions each week, each session lasting approximately sixty to seventy-five minutes, and is organised as a daily undulating arrangement in which one session emphasises high-load strength, one session emphasises explosive strength and rate of force development, and one session emphasises strength-speed through moderately loaded, high-intent multi-joint movements. The high-load session is built around back squat or safety-bar squat variations, Romanian deadlift or hip-hinge variations, horizontal and vertical pressing, and upper-body pulling, generally prescribed for three to five sets of four to six repetitions at loads corresponding to an estimated eighty to eighty-seven percent of one-repetition maximum, with rest intervals of three minutes. The explosive session includes jump squats, loaded or unloaded countermovement and drop-jump variations as technically appropriate, Olympic-lift derivatives such as hang cleans or jump shrugs where coaching competence allows, and medicine-ball throws, prescribed for three to five sets of three to six repetitions with the instruction to move the load as quickly as possible while preserving posture. The strength-speed session uses trap-bar jumps or accelerated step-ups, hip-dominant pulls at moderate load, and resisted locomotion such as sled accelerations over ten to twenty metres, again with high intent and full recovery. Loads are progressed weekly provided that technical quality is maintained, and a light deload is scheduled in week five. All sessions begin with a general pulse raiser, targeted mobility, and specific activation, and they end with low-volume trunk and posterior-chain accessory work. The comparison group attends their usual technical and tactical sessions and may complete body-mass circuits or light aerobic work already embedded in their sport programme, but they do not receive the three-session resistance prescription and they are asked not to begin a new external gymnasium programme during the eight weeks.

Testing is conducted in the week before the intervention and in the week after its completion, at the same time of day, after a standardised twenty-four-hour period of reduced training and familiarisation with every procedure. Strength is assessed through estimated or true one-

repetition-maximum back squat and bench press, isometric mid-thigh pull peak force where a force platform or calibrated strain system is available, and countermovement-jump height together with, if instrumentation permits, peak power. Linear speed is assessed by electronic timing of ten-metre and thirty-metre sprints from a standing start, with two trials at each distance and the best trial retained. Agility and change-of-direction ability are assessed with the 505 test and the T-test, again with the better of two successful trials retained, and with the instruction that trials are discarded and repeated if a cone is displaced or a prescribed foot-plant is missed. Sports performance is operationalised in a sport-sensitive manner: invasion-game athletes complete a repeated-sprint protocol and a coach-rated small-sided-game performance sheet covering high-intensity actions; court-sport athletes complete a sport-specific jump or agility circuit together with a brief skill-speed task such as a reactive hitting or shooting sequence; individual-sport athletes complete the performance marker that their coaches already treat as a seasonal benchmark, such as a time trial, a throw, or a bout-specific work output. Secondary measures include body mass, standing height, and a brief wellness and session-rating-of-perceived-exertion log so that training load and academic-week stress can be described. All testers are trained to a common script, and, where possible, the tester who records post-tests is blinded to group allocation.

Data analysis proceeds from inspection of completeness and normality toward a combination of within-group and between-group comparisons that respect the pre-test and post-test structure of the design. Continuous outcomes are summarised as means and standard deviations, and change scores are accompanied by ninety-five percent confidence intervals and standardised effect sizes so that practical as well as statistical meaning can be discussed. Mixed-model or analysis-of-covariance procedures, with group as the between-subjects factor and baseline score as a covariate, form the primary test of the experimental effect on each outcome family, namely strength, speed, agility, and the sport-sensitive performance marker, while sex and sport category are examined as exploratory moderators rather than as fully powered factors. Associations among change scores are described with correlation coefficients in order to address the third research question concerning the relationship between physical adaptations and sports performance. Attendance below eighty percent is treated as a per-protocol concern and is reported transparently alongside an intention-to-treat summary. Ethical practice includes the right to withdraw without penalty to team selection, referral pathways for pain or injury arising during testing or training, and the return of individual results to each athlete in a form that supports rather than undermines subsequent coaching.

