International Journal of Education, Leadership, Artificial Intelligence, Computing, Business, Life Sciences, and Society - https://journalviral.org
DOI: https://doi.org/10.65222/VIRAL.2026.8.47.67

Evolution of Competitive Performance in IFBB Fitness Challenge: A Longitudinal Analysis of International Competition Results from 2021 to 2026

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Abstract. *Fitness Challenge has developed rapidly from a newly introduced competitive format into an internationally contested performance discipline. However, the evolution of competitive standards since its introduction has not yet been systematically examined. This study aimed to characterize year-to-year changes in competition-level Fitness Challenge performance between 2021 and 2026 using officially published international competition results. A retrospective repeated cross-sectional design was applied to senior individual Gold and Silver competition records obtained from International Federation of Bodybuilding and Fitness championships. Total valid repetitions, winning performance, competitive-standard differences, sex-specific patterns, and selected repeated-athlete trajectories were examined. Because exercise selection, external loading, and technical regulations evolved during the observation period, performance changes were interpreted within their regulatory context rather than as direct year-to-year physiological improvements. The results revealed a descriptive pattern of competitive development across the observation period. Women's winning Gold performance increased markedly from the inaugural 2021 benchmark before stabilizing during the later competitive seasons, whereas men's Gold performance showed a nonlinear trajectory followed by its highest observed benchmark in 2026. Silver-level performances showed greater stability among men after 2022 and progressive convergence between male and female repetition outputs. Repeated-athlete records further indicated that individual progression and competitive placing were not interchangeable, as improvements in absolute output did not necessarily translate into higher rankings when field strength changed. The findings suggest that Fitness Challenge underwent an early phase of rapid competitive maturation followed by increasing performance stabilization and specialization. The study provides an initial longitudinal framework for establishing normative standards, monitoring competitive development, interpreting athlete progression, and designing future Fitness Challenge-specific performance research.*

Keywords: functional fitness; sex differences; competition design; repeated cross-sectional data; performance variability..

1 Introduction

The emergence of new competitive sports provides a rare opportunity to observe the development of performance standards almost from their inception. In established Olympic and professional sports, longitudinal analyses typically examine marginal improvements superimposed on decades of technical, physiological, and organizational development. In contrast, newly formalized competitive disciplines can undergo rapid changes in participation, training specialization, technical standards, competition rules, and athlete performance during their first competitive cycles.

Fitness Challenge represents such a case.

The International Federation of Bodybuilding and Fitness introduced Fitness Challenge as a performance-based competitive discipline in which ranking is determined by objectively counted exercise repetitions rather than by aesthetic assessment. The discipline was contested internationally at the 2021 IFBB Fitness Challenge World Championships in Santa Susanna, Spain, and has subsequently expanded through World, European, Asian, Balkan, national, and international ranking events (International Federation of Bodybuilding and Fitness, 2021a; 2024a).

The competitive format is based on a standardized circuit of six exercise stations. Athletes attempt to accumulate the maximum number of technically valid repetitions during predetermined work intervals, while exercise difficulty and prescribed external resistance vary according to competitive standard and sex (International Federation of Bodybuilding and Fitness, 2024a; 2025c).

This structure offers an important advantage for competition analysis. Unlike sports in which competition outcome depends heavily on direct interaction with opponents, tactical positioning, or environmental conditions, Fitness Challenge produces a direct numerical measure of physical output: valid repetitions.

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Nevertheless, longitudinal interpretation is not straightforward. The discipline itself has evolved. Exercise selection, technical requirements, external loads, competition levels, and event formats have changed during the period from 2021 to 2026. Consequently, an increase in total repetitions cannot automatically be interpreted as an equivalent increase in physiological capacity.

Research investigating competitive performance in other sports has demonstrated that longitudinal performance analysis must account for both true athlete development and variation produced by competition context, measurement structure, environmental conditions, and rule changes (Hopkins et al., 1999; Pyne et al., 2004; Malcata and Hopkins, 2014).

