THE SAFEST AND RISKIEST FORMS OF RESISTANCE TRAINING

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Many people who engage in resistance training, or are looking to begin, have no interest in competing in strength-based sports such as powerlifting, Olympic-style weightlifting, or Strongman. Instead, they use resistance training as a means to improve general health, fitness, and physical function. For these individuals, the goal is to train effectively and consistently over time—without unnecessary injury risk that can disrupt progress or deter participation altogether. Yet, different forms of resistance training expose participants to different levels of risk. Variations in exercise selection, loading, and technique demands can influence how often injuries occur in each modality. Understanding these differences helps personal trainers and clients make smarter programming choices that balance challenge with safety.

This article reviews the research comparing injury rates across major resistance training styles and ranks them from the safest to the riskiest. It also provides practical recommendations that personal trainers and everyday lifters can apply to improve training safety, without compromising results.

RESISTANCE TRAINING SAFETY – SEPARATING DATA FROM DOGMA

Numerous epidemiological studies and systematic reviews consistently show that resistance training—particularly in general fitness and supervised settings—is among the safest forms of physical activity, with injury rates far lower than those seen in most recreational and competitive sports (7,8).

For example, resistance training injuries are estimated at just 0.24 – 1 injury per 1,000 training hr, whereas running can be 2 – 10 times higher (9,13,14). When considering team sports, like football or soccer, the injury rates can be as high as 6 – 10 injuries per 1,000 hr (9).

However, the aforementioned data only tells half the story. The real question is not whether resistance training is safer than field, court, or combat sports, it is which forms of resistance training pose greater or lesser risk to general training clients? Without investigation into this question, any assertions, statements, or discussions about the safety of resistance training lack contextual validity. This is because as the following evidence will show, not all strength training methods are equally safe because context, loading, and exercise selection all affect injury risk.

COMPARING INJURY RISK ACROSS RESISTANCE TRAINING MODALITIES

A 2023 systematic review sought to verify which forms of resistance training are safest in terms of injury prevalence and incidence (11). For this systemic review, the participants were, on average, about 29 years old (± 6 years), and their average weekly training was 2 – 6.10 workouts per week (11).

Here is a summary of the injury rates found, in order from the modalities with the most to least injury prevalence (11):

- **Strongman:** The average prevalence of injuries was 82% and the average incidence ratio of 5.5 injuries per 1,000 hr of training
- **Powerlifting:** The average prevalence of injuries was 56.6% and the average incidence ratio of 4 injuries per 1,000 hr of training
- **Olympic-Style Weightlifting:** The average prevalence of injuries was 46.2% and the average incidence ratio of 3.2 injuries per 1,000 hr of training
- **Strength Training:** The average prevalence of injuries was 12.6%, but studies did not show and the average incidence ratio of training

In short, this systematic review showed that traditional strength training is the safest resistance training method generally, and Strongman is the least safe regarding injuries (11). However, since only one study was found on Strongman training, it is more difficult to consider the above results on Strongman training as accurate as the rest of the data on the other modalities (15). Therefore, one could argue that this systematic review showd that powerlifting is the least safe regarding injuries, of the viable options presented.

Another study found similar results, which are listed in order from the modalities with the most to least injury prevalence (9):

- **Highland Games:** Averaged 7.5/1,000 injuries per 1,000 hr of training
- **Strongman:** Averaged 4.5 – 6.1 injuries per 1,000 hr of training
- **Olympic-Style Weightlifting:** Averaged 2.4 – 3.3 injuries per 1,000 hr of training
- **Powerlifting:** Averaged 1.0 – 5.8 injuries per 1,000 hr of training
- **Bodybuilding:** Averaged 0.24 – 1.0 injuries per 1,000 hr of training

And, other research also had similar findings (1):

- **Olympic-Style Weightlifting:** Average incidence ratio of 2.4 – 3.3 injuries per 1,000 hr of training
- **Powerlifting:** Average incidence ratio of 1.0 – 4.4 injuries per 1,000 hr of training

RISK VS. RISKY

To be clear, there is a difference between something carrying greater risk relative to something else, and something being "risky," as in dangerous, in general. For the results of these studies, powerlifting had a low incidence of injury, very similar to Olympic-style weightlifting (1,9,11,15). With that being said, the following is a rough mapping of those data-to-risk categories (4,5,6,10,12,13):

- Very low risk (< ~1/1,000 hr)
- Low to moderate risk (~1 – 5/1,000 hr)
- Moderate to high risk (~5 – 10/1,000 hr)
- High risk (> ~10/1,000 hr)

It is important to note that no single study formally defines these injury-risk categories as fixed thresholds. Instead, the above categories were developed by the author from reviewing reported injury rates (per 1,000 hr of exposure) across different sports and training activities. When these data are compared, natural groupings become apparent. The proposed categories are therefore intended as a practical framework for comparing relative risks across activities. Based on comparative epidemiological data across multiple modalities, activities resulting in fewer than approximately two injuries per 1,000 hr are generally classified as low risk, 2 – 5 injuries per 1,000 hr as moderate risk, and consistent rates exceeding 5 – 10 injuries per 1,000 hr as high-risk exposures (4,5,6,10,12,13). These thresholds reflect the relative frequency of time-loss or medically attended injuries, rather than an inherent danger of the activity itself.

