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Functional Capacities Of The Body In Girls Specializing In Pilates Under Systematic Training Conditions

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Abstract: Systematic Pilates training is increasingly used in youth and student sport environments as a low-impact method that combines breathing control, trunk stabilization, postural alignment, and coordinated movement. The present article analyzes how regular Pilates practice influences functional capacities in girls and young women, focusing on cardiorespiratory fitness, pulmonary function, core endurance, flexibility, and postural stability. The work is designed as an integrative evidence synthesis with a pedagogical–biological interpretation of "systematic training conditions" (regularity, dose, progression, supervision, and feedback). Results from recent controlled trials in female university students indicate that Pilates, especially when paired with structured breathing training, can improve forced vital capacity and other ventilatory indices and simultaneously enhance postural stability. Findings from meta-analyses suggest that Pilates can produce meaningful gains in cardiorespiratory fitness compared with non-exercise control, while its advantage over other exercise modes is less consistent; training dose appears to be an important moderator, with cumulative exposure linked to more reliable improvements. The article presents a unified mechanistic model explaining how respiratory–postural coupling, neuromuscular control, and connective-tissue adaptation contribute to functional outcomes under systematic practice. The practical contribution of the article is a scientifically grounded framework for structuring Pilates programs for girls and young women in educational and sport settings, with attention to safety, progression, and outcome monitoring.

Keywords: Pilates; girls; young women; functional capacity; pulmonary function; cardiorespiratory fitness; postural stability; core endurance; systematic training.

Introduction: Functional capacity in girls and young women is often discussed through a narrow lens such as "fitness level" or "sport performance," yet in training practice it represents a broader integration of systems that support efficient movement, learning, recovery, and health. In applied sports science, functional capacity typically reflects how effectively the respiratory, cardiovascular, neuromuscular, and musculoskeletal systems cooperate to sustain physical work, regulate posture, and adapt to repeated training loads. For populations specializing in Pilates, the concept becomes especially relevant because Pilates is not only a strengthening method but also a movement culture emphasizing precise motor control, breathing coordination, and postural discipline. These characteristics make it an attractive training choice for young women who need a safe and scalable modality that can be integrated into educational schedules and varied fitness backgrounds.

"Systematic training conditions" in this context should be understood as more than simply attending classes. Systematic conditions include stable frequency, sufficient total training dose, gradual progression of complexity and load, methodological supervision, and continuous feedback that shapes technique, breathing pattern, and movement quality. When these conditions are present, adaptations are expected to appear not only in local muscle endurance, but also in the regulation of posture, respiratory mechanics, and movement economy. This is consistent with the idea

that mind–body exercise methods, when practiced regularly and with adequate volume, may influence multiple functional domains through coordinated neuromuscular activation and improved biomechanical efficiency.

At the same time, scientific discussions about Pilates sometimes contain two extremes. One extreme overstates Pilates as a universal solution for any fitness objective, including high-level aerobic conditioning. The other extreme underestimates it as merely a "soft" flexibility routine. Evidence suggests a more nuanced view: Pilates can improve several functional indicators, and the magnitude and profile of improvement depend on program dose, participant baseline status, and whether the program includes breathing and posture-focused components that expand physiological demand. A recent meta-analysis that concentrated on cardiorespiratory fitness in healthy adults reported that Pilates was superior to non-exercise controls but did not clearly outperform other exercise modalities, and it highlighted the importance of cumulative dose for producing measurable changes. Earlier meta-analytic evidence also supports Pilates as a viable option for improving VO_2max, while noting uncertainty regarding the intensity achieved during sessions and the variability of protocols across studies.

For girls and young women, the relevance of Pilates extends beyond fitness into posture and respiratory health. University and adolescent populations spend considerable time in sitting and screen-based behavior, which is frequently associated with altered posture patterns and reduced thoracic mobility. In female university students with poor posture, a randomized trial found that combining Pilates with breathing exercises improved lung function indices and postural stability more than Pilates alone, suggesting a meaningful coupling between respiratory muscle function and postural control. Such findings strengthen the rationale for viewing functional capacity in Pilates specialists as a multi-system outcome rather than a single performance metric.

The purpose of this article is to analyze functional capacities in girls specializing in Pilates under systematic training conditions and to present an evidence-informed model explaining the principal adaptation pathways. The objective is not to reduce outcomes to isolated "tests," but to interpret them as integrated markers of functional readiness, health, and movement competence in educational and sport practice.

An integrative evidence synthesis design was used, combining (1) targeted review of controlled studies in girls and young women undergoing Pilates training and (2) synthesis of findings from meta-analyses addressing Pilates-related changes in cardiorespiratory and functional indicators. The selection logic focused on interventions representing systematic training conditions, defined operationally as structured sessions conducted for a minimum of eight weeks, with documented frequency and session duration. Studies emphasizing young women or female students/athletes were prioritized to align with the article's population focus. Special attention was paid to trials where Pilates was paired with breathing-focused training, because respiratory–postural mechanisms are central to functional outcomes in Pilates pedagogy.