Resistance Training and Strength Development in University Athletes

The most consistent finding in the resistance-training literature is also the finding that university programmes can least afford to neglect, namely that a well-progressed loading scheme reliably increases the capacity of athletes to produce force against an external resistance, and that this increase is larger and more robust than the accompanying changes in speed or sport-skill tests. Lesinski, Prieske and Granacher (2016) quantified a moderate effect of resistance training on muscle strength in youth athletes and showed that higher intensities, lower repetition ranges, and longer rest intervals were associated with the greatest strength gains, a pattern that is entirely compatible with the high-load session proposed in the present methodology and that stands as a warning against the substitution of high-repetition circuits for genuine strength work. Granacher, Lesinski, Büsch, Muehlbauer, Prieske, Puta, Gollhofer and Behm (2016) reached a similar conclusion inside a long-term development frame, noting that muscular strength showed the largest improvement among the fitness qualities examined and that free-weight methods were particularly well suited to that improvement. In high-level youth soccer players, Oliver,

Ramachandran, Singh, Ramirez-Campillo and Lloyd (2024) found that lower-body strength was the only outcome on which training mode produced a statistically detectable difference, with strength and combined programmes yielding moderate effects and plyometric training yielding only a small effect, and this result is especially relevant to university departments that are tempted to replace barbell work with jump circuits on the grounds that the latter look more sport-specific. Behm et al. (2017) likewise reported that traditional strength training produced large changes in lower-body strength, whereas power training produced smaller strength effects, which is why the present design retains a dedicated high-load day rather than collapsing the week into jumps and sleds.

Mechanistically, strength gains in already active young adults are a joint product of neural and morphological adaptation. Early weeks of a programme, particularly in athletes whose previous resistance experience has been informal, are dominated by improved motor-unit recruitment, reduced antagonist co-contraction, and more effective intermuscular coordination, whereas continued loading begins to increase muscle cross-sectional area and to alter pennation and tendon stiffness in ways that further raise force capacity (Suchomel, Nimphius, Bellon and Stone, 2018; Cormie, McGuigan and Newton, 2011). University athletes often present with uneven strength profiles, including relatively strong prime movers and relatively neglected posterior-chain and trunk musculature, and a programme that includes hip-hinge patterns, upper-body pulling, and controlled eccentric work is therefore not only a route to a larger squat number but also a route to a more balanced force system. Hameed (2025) observed a clear rise in one-repetition-maximum squat among university volleyball players after eight weeks of structured resistance training, a result that aligns with the broader claim that campus athletes retain a substantial adaptive reserve when the stimulus is specific, supervised, and progressive. Harries, Lubans and Callister (2012), reviewing resistance training in adolescent athletes, similarly concluded that supervised programmes increase strength and selected performance skills when compared with sport practice alone, which is the comparison that university departments most need to make. The practical implication is that strength should be treated as a primary outcome rather than as a hoped-for side effect of general conditioning, and that testing a squat or an isometric mid-thigh pull at the beginning and end of a mesocycle is not an optional luxury but the minimum requirement for knowing whether the gymnasium hours have done their first job. It does not follow that every increment in maximal strength will be equally useful, or that strength can be pursued without regard to the mass and the contractile qualities that accompany it. Suchomel, Nimphius and Stone (2016) emphasised that the value of strength lies in its contribution to force-time characteristics and to sport tasks, not in the isolated pursuit of load on the bar, and subsequent discussion of sprint and endurance trade-offs has cautioned that substantial hypertrophy can, under some conditions, increase the mass that must be accelerated or alter internal moment arms in ways that are not automatically helpful for high-velocity performance. Lloyd et al. (2014) and Faigenbaum and Myer (2010) nevertheless insist that the greater public and institutional risk is not that young athletes will become too strong, but that they will be denied a competent strength stimulus on the basis of outdated safety concerns. For university athletes this caution should be interpreted as a call for intelligent programming rather than as a reason to fear strength. Most campus competitors are not close to the hypertrophic ceiling that would make added mass a serious mechanical problem, and the greater risk in this population is under-loading. The eight-week arrangement described above therefore keeps high-load work in view, pairs it with high-intent explosive work so that the new force capacity can be expressed quickly, and measures both maximal and explosive strength so that coaches can see whether the programme has raised the ceiling, the rate, or both.