Similar considerations have emerged in functional fitness competition. Analyses of repeated CrossFit Open workouts have shown that competitive populations can improve considerably over time, while ranking may simultaneously become more difficult because the entire competitive field improves (Mangine et al., 2023b). Research has also demonstrated that strength, physiological characteristics, sport-specific skill, pacing, and competition experience contribute differently to functional fitness performance (Bellar et al., 2015; Serafini et al., 2018; Martínez-Gómez et al., 2020; Mangine et al., 2020).

No equivalent longitudinal characterization has yet been established for IFBB Fitness Challenge. The purpose of the present study was therefore to examine the evolution of competitive performance in Fitness Challenge from its inaugural international period in 2021 through the available 2026 competitive season, using officially published competition results. The analysis was conducted at the level of competition results and competitive fields rather than as a longitudinal cohort study tracking the same athletes across all seasons. Rather than assuming that higher repetition totals necessarily represent direct physiological improvement, the analysis integrates performance output with the regulatory and competitive development of the discipline.

2 Literature Review

2.1 Longitudinal Analysis of Competitive Sport Performance

Longitudinal competition data represent one of the most ecologically valid sources for studying sport performance because they measure athletes under the conditions for which training is ultimately intended. However, competitive results contain both systematic and random variation.

Hopkins et al. (1999) emphasized that studies examining sport-performance enhancement should distinguish practically meaningful changes from normal performance variability. This principle becomes especially important when small changes determine competitive ranking.

Pyne et al. (2004), studying Olympic swimmers, demonstrated that competitive performance can be characterized simultaneously by long-term progression and within-athlete variability. Their work illustrates the importance of examining the magnitude of improvement relative to normal competition-to-competition fluctuations.

Similar findings have been observed in cycling. Paton and Hopkins (2006) demonstrated event-dependent race-to-race variation among elite cyclists, emphasizing that the meaning of a performance change depends on the typical variability of the competitive task.

Malcata and Hopkins (2014), in a systematic review of elite sport, concluded that competitive performance variability differs substantially between sports and event types. Consequently, thresholds derived from one sport cannot simply be transferred to another. For a new discipline such as Fitness Challenge, establishing basic longitudinal performance characteristics is therefore a prerequisite for defining what constitutes meaningful athlete improvement.

2.2 Functional Fitness Competition as an Emerging Research Field

High-intensity functional training has been characterized as a multimodal training approach incorporating functional movement patterns performed at relatively high intensity (Feito et al., 2018). Its expansion into competitive formats has generated growing scientific interest.

Claudino et al. (2018) identified substantial growth in research examining CrossFit and related high-intensity functional exercise, although the authors also highlighted methodological heterogeneity and a limited amount of high-quality longitudinal research.

Competitive functional fitness performance appears to be multifactorial. Bellar et al. (2015) identified relationships between aerobic capacity, anaerobic power, experience, and CrossFit performance. Butcher et al. (2015) similarly found that physiological measures were associated with benchmark workout performance, although predictive relationships differed according to workout structure.

DOI: https://doi.org/10.65222/VIRAL.2026.8.47.67

Serafini et al. (2018), analyzing a large international online competition sample, demonstrated that higher-ranked competitors reported superior strength and sport-specific performance across multiple domains. Martínez-Gómez et al. (2019) identified full-squat performance as an important characteristic associated with CrossFit performance, while subsequent work showed that competitive outcome is better understood using combinations of physiological variables than by a single predictor (Martínez-Gómez et al., 2020). Mangine et al. (2020) likewise showed that body composition, competition experience, muscle morphology, cardiorespiratory characteristics, and force-development capacity may contribute to performance.

These findings consistently support a multidimensional interpretation of functional fitness competition, while also underscoring the need to avoid treating evidence from CrossFit or hybrid racing as direct evidence for the distinct IFBB Fitness Challenge format.

Accordingly, evidence derived from traditional physique-based fitness and bodybuilding disciplines cannot be directly transferred to Fitness Challenge, where competitive outcomes are determined by standardized task performance rather than aesthetic evaluation

2.3 Competitive Performance Across Time

Of particular relevance to the present investigation is the work of Mangine et al. (2023b), who examined repeated CrossFit Open workouts across multiple years. Performance improved in most repeated workouts, yet improved absolute performance did not automatically produce improved ranking because the competitive population also improved.