Outcome domains were grouped into four functional blocks for synthesis. The first block was cardiorespiratory fitness, typically represented by VO_2-related indices or treadmill-based maximal/threshold measures. The second block was pulmonary function and respiratory muscle performance, reflected in forced vital capacity and related spirometric indicators. The third block represented neuromuscular function relevant to Pilates specialization, including core endurance, trunk extensor endurance, and functional task performance. The fourth block included posture-related functional indicators such as static postural stability and flexibility, which are directly tied to Pilates movement quality and injury-prevention logic.

Data were synthesized narratively with an emphasis on agreement across studies, plausible physiological mechanisms, and program dose and structure as moderators. Rather than treating Pilates as a uniform intervention, the synthesis considered the pedagogical structure of sessions: cueing quality, breathing instruction, progression rules, and transfer to daily posture. Where available, information about intervention duration, frequency, session length, and participant characteristics was extracted to support interpretation of "systematic conditions" as a training variable.

Across selected studies, systematic Pilates training in

female youth and young women demonstrated a characteristic adaptation profile: consistent improvements in trunk endurance, flexibility, and functional task performance, with pulmonary and cardiorespiratory changes depending more strongly on dose, baseline fitness, and the inclusion of breathing-focused components. Evidence in female university students indicates that extending training duration and integrating targeted breathing can amplify respiratory outcomes and may also support postural stability improvements. Evidence from synthesis research indicates that Pilates can improve cardiorespiratory fitness versus non-exercise control, but comparisons against other exercise modes are less decisive, emphasizing the need to interpret CRF outcomes through program design and total dose rather than Pilates "as a label."

Table 1. Selected controlled studies and syntheses on Pilates training and functional indicators in females under systematic training conditions

Source	Participants	Training structure	Main functional indicators reported	Direction of change
Zhang J., Zhao Y., Wang Q., 2025	66 female university students (~19 y) with poor posture; 3 groups	16 weeks total; 3×/week; 60 min; Pilates + breathing vs Pilates vs control	FVC, MV, FEV1%, PEFR, TV; posture; postural stability	Combined breathing + Pilates produced broader lung function gains and improved stability more consistently than Pilates alone
Adıgüzel S. et al., 2023	Young adult healthy women, normal BMI	10 weeks; equipment-based Pilates vs breathing vs combined	HRV indices; pulmonary function; body composition	Combined program showed wider pulmonary improvements (FVC, FEV1, VC, IC, TV, MVV, VE) than single-mode programs

Cattolico A. et al., 2025	40 young female volleyball players	32 weeks; 2×/week Pilates added to regular training	Flexibility tests (spine, SLR, PA) and abdominal strength (HSU)	Significant improvements in multiple flexibility measures and abdominal strength after systematic long-term exposure
Rayes A.B.R. et al., 2019	Adults overweight/obese; mixed age	8 weeks; 3×/week; 60 min; total 24 sessions	Chair test, stair test, trunk endurance; VO_2-related indices	Large improvements in functional tasks and trunk endurance; medium-classified improvement in VO_2peak reported in Pilates group
Pessôa R.A.G. et al., 2023	Meta-analysis (12 RCTs; 569 participants)	Dose moderator reported	Cardiorespiratory fitness outcomes	Pilates superior to control; dose ≥1440 min associated with effect; not clearly superior to other exercise
Fernández-Rodríguez R. et al., 2019	Systematic review & meta-analysis	Mixed protocols	VO_2max-focused CRF outcomes	Pilates can improve VO_2max; heterogeneity and intensity uncertainty emphasized

The synthesized evidence supports the interpretation that functional capacity improvements in girls and young women specializing in Pilates are driven by an interaction between training dose and the method's distinctive pedagogical features. Under systematic conditions, Pilates provides repeated practice of controlled spinal articulation, lumbopelvic stabilization, and coordinated breathing, which together can enhance neuromuscular efficiency and postural regulation. The presence of consistent gains in trunk endurance and flexibility across different female populations suggests that these outcomes represent the "core adaptation signature" of Pilates specialization, likely because they align directly with the movement demands and coaching cues typical of Pilates sessions.

Respiratory and cardiorespiratory outcomes show greater dependence on how Pilates is implemented.

The randomized trial in female university students demonstrated that adding structured breathing exercises to Pilates yielded more pronounced improvements in forced vital capacity and other lung function indices than Pilates alone, and it simultaneously improved static postural stability. This pattern is physiologically coherent because respiratory muscle function and postural control share common mechanisms. The diaphragm participates not only in ventilation but also in regulation of intra-abdominal pressure and trunk stabilization, which influences balance and posture. When breathing training explicitly targets muscle coordination and breathing pattern quality, the intervention may more reliably stimulate adaptations that are not guaranteed by Pilates practice alone, particularly in individuals whose baseline posture restricts thoracic expansion.