Resistance Training, Linear Speed, and Agility

Speed and agility occupy a more complicated place in the evidence base because they are products of strength, power, technique, and perception, and because resistance training influences some of these ingredients more directly than others. Linear sprint performance has repeatedly shown smaller pooled effects than maximal strength in resistance-training meta-analyses of young athletes, with Lesinski, Prieske and Granacher (2016) reporting a small effect for linear sprint and a small-to-moderate effect for agility, and with Oliver, Ramachandran, Singh, Ramirez-Campillo and Lloyd (2024) likewise finding only small improvements in speed among high-level youth soccer players even when strength and jump qualities improved moderately. These magnitudes should not be read as failure. A reduction of a few hundredths of a second over ten or thirty metres is competitively meaningful in university fixtures, and the mechanical literature suggests that the route to that reduction often runs through improved horizontal force application and through a higher strength reserve rather than through a mysterious change in stride rate produced by the squat itself. Seitz, Reyes, Tran, Saez de Villarreal and Haff (2014) reported a positive transfer from lower-body strength gains to sprint performance, Comfort, Haigh and Matthews (2012) showed that preseason increases in squat strength were accompanied by faster five-metre, ten-metre, and twenty-metre times, and Styles, Matthews and Comfort (2016) showed that heavy squat training could improve both strength and sprint times in trained soccer players, thereby giving campus coaches a warrant for retaining heavy lower-body loading even when the stated goal of the athlete is to become faster.

Change-of-direction and agility outcomes have, if anything, been more responsive to resistance training than maximal linear speed in several pooled analyses. Chaabene, Prieske, Moran, Negra, Attia and Granacher (2020) found a large overall effect of resistance training on change-of-direction speed in youth and young athletic adults, with particularly large effects in younger and male subgroups, and they noted that two sessions each week could produce large effects, a scheduling detail that maps well onto crowded university weeks. The theoretical explanation is straightforward: cutting, planting, and re-accelerating require high levels of eccentric and isometric strength as well as the ability to reapply force in a new direction, and these qualities are precisely those that heavy and mixed resistance programmes develop. Comfort, Bullock and Pearson (2012) reported significant negative correlations between relative squat strength and short-sprint times, which supports the idea that a stronger lower body is a usable resource for the first steps of acceleration that also open most change-of-direction tasks. Ribič, Pleša, Ujaković and Kozinc (2025) further showed that strength-oriented resistance work can improve the mechanical profile of sprinting, including the ratio of horizontal to resultant force, even when peak velocity remains stubborn, and this finding helps to explain why agility tests that reward acceleration and braking often move more than flying-sprint tests after a strength block. Silva, Nassis and Rebelo (2015) reached a similar applied conclusion in soccer by arguing that strength training improves the physical basis of accelerations, duels, and high-intensity actions when it is periodised alongside pitch work. University programmes that test only a thirty-metre sprint may therefore underestimate the speed-related value of their gymnasium work, whereas programmes that also administer a 505 or a T-test are more likely to capture the change-of-direction dividend that the literature now regards as one of resistance training's more dependable field transfers.

Two qualifications must be stated with the same length and care as the positive claims. First, agility in its fullest sense includes a perceptual and decision-making component that no squat or sled drill can supply, and resistance training should therefore be described as an enhancer of pre-planned change-of-direction speed and of the physical prerequisites of reactive agility rather

than as a complete agility method. Second, the transfer from strength to speed is greater when the resistance programme contains high-intent, high-velocity expressions of force and when sport practice continues to supply sprinting and cutting exposures, a point that follows from the force-velocity and specificity arguments developed by Suchomel, Nimphius, Bellon and Stone (2018) and Cormie, McGuigan and Newton (2011), and from the mode-comparison work of Oliver, Ramachandran, Singh, Ramirez-Campillo and Lloyd (2024) and Behm et al. (2017). The methodology of the present article honours both qualifications by retaining usual sport practice in both groups, by including an explosive and a strength-speed session rather than high-load work alone, and by measuring ten-metre acceleration, thirty-metre sprint, and two change-of-direction tests so that the speed family is not collapsed into a single number. Under those conditions it is reasonable to expect that university athletes will show their clearest speed-related gains in acceleration and change of direction, with more modest change at longer linear distances.