This observation has important implications for Fitness Challenge. An athlete can improve total repetition output between seasons yet fail to improve competitive ranking if the overall field improves more rapidly, stronger athletes enter the competition, the number of participants changes, or exercise standards and external loads are modified. Consequently, absolute output and competitive placing represent related but distinct dimensions of performance.

The creation of normative scores from large competition leaderboards provides another useful methodological precedent. Mangine, Grundlingh and Feito (2023a) used official CrossFit Open data from 2011–2022 to calculate population-based normative scores and sex comparisons, illustrating how competition archives can be transformed into practical performance standards. A similar approach could ultimately be developed for Fitness Challenge, provided that regulation versions and competition levels are modeled explicitly.

Pacing also contributes to functional fitness performance. Mangine et al. (2021) demonstrated that repetition rate and sustainable pacing can strongly predict workout performance. Subsequent analyses showed systematic differences in pacing according to competitive rank and sex (Mangine et al., 2023c), while a larger retrospective analysis confirmed the importance of repetition pace, break strategy, experience, and consistency (Mangine et al., 2024). These findings are particularly relevant for Fitness Challenge because its fixed work periods reward the ability to sustain repetition output rather than simply maximize instantaneous performance.

2.4 Sex-Specific Performance and Competition Design

Sex differences in absolute strength and power are well established; however, competition-specific loading can modify the extent to which these physiological differences appear in final performance scores. Fitness Challenge uses different prescribed external loads for men and women. The purpose of comparing male and female repetition totals is therefore not to infer equal physiological capacities but to examine whether competition design produces comparable levels of relative competitive output.

Research examining high-level functional fitness athletes demonstrates that both men and women competing at elite level possess highly developed aerobic, anaerobic, strength, and body-composition characteristics (D'Hulst et al., 2024; Sauvé et al., 2024). Sex-specific pacing patterns have also been identified during functional fitness competition (Mangine et al., 2023c).

Consequently, longitudinal convergence between men's and women's Fitness Challenge scores could reflect several interacting mechanisms: increased female participation, improved sport-specific preparation, changes in prescribed loading, technical development, and progressive calibration of competition standards.

2.5 Standardization and Performance Interpretation

Standardization is central to meaningful longitudinal analysis. A score obtained from an unchanged competitive test can be compared directly with an earlier score. In contrast, interpretation becomes more complex when exercises or loads change.

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This issue is especially important in Fitness Challenge. During earlier competitive seasons, Gold-level competition included a station configuration based on movements such as pull-ups, box jumps, dips, walking lunges, sit-ups, and devil press. Subsequent regulations introduced kettlebell squat-to-pull and toes-to-bar and modified the final station. At Silver level, the Jefferson lift used during earlier seasons was later replaced by the Hexa Lift (International Federation of Bodybuilding and Fitness, 2024a; 2025c).

Therefore, the entire 2021–2026 period should not be treated statistically as if athletes had repeatedly performed an identical test. The appropriate approach is a segmented longitudinal interpretation in which performance trends are evaluated alongside regulatory epochs.

2.6 Research Gap

The scientific literature contains an increasing number of studies addressing physiological determinants of functional fitness, competition ranking, pacing, sex differences, performance prediction, repeated-workout improvement, normative scoring, and competitive variability. However, these studies have predominantly concerned CrossFit or other emerging hybrid exercise formats.

To date, the year-to-year development of competition-level performance in IFBB Fitness Challenge from its inaugural international season has not been systematically characterized in the peer-reviewed literature. Because official results exist from the formative years of the discipline, Fitness Challenge offers an unusual opportunity to document the evolution of a competitive sport during its early institutional and performance-development period.

3 Methodology

3.1 Study Design

A retrospective, repeated cross-sectional, longitudinal competition-analysis design was employed. The unit of observation was an officially recorded competitive performance. The study therefore evaluates longitudinal development at the discipline and competitive-field level and should not be interpreted as a conventional longitudinal cohort study in which the same athletes were followed at every observation point.

Competition data were obtained from publicly available official results published by the International Federation of Bodybuilding and Fitness and from the authors' harmonized longitudinal competition database compiled from those official records. The observation period extended from the inaugural international World Championship season in 2021 to the most recent international competition results available at the analytical cut-off in 2026.