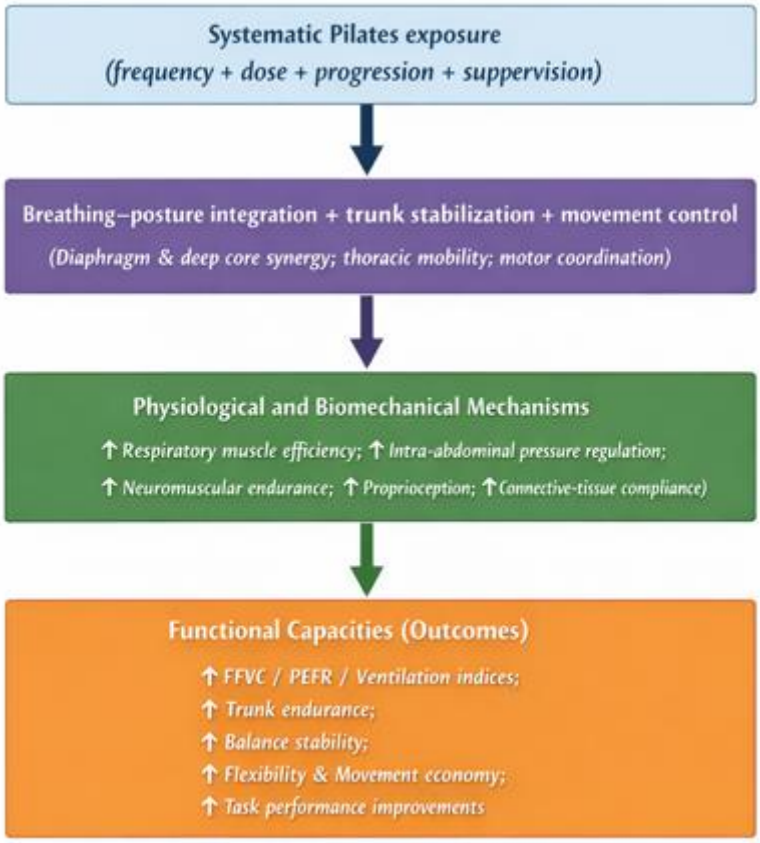

Figure 1. Conceptual model of functional adaptations in girls specializing in Pilates under systematic training conditions

Cardiorespiratory fitness is more complex. Meta-analytic evidence indicates that Pilates can improve cardiorespiratory fitness compared with non-exercise control, but it is not consistently superior to other forms of exercise, and certainty of evidence can be low due to protocol heterogeneity. This suggests a practical conclusion for training design: if the goal is to improve CRF in girls specializing in Pilates, systematic training conditions must include sufficient total dose and appropriately challenging sequences that raise physiological demand. The dose threshold concept reported in CRF-focused synthesis work is instructive because it shifts attention from the brand name of the method to the exposure needed for adaptation. For practitioners in educational environments, this implies that short-term or low-frequency Pilates participation may be valuable for posture and core endurance yet may be insufficient for robust CRF gains unless the program design deliberately supports that objective.

A separate but important dimension in girls' training is the role of long-term consistency. Evidence from longer interventions in young female athletes indicates that systematic exposure over months can yield meaningful improvements in flexibility and core-related performance measures. This supports the training principle that many Pilates-related adaptations are cumulative and technique-dependent. Because Pilates emphasizes movement quality, improvements may

accelerate after learners acquire motor patterns that allow deeper engagement of stabilizing muscles and more efficient breathing mechanics. In this regard, systematic conditions are not merely logistical; they create a learning environment in which technical mastery becomes the pathway to physiological adaptation.

From a methodological perspective, the synthesis indicates that future applied research in girls specializing in Pilates should standardize reporting of program dose, progression rules, adherence, and cueing strategies, because these variables likely explain part of the variability seen in cardiorespiratory and respiratory outcomes. In practical monitoring, institutions can prioritize a small set of functional markers that correspond to Pilates logic: spirometric indices when feasible, trunk endurance tests, flexibility measures, and postural stability tasks. The integrated model presented in Figure 1 helps explain why these markers should be interpreted together rather than separately: improvements in breathing mechanics can support posture and stability, while stability and motor control can reduce energy waste and potentially contribute to better functional endurance.

Under systematic training conditions, Pilates specialization in girls and young women is associated with reliable improvements in trunk endurance, flexibility, and functional task performance, reflecting enhanced neuromuscular control and connective-tissue adaptation. Respiratory outcomes become more pronounced when Pilates is combined with structured breathing training, which can improve lung function indices and postural stability in female university students. Cardiorespiratory improvements are possible, particularly relative to inactivity, but they depend strongly on total dose and program design rather than on Pilates as a method label alone; evidence syntheses highlight dose as a key moderator. Overall, the most scientifically grounded way to interpret functional capacities in girls specializing in Pilates is as a multi-system adaptation produced by consistent exposure, progressive complexity, and high-quality pedagogical supervision that integrates breathing, posture, and controlled movement.

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