Resistance Training and Sports Performance

Sports performance is the outcome that administrators and athletes care about most and the outcome that researchers find hardest to isolate, because matches and events are decided by skill, tactics, officiating, opposition quality, and chance as well as by physical capacity. Nevertheless, the most comprehensive recent synthesis of resistance training in elite athletes reported a large overall effect on sport-specific performance, with a standardised mean difference of 1.16, and with larger effects among national-level than among international-level athletes and among more local, task-specific outcomes than among global endurance-style outcomes (Makaruk, Starzak, Tarkowski, Sadowski and Winchester, 2024). University athletes, who typically compete at a national-collegiate rather than a world-championship standard, therefore occupy the competitive band in which the sport-specific return on resistance training appears to be at its highest. Local outcomes such as throwing velocity, jump-based court actions, scrum or tackle momentum, and short repeated-sprint sequences are precisely the kinds of tasks that campus sport rewards, and they are also the kinds of tasks that respond when the force-producing system is strengthened and then expressed at higher velocities (Suchomel, Nimphius and Stone, 2016; Granacher et al., 2016). The implication is not that resistance training wins matches by itself, but that it changes the physical currency with which skill and tactics are spent. Lauenstein, Bertelsen and Andersen (2014) add a second competitive argument by showing that strength training is among the more effective exercise-based methods for reducing sports injuries, which matters in universities where a single lost athlete can collapse a small squad.

The pathway from gymnasium adaptation to competitive action is best understood as a cascade rather than as a single leap. Greater maximal strength enlarges the force ceiling; improved rate of force development and power allow a larger fraction of that ceiling to be used in the brief ground-contact and striking intervals that sport actually provides; improved change-of-direction and acceleration qualities allow that force to be applied when the athlete must start, stop, and restart; and only then does the sport-specific task, whether a spike, a drive to the basket, a tackle, or a finishing sprint, become more robust under fatigue (Suchomel, Nimphius and Stone, 2016; Cormie, McGuigan and Newton, 2011; Seitz et al., 2014). Hameed (2025) illustrated the early part of this cascade in university volleyball players by showing concurrent improvements in squat strength and sprint time after eight weeks, and team-sport reviews have repeatedly linked structured strength work with better sprinting, jumping, and high-intensity action profiles that coaches recognise as match-relevant (Silva, Nassis and Rebelo, 2015; Harries, Lubans and Callister, 2012). Makaruk, Starzak, Tarkowski, Sadowski and Winchester (2024) also observed that heavy and light loads did not differ significantly in their pooled effect on sport-specific

performance, a result that should comfort university practitioners who cannot always provide heavy loading for every athlete and who may need to mix moderate loads moved with high intent. Comfort, Haigh and Matthews (2012) and Styles, Matthews and Comfort (2016) supply the applied middle of the cascade by showing that squat-strength gains travel with short-sprint gains in trained team-sport players, which is the kind of transfer campus coaches can explain to athletes who ask why they must squat in a week that already contains lectures and fixtures.

For university departments the operational lesson is to measure sports performance in a way that is close enough to the event to be meaningful and close enough to the physical intervention to be interpretable. A single win-loss record is too remote; a laboratory peak-power number is too near. The methodology proposed here therefore uses repeated-sprint ability and small-sided-game ratings for invasion-game athletes, jump and skill-speed circuits for court athletes, and existing seasonal benchmarks for individual-sport athletes, and it then asks, as a third research question, which physical change scores travel most reliably with those performance markers. On the basis of the reviewed evidence it is expected that improvements in explosive strength and in change-of-direction speed will show closer associations with sport-sensitive tasks than will improvements in slow, long-duration strength tests alone, although maximal strength is still expected to function as the enabling quality without which the more specific expressions remain limited (Suchomel, Nimphius, Bellon and Stone, 2018; Chaabene et al., 2020; Oliver et al., 2024; Behm et al., 2017). If those associations appear in university data, coaches will have a stronger warrant for protecting gymnasium time during examination weeks; if they do not appear, the field will have learned that transfer in this population requires a different blend of load, velocity, and sport practice than the elite and youth literatures have so far described. In either case the measurement habit itself is part of the intervention, because programmes that never test strength, speed, agility, and a sport marker cannot know whether their resistance work is an investment or only a tradition.