Because the 2026 season was ongoing at the time of analysis, 2026 data represent a partial competitive season, primarily through the European Championships held from 30 April to 4 May 2026 and other available early-season international events.

3.2 Data Sources

Primary competition records included official IFBB Fitness Challenge results from the 2021 World Championships in Santa Susanna, the 2022 international championship season, the 2023 World Fitness Challenge Championships in Kyrgyzstan, 2024 World and European competition records, the 2025 European and other international Fitness Challenge results, and the 2026 European and Balkan Championships. The principal longitudinal benchmark analysis focused on individual senior/open Gold and Silver performance because these standards provided the strongest continuity across competitive seasons.

Junior, Masters, Couples, Team, Bronze, Children's, and SpeedFit categories were retained for contextual interpretation where relevant but were not pooled into the principal annual benchmark series.

3.3 Data Quality Procedures

Officially published scores were transcribed from federation result documents. Where station-level data were available, the six station values were checked against the officially reported total. Entries consisting entirely of zero values and representing a did-not-finish, disqualification, or non-scoring performance were not treated as valid zero-performance observations. Missing station data were not imputed.

Names were harmonized where spelling variations occurred across competition documents. Country, sex, competitive level, age category, competition year, competition name, station scores, total score, and final place were retained whenever available.

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3.4 Regulatory Harmonization

Before longitudinal comparison, each competition was classified according to its exercise configuration. This procedure was necessary because the competitive test changed during the observation period.

The analysis therefore differentiated an early competitive configuration, a transitional configuration characterized by progressive replacement of exercises and refinement of technical standards, and the current configuration represented by the updated Gold, Silver, and Bronze regulations used during the 2026 season.

Raw totals were therefore interpreted as competition-specific output, not as directly interchangeable physiological test scores across all six years.

3.5 Primary Outcome Variables

The primary variables were: (1) total valid repetitions; (2) championship-winning total; (3) podium threshold; (4) performance range; (5) mean and standard deviation when complete category data were available; (6) relative female-to-male winning performance; (7) percentage change in annual benchmark performance; and (8) repeated-athlete score trajectory where an athlete competed across multiple seasons.

For two scores P_1 and P_2, percentage change was calculated as:

$$\Delta P\ (\%) = ((P_2 - P_1) / P_1) \times 100$$

Sex-specific competitive output was additionally expressed as:

$$\text{Performance Ratio } (\%) = (\text{Female Score} / \text{Male Score}) \times 100$$

These ratios describe competition output under sex-specific competition loads and should not be interpreted as physiological equivalence.

3.6 Statistical Analysis

Descriptive statistics were used as the principal analytical approach. Means, standard deviations, ranges, absolute differences, relative percentage changes, and sex-specific performance ratios were calculated where data completeness permitted. No inferential hypothesis testing was performed; the statistical analysis was intended to characterize observed competition-level patterns rather than estimate population-level effects.

Given the structural changes to station configuration and the non-random composition of championship fields, a single linear regression across 2021–2026 was considered potentially misleading and was not used as evidence of physiological improvement. Instead, trends were interpreted descriptively and by regulatory period. This approach follows broader recommendations in sport-performance research that competitive change should be interpreted in relation to measurement reliability, event structure, and typical performance variability (Hopkins et al., 1999; Hopkins et al., 2009; Malcata and Hopkins, 2014).

3.7 Research Questions

RQ1. How has benchmark competitive output in senior Gold and Silver Fitness Challenge changed between 2021 and 2026?

RQ2. Do longitudinal patterns differ between male and female competition?

RQ3. To what extent can changes in raw performance be separated from changes in competition rules and exercise structure?

RQ4. What do repeated-athlete performances reveal about individual progression relative to changes in competitive ranking and field strength?

4 Results

4.1 Development of Annual Winning Performance

Table 1 presents championship-winning repetition totals from the annual reference competition series compiled in the authors' longitudinal database. Because the competition structure evolved across seasons, the values should be interpreted as annual benchmark outputs rather than as repetitions from an invariant physiological test.

Table 1. Benchmark senior individual winning scores across the 2021–2026 analytical period

DOI: https://doi.org/10.65222/VIRAL.2026.8.47.67

Year	Reference competition	Men Gold	Women Gold	Men Silver	Women Silver
2021	World Championships	326	203	433	373
2022	World championship season	306	231	498	417
2023	World Championships	297	292	467	450
2024	European Championships	319	273	500	486
2025	European Championships	327	297	483	502
2026*	European Championships	356	295	476	482

**2026 represents a partial competitive season. Values are valid repetitions. Because station configuration changed across the observation period, direct physiological interpretation of absolute changes is not appropriate.*

Source: Authors' compilation from official IFBB competition results and the harmonized 2021–2026 longitudinal database.

The data demonstrate that performance evolution was not linear. Men's Gold winning output declined from 326 repetitions in 2021 to 297 in 2023 before increasing to 319 in 2024, 327 in 2025, and 356 in 2026. The 2026 benchmark was 9.2% above the inaugural 2021 value and 19.9% above the 2023 value. However, part of this difference coincided with substantial changes to Gold-level exercise structure and therefore cannot be attributed exclusively to improved athlete capacity.

4.2 Evolution of Women's Gold Performance

Women's Gold displayed a different developmental profile. The winning benchmark increased from 203 repetitions in 2021 to 231 in 2022 and 292 in 2023. Thereafter, performance stabilized within a considerably narrower range: 273 repetitions in 2024, 297 in 2025, and 295 in 2026.

The 2026 benchmark was 45.3% higher than the inaugural 2021 value but only 1.0% higher than the 2023 benchmark. This pattern suggests that the largest change occurred during the early competitive-development phase, after which Gold-level female performance entered a period of relative stabilization. Because both competition design and athlete population changed during the same period, the increase should be interpreted as competitive maturation rather than exclusively as physiological improvement.

4.3 Evolution of Silver Performance

Silver-level performance followed a different pattern. Men's winning scores were 433, 498, 467, 500, 483, and 476 repetitions from 2021 through 2026, respectively. Following the initial 2021 season, annual winning outputs remained within a relatively restricted range. Between 2023 and 2026, the benchmark changed from 467 to 476 repetitions, a difference of only 1.9%.

Women's Silver output increased more progressively: 373 repetitions in 2021, 417 in 2022, 450 in 2023, 486 in 2024, and 502 in 2025, before decreasing slightly to 482 in 2026. The 2026 value remained 29.2% above the 2021 benchmark and 7.1% above the 2023 value.

Importantly, the Silver exercise configuration changed before the 2026 season, including replacement of the Jefferson lift with the Hexa Lift. Consequently, the reduction from 502 to 482 repetitions between the 2025 and 2026 reference competitions should not be interpreted as a decline in athlete quality.

4.4 Convergence of Male and Female Competitive Output

A notable longitudinal feature was the increasing proximity between male and female repetition totals. In the Gold competition, the female winning score represented approximately 62.3% of the male score in 2021, 75.5% in 2022, 98.3% in 2023, 85.6% in 2024, 90.8% in 2025, and 82.9% in 2026.

The Silver pattern showed even greater convergence. Female-to-male winning output increased from 86.1% in 2021 to 96.4% in 2023 and exceeded 100% in the 2025 reference competition.

This does not indicate disappearance of biological sex differences in strength or power. Rather, the finding demonstrates that sex-specific prescribed loads and exercise configurations can produce broadly comparable competitive repetition totals. This pattern was particularly evident within the Silver format.

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4.5 Competitive Field Characteristics in 2025 and 2026

The availability of complete station-level datasets from the recent European Championships permitted more detailed analysis. At the 2025 European Championships, Gold men averaged 293.1 ± 29.9 repetitions and Gold women 270.4 ± 27.0 repetitions. Silver men averaged 421.2 ± 77.6 repetitions and Silver women 420.3 ± 79.4 repetitions.

At the 2026 European Championships, Gold men averaged 281.1 ± 66.3 repetitions and Gold women 283.0 ± 17.4 repetitions. Silver men averaged 360.7 ± 76.0 repetitions and Silver women 374.8 ± 72.7 repetitions.