Conclusion

Resistance training remains one of the most defensible investments that a university sport programme can make, provided that it is understood as a method for raising the force-producing capacity of athletes and for converting that capacity into faster, more agile, and more effective sporting actions rather than as a generic ritual of tiredness in the gymnasium. The evidence assembled in this article indicates that maximal and explosive strength are the qualities most securely improved by progressive loading, that linear speed and especially change-of-direction ability can improve when strength work is paired with high-intent and sport practice, and that sport-specific performance is more likely to benefit in university and national-collegiate populations than in already world-class cohorts whose residual adaptive room is smaller. These conclusions do not require every campus athlete to become a powerlifter, nor do they require departments to pretend that a squat will teach perception or tactics. They do require programmes to specify a training dose, to test the qualities they claim to develop, and to stop treating strength, speed, agility, and performance as interchangeable labels for the same circuit. The problem that opened this article was the gap between the general reputation of resistance training and the particular conditions of university sport, and the objectives and research questions that followed from that problem now have a practical shape. An eight-week, three-session, daily undulating programme that combines high-load strength, explosive strength, and strength-speed work, set against a comparison group that continues usual sport practice, offers a feasible way for campus departments to determine what their gymnasium time is actually buying. Strength should be expected to move first and most clearly. Acceleration and change of direction should be expected to move next if the programme includes high intent and if sport

practice is not withdrawn. Sports performance should be expected to move to the extent that the chosen markers depend on those physical qualities and to the extent that skill practice remains intact. Where results confirm these expectations, universities will have a local evidence base for staffing, timetabling, and athlete education. Where results diverge, they will have discovered the limits of transfer in a population that must study as well as train, and that discovery will be more useful than another untested claim that lifting makes athletes better. In either case the responsible course is the same: train with purpose, measure with honesty, and treat the university athlete as a distinct performer rather than as a smaller version of a professional or a larger version of a schoolchild.

References

- Behm, D.G., Young, J.D., Whitten, J.H.D., Reid, J.C., Quigley, P.J., Low, J., Li, Y., Lima, C.D., Horan, D.D., Foley, R.C.A., Naim, S., Sadreh, M. and Granacher, U. (2017) Effectiveness of traditional strength vs. power training on muscle strength, power and speed with youth: a systematic review and meta-analysis. *Frontiers in Physiology*, 8, 423. Available at: <https://www.frontiersin.org/articles/10.3389/fphys.2017.00423/full>
- Chaabene, H., Prieske, O., Moran, J., Negra, Y., Attia, A. and Granacher, U. (2020) Effects of resistance training on change-of-direction speed in youth and young physically active and athletic adults: a systematic review with meta-analysis. *Sports Medicine*, 50(8), pp. 1483-1499. Available at: <https://pmc.ncbi.nlm.nih.gov/articles/PMC7376516/>
- Comfort, P., Bullock, N. and Pearson, S.J. (2012) A comparison of maximal squat strength and 5-, 10-, and 20-meter sprint times, in athletes and recreationally trained men. *Journal of Strength and Conditioning Research*, 26(4), pp. 937-940. Available at: <https://pubmed.ncbi.nlm.nih.gov/22446673/>
- Comfort, P., Haigh, A. and Matthews, M.J. (2012) Are changes in maximal squat strength during preseason training reflected in changes in sprint performance in rugby league players? *Journal of Strength and Conditioning Research*, 26(3), pp. 772-776. Available at: <https://pubmed.ncbi.nlm.nih.gov/22310512/>
- Cormie, P., McGuigan, M.R. and Newton, R.U. (2011) Developing maximal neuromuscular power: part 2 - training considerations for improving maximal power production. *Sports Medicine*, 41(2), pp. 125-146. Available at: <https://pubmed.ncbi.nlm.nih.gov/21244105/>
- Faigenbaum, A.D. and Myer, G.D. (2010) Resistance training among young athletes: safety, efficacy and injury prevention effects. *British Journal of Sports Medicine*, 44(1), pp. 56-63. Available at: <https://bjsm.bmj.com/content/44/1/56>
- Granacher, U., Lesinski, M., Büsch, D., Muehlbauer, T., Prieske, O., Puta, C., Gollhofer, A. and Behm, D.G. (2016) Effects of resistance training in youth athletes on muscular fitness and athletic performance: a conceptual model for long-term athlete development. *Frontiers in Physiology*, 7, 164. Available at: <https://pmc.ncbi.nlm.nih.gov/articles/PMC4861005/>
- Hameed, S. (2025) Impact of resistance training upon strength and speed of universities volleyball players by using scientific training method. Available at: https://www.researchgate.net/publication/395240137_Impact_of_Resistance_Training_upon_Strength_and_Speed_of_Universities_Volleyball_Players_by_Using_Scientific_Training_Method
- Harries, S.K., Lubans, D.R. and Callister, R. (2012) Resistance training to improve power and sports performance in adolescent athletes: a systematic review and meta-analysis. *Journal of Science and Medicine in Sport*, 15(6), pp. 532-540. Available at: <https://pubmed.ncbi.nlm.nih.gov/22541990/>