The near-equivalence of Gold mean output in 2026 and the almost identical Silver means in 2025 are consistent with the interpretation that sex-specific competition prescriptions can yield comparable repetition-based output. However, differences in sample size and dispersion mean that equality of group means should not be interpreted as equality of field depth.

However, the 2026 values should be interpreted as provisional, as they represent only the international competition results available at the analytical cut-off rather than a complete competitive season.

4.6 Evidence of Increasing Elite Performance

The highest 2026 European Gold men's performance was 356 repetitions, achieved through station scores of 43, 95, 72, 68, 57, and 21 repetitions. The second-placed athlete recorded 347 repetitions, while third place required 320. Thus, the difference separating first and third place was only 36 repetitions across six stations (International Federation of Bodybuilding and Fitness, 2026a).

The 2025 European Gold men's winner recorded 327 repetitions, followed by 318 and 316. Although the station configuration evolved, these results illustrate the small absolute differences separating the top-ranked performances within this competition (International Federation of Bodybuilding and Fitness, 2025a).

A similar pattern can be identified in women's Gold competition. The 2026 European winner achieved 295 repetitions, compared with 291 for second place and 263 for third. The four-repetition difference between first and second place demonstrates that, within a mature elite subgroup, relatively small performance differences can determine championship outcome.

4.7 Repeated-Athlete Trajectories

Competition archives also permitted identification of athletes appearing repeatedly across seasons. Several cases illustrate the distinction between absolute progression and competitive ranking.

In women's Silver competition, Oana Vasilescu recorded 450 repetitions at the 2023 World Championships, 447 at the 2024 European Championships, 494 at the 2025 European Championships, and 482 at the 2026 European Championships, with a 500-repetition performance also recorded at the 2026 Balkan Championships. Despite variation between events, the overall trajectory demonstrates maintenance of high international-level performance across multiple seasons.

Elena Novac showed another notable progression at Silver level, with 429 repetitions in the 2023 World Championship dataset, 486 at the 2024 European Championships, and 502 at the 2025 European Championships. She also competed at Gold level, highlighting that athlete development within Fitness Challenge may involve progression not merely through higher scores but through transition between competitive standards.

Among men, Lucian Constantin Popa recorded 467 repetitions at the 2023 World Championships, 500 at the 2024 European Championships, and 483 at the 2025 European Championships in Silver competition. These trajectories demonstrate that individual performance is not necessarily monotonic. Competition-to-competition variation, event strength, athlete preparation, tactical pacing, rule structure, and exercise configuration all influence the observed score.

4.8 Performance Versus Ranking

The longitudinal dataset provides examples in which competitive place and absolute performance did not move in parallel. An athlete can record a lower score yet achieve a higher ranking when the competitive field is smaller or weaker. Conversely, an athlete may improve substantially while achieving an unchanged or lower position if the competitive field improves more rapidly.

This phenomenon is consistent with Mangine et al. (2023b), who demonstrated that improvements in repeated functional-fitness workouts did not necessarily improve ranking because population-level performance also increased. Accordingly, Fitness Challenge monitoring should retain both absolute output metrics -

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repetitions, station scores, repetition rate - and relative competitive metrics - placing, percentile, podium distance, and performance relative to the event winner.

5 Discussion

The principal finding of this investigation is that competitive Fitness Challenge performance evolved substantially between 2021 and 2026, but that the evolution was nonlinear and multidimensional. Descriptively, the observed performance patterns suggest two broad developmental phases: an early competitive maturation phase, approximately 2021–2023, and a performance consolidation and specialization phase, increasingly visible from 2024 onward.

5.1 Early Competitive Maturation

The strongest evidence for rapid early maturation can be observed in women's competition. The women's Gold winning benchmark increased from 203 repetitions in 2021 to 292 in 2023. Silver increased from 373 to 450 during the same period.

Several mechanisms may have contributed. First, 2021 represented the inaugural international competitive period. Athlete preparation would therefore have been based on limited competition-specific experience. Second, as the sport expanded, coaches and athletes gained increasing knowledge regarding station-specific technique, pacing, transitions, fatigue management, exercise selection, and competition preparation.

The importance of sport-specific familiarity is supported by functional fitness research. Bellar et al. (2015) identified experience as one factor associated with performance, while Serafini et al. (2018) showed clear differences in sport-specific performance between higher- and lower-ranked competitors. Mangine et al. (2021, 2023c, 2024) demonstrated that pacing and repetition-management strategies can have substantial effects even without changes in maximal physical capacity. A portion of early Fitness Challenge improvement may therefore represent learning of the competitive task.

5.2 Stabilization of Elite Standards

From approximately 2023 onward, several performance series became more stable. Women's Gold winning totals remained between 273 and 297 repetitions across the 2023–2026 reference series. Men's Silver winning totals were similarly stable after the early development period.

Stabilization of championship benchmarks is a characteristic expected as a sport matures. Initially, rapid improvements can occur as training practices, technique, talent identification, and competitive participation improve simultaneously. Later, further gains become more difficult, and elite performance increasingly depends on smaller improvements.

This pattern is well established in mature sports. Pyne et al. (2004) demonstrated that progression among Olympic swimmers occurs against a background of relatively small competition-to-competition variability. Malcata and Hopkins (2014) similarly emphasized that increasingly small changes can become competitively meaningful at elite level. Fitness Challenge may now be beginning to display this characteristic.

5.3 Increasing Importance of Small Performance Differences

The 2025 and 2026 results also indicate that small absolute differences can separate medal positions at the current elite level. At the 2025 European Championships, only two repetitions separated second and third places in the men's Gold category. At the 2026 European Championships, only four repetitions separated first and second in women's Gold.

Because the final score represents the sum of six stations, such differences may be generated by fractions of a repetition per station. At elite level, future improvement may increasingly depend on minimizing invalid repetitions, improving transitions, optimizing pacing, maintaining technique under fatigue, identifying station-specific weaknesses, reducing unnecessary rest, and increasing repetition economy.

These factors closely parallel findings from functional fitness research showing that pacing consistency, transition management, and repetition rate differentiate higher-ranked athletes (Mangine et al., 2021, 2023c, 2024).

5.4 Competition Standard Matters

Gold and Silver should not be interpreted merely as the same test performed at different loads. They represent different combinations of technical complexity, strength demands, bodyweight control, and muscular endurance. The longitudinal results reinforce this distinction.

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Men's Silver output stabilized relatively early, whereas Gold performance remained more variable. This may indicate that Gold performance is more sensitive to technical skill, athlete selection, exercise changes, relative strength, and higher-complexity movement standards.

Meier (2021) and Meier et al. (2023) demonstrated that the predictive relevance of physical capacities in CrossFit varies according to task structure. Fitness Challenge is likely to exhibit a similar principle despite its more standardized format. Future studies should therefore examine each competitive level independently.

5.5 Interpretation of Sex Convergence

One of the most interesting findings is the progressive convergence of male and female repetition output. At Silver level, women reached or exceeded male championship-winning totals during some recent competitions. This should not be interpreted physiologically as equal strength or power. The better interpretation is competition calibration.

The external loads prescribed for women are lower than those prescribed for men. If these loads are appropriately calibrated to the population competing at each level, then similar repetition totals are possible. The near-identical male and female mean Silver totals observed in 2025 provide empirical support for this interpretation.

The finding has practical importance because a well-calibrated scoring structure facilitates comparable competition duration, similar spectator experience, balanced competition density, and common performance metrics across sex divisions. Nevertheless, further research using relative load expressed as a percentage of individual maximal strength would be necessary before conclusions regarding physiological equivalence could be made.

5.6 Regulatory Evolution as a Scientific Confounder

The most important methodological finding of the study may be that longitudinal Fitness Challenge research cannot ignore rule evolution. Gold-level exercise composition differed across early and later competition configurations. Similarly, Silver transitioned from Jefferson Lift to Hexa Lift.

Accordingly, a difference of 20 repetitions between two seasons may be caused partly by improved athlete capacity, changed exercise difficulty, altered external loading, technical-standard changes, or altered field strength. Future Fitness Challenge databases should therefore include a regulation-version variable.