- Lauersen, J.B., Bertelsen, D.M. and Andersen, L.B. (2014) The effectiveness of exercise interventions to prevent sports injuries: a systematic review and meta-analysis of randomised controlled trials. *British Journal of Sports Medicine*, 48(11), pp. 871-877. Available at: <https://bjsm.bmj.com/content/48/11/871>
- Lesinski, M., Prieske, O. and Granacher, U. (2016) Effects and dose-response relationships of resistance training on physical performance in youth athletes: a systematic review and meta-analysis. *British Journal of Sports Medicine*, 50(13), pp. 781-795. Available at: <https://pmc.ncbi.nlm.nih.gov/articles/PMC4941165/>
- Lloyd, R.S., Faigenbaum, A.D., Stone, M.H., Oliver, J.L., Jeffreys, I., Moody, J.A., Brewer, C., Pierce, K.C., McCambridge, T.M., Howard, R., Herrington, L., Hainline, B., Micheli, L.J., Jaques, R., Kraemer, W.J., McBride, M.G., Best, T.M., Chu, D.A., Alvar, B.A. and Myer, G.D. (2014) Position statement on youth resistance training: the 2014 International Consensus. *British Journal of Sports Medicine*, 48(7), pp. 498-505. Available at: <https://bjsm.bmj.com/content/48/7/498>
- Makaruk, H., Starzak, M., Tarkowski, P., Sadowski, J. and Winchester, J. (2024) The effects of resistance training on sport-specific performance of elite athletes: a systematic review with meta-analysis. *Journal of Human Kinetics*, 91, pp. 135-155. Available at: <https://pmc.ncbi.nlm.nih.gov/articles/PMC11057612/>
- Oliver, J.L., Ramachandran, A.K., Singh, U., Ramirez-Campillo, R. and Lloyd, R.S. (2024) The effects of strength, plyometric and combined training on strength, power and speed characteristics in high-level, highly trained male youth soccer players: a systematic review and meta-analysis. *Sports Medicine*, 54(3), pp. 623-643. Available at: <https://pmc.ncbi.nlm.nih.gov/articles/PMC10978689/>
- Ribič, A., Pleša, J., Ujaković, F. and Kozinc, Ž. (2025) Effects of strength, speed and non-specific resistance training on athletic performance and FVP profile characteristics of youth professional soccer players. *International Journal of Strength and Conditioning*, 5(1). Available at: <https://journal.iusca.org/index.php/Journal/article/view/392>
- Seitz, L.B., Reyes, A., Tran, T.T., Saez de Villarreal, E. and Haff, G.G. (2014) Increases in lower-body strength transfer positively to sprint performance: a systematic review with meta-analysis. *Sports Medicine*, 44(12), pp. 1693-1702. Available at: <https://pubmed.ncbi.nlm.nih.gov/25059334/>
- Silva, J.R., Nassis, G.P. and Rebelo, A. (2015) Strength training in soccer with a specific focus on highly trained players. *Sports Medicine - Open*, 1, 17. Available at: <https://pmc.ncbi.nlm.nih.gov/articles/PMC5005580/>
- Styles, W.J., Matthews, M.J. and Comfort, P. (2016) Effects of strength training on squat and sprint performance in soccer players. *Journal of Strength and Conditioning Research*, 30(6), pp. 1534-1539. Available at: <https://pubmed.ncbi.nlm.nih.gov/26473518/>
- Suchomel, T.J., Nimphius, S. and Stone, M.H. (2016) The importance of muscular strength in athletic performance. *Sports Medicine*, 46(10), pp. 1419-1449. Available at: <https://link.springer.com/article/10.1007/s40279-016-0486-0>
- Suchomel, T.J., Nimphius, S., Bellon, C.R. and Stone, M.H. (2018) The importance of muscular strength: training considerations. *Sports Medicine*, 48(4), pp. 765-785. Available at: <https://link.springer.com/article/10.1007/s40279-018-0862-z>