Rather than storing only athlete → year → score, the preferred structure is athlete → competition → category → regulation version → station configuration → station scores → total → placing. This structure will allow substantially stronger statistical modeling and more defensible longitudinal inference.

5.7 Repeated Athletes as a Future Research Model

Repeated-athlete analysis is particularly valuable. Population-level analyses can show that championship standards are increasing, but they cannot demonstrate that a specific athlete improved. Repeated observations can.

Future studies should create unique athlete identifiers allowing repeated results to be linked across multiple competitions. Mixed-effects longitudinal models could then separate within-athlete change, between-athlete differences, competition effects, sex effects, rule-version effects, and age effects. This would represent a major methodological advance over simple annual score comparisons.

5.8 Toward Normative Fitness Challenge Standards

The dataset also creates the possibility of developing performance norms. Instead of interpreting a score only within one competition, future research could establish percentile bands for developing, intermediate, advanced, international, and elite performance levels.

These norms should be calculated separately for sex, Gold/Silver/Bronze standard, Junior/Senior/Masters category, and regulation version. The methodological precedent of normative analysis from large functional fitness leaderboards (Mangine, Grundlingh and Feito, 2023a) is particularly relevant. Such Fitness Challenge-specific normative data could become valuable for coaches, national federations, athlete selection, talent development, and international ranking systems.

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6 Conclusions

Regarding RQ1, benchmark performance changed substantially during the first six competitive seasons but did not follow a simple linear progression. The largest changes were generally observed during the earlier developmental period, followed by increasing stabilization of elite output.

Regarding RQ2, male and female competitive patterns differed. Women showed particularly pronounced early improvements, while recent Silver-level competition demonstrated substantial convergence between male and female repetition outputs under sex-specific loading prescriptions.

Regarding RQ3, some of the observed year-to-year variation cannot be separated from changes in competition design. Exercise replacements and technical modifications mean that raw scores from different regulation periods should not automatically be considered equivalent measures.

Regarding RQ4, the available repeated-athlete observations illustrate that absolute improvement and competitive ranking are distinct outcomes. Athlete progression should therefore be assessed using both absolute performance and performance relative to the contemporary competitive field.

Taken together, the findings indicate that IFBB Fitness Challenge has progressed from an early developmental phase toward a more mature and specialized competitive environment. The principal contribution of this study is not merely the description of historical scores; it establishes a methodological framework for interpreting Fitness Challenge performance longitudinally.

The next phase of research should include complete international databases, unique athlete identification, percentile-based normative standards, station-specific performance modeling, repeated-athlete analysis, sex- and age-specific trajectories, regulation-adjusted performance indices, multilevel predictive models, and physiological validation of competition-derived performance indicators.

The principal limitations of the present analysis are the changing regulatory structure, unequal field sizes across competitions, the use of repeated cross-sectional rather than complete cohort data, and the fact that the 2026 season was incomplete at the analytical cut-off. Despite these limitations, the availability of official competition records from the formative years of the discipline provides an unusual scientific opportunity. Continued systematic collection of Fitness Challenge data may support the development of an increasingly robust evidence-based performance model for this emerging functional fitness discipline. In addition, year-to-year comparisons may be influenced by differences in the composition and competitive strength of the athlete fields represented in the selected international events

Declaration of Generative AI and AI-assisted Technologies in the Writing Process

During the preparation of this work, the authors used ChatGPT (OpenAI) to assist with literature identification, manuscript structuring, language refinement, and descriptive calculation support. All competition data, calculations, references, interpretations, and AI-assisted content were subsequently reviewed and verified by the authors. The authors take full responsibility for the accuracy, integrity, and final content of the publication.

Data Availability Statement

The competition results underlying this study were derived from officially published International Federation of Bodybuilding and Fitness competition result documents. The harmonized analytical database and derived statistics are available from the corresponding author upon reasonable request,, subject to the conditions governing the use and redistribution of the original federation records.
The study was based exclusively on publicly available official competition results and involved no direct interaction with athletes, collection of private information, or experimental intervention. Accordingly, the analysis was treated as secondary research using publicly accessible competition data.

Conflict of Interest

The authors declare no conflict of interest.

Funding

The authors received no specific funding for this study.

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