THE SAFETY HIERARCHY OF RESISTANCE TRAINING MODALITIES

Taken collectively, these findings indicate that traditional strength training and bodybuilding-type resistance exercise are generally the safest forms of resistance training, while Strongman and Highland Games disciplines exhibit the highest injury risk. When considering both incidence and prevalence data, the relative safety order of modalities can be represented as:

1. Bodybuilding / traditional strength training (very low risk)
2. Olympic-style weightlifting (low to moderate risk)
3. Powerlifting (low to moderate risk)
4. Strongman (moderate to high risk)
5. Highland Games (moderate to high risk)

This ranking reflects both injury frequency and the strength of available evidence, with the caveat that limited research on niche modalities (e.g., Strongman, Highland Games) constrains definitive comparisons. Based on the available epidemiological evidence, the estimated hierarchy of injury risk across resistance training modalities can be summarized as follows (1,9,11):

1. **Bodybuilding/Traditional Strength Training**

   Injury incidence: ~0.24 – 1.0 injuries per 1,000 training hr

   Injury prevalence: ~12.6%

   Summary: Consistently shown to have the lowest injury rates among resistance training forms, likely due to the use of controlled loading, machine-based or moderate free-weight exercises, and the absence of maximal-effort lifts.

2. **Olympic-Style Weightlifting**

   Injury incidence: ~2.4 – 3.3 injuries per 1,000 hr

   Injury prevalence: ~46%

   Summary: Although highly technical, Olympic-style weightlifting exhibits relatively low injury incidence when performed under structured supervision and periodized programming.

3. **Powerlifting**

   Injury incidence: ~1.0 – 5.8 injuries per 1,000 hr

   Injury prevalence: ~56.6%

   Summary: Risk increases with high-load training near maximal effort. Common injury sites include the shoulder, lower back, and knee.

4. **Strongman Training**

   Injury incidence: ~4.5 – 6.1 injuries per 1,000 hr

   Injury prevalence: ~82%

   Summary: Demonstrates the highest injury prevalence among studied modalities. However, conclusions should be drawn cautiously, as only a limited number of studies exist and sample sizes are small.

5. **Highland Games**

   Injury incidence: ~7.5 injuries per 1,000 hr

   Summary: Although fewer data exist, Highland Games events appear to have the highest injury rate among strength-based sports.

ADDRESSING COMMON QUESTIONS AND CONCERNS ABOUT INJURY DATA RELIABILITY

While injury incidence estimates help contextualize the relative safety of different resistance training modalities, before drawing firm conclusions, it is essential to acknowledge and critically examine the most common and reasonable concerns regarding the accuracy and reliability of these data.

1. INCONSISTENT INJURY DEFINITIONS BETWEEN STUDIES

It is true that studies do not always use the exact same definition of what is considered an "injury" (3). For instance, research showing higher prevalence often defines an injury as any pain or loss of function that causes a change in training or a reduction in

performance (2,13). Other studies report lower rates because they use looser criteria or do not explicitly define "injury" at all (9).

At first glance, that might sound like a serious limitation. But if this lack of a uniform definition were truly skewing the data, we would expect to see wildly different injury rates between studies examining the same modality. In reality, that is not what we see. The injury incidence and prevalence rates reported across multiple studies on Olympic-style weightlifting and powerlifting are remarkably consistent, and align closely with previous findings (2,6,9,14).

It is worth noting that while not every research study spells it out, most researchers in this area are most likely operating within the well-established sports medicine definition of injury—an event causing pain or loss of function that leads to restricted participation or performance and can lead the athlete to seek medical treatment (10,13). In other words, even when not explicitly stated, the working definitions used across studies are generally similar enough to make the aggregated findings reliable and comparable.

2. SELECTION BIAS IN INJURY REPORTING

In their systematic review, Keogh and Winwood noted that survey-based studies on injury prevalence in resistance training "may be affected by selection bias, as individuals who have sustained injuries could be more inclined to participate, potentially inflating reported injury rates," (9).

While this limitation is important to recognize, it does not necessarily undermine comparisons across resistance training modalities. This is because the same methodological bias is present in nearly all self-reported datasets for each modality. Therefore, the relative differences in injury prevalence remain meaningful.

In other words, even if absolute injury rates are somewhat overestimated, the relative differences between modalities remain meaningful. In that, if one form of training consistently attracts higher reports of injury despite identical methodological limitations, it still provides a valid indication that this modality carries greater real-world injury risk.

3. PREVIOUS INJURY

It is well established that the strongest predictor of a future injury is a history of a previous one (3). For example, athletes with previous shoulder injuries are eight times more likely to injure the area compared to athletes with healthy shoulders (2).

The role of increased injury risk from previous injury is consistent across nearly all forms of physical activity and sport. Therefore, many of the injuries captured in resistance training research likely involve participants who had prior injuries.

However, this does not invalidate modality comparisons because this factor applies equally across all resistance training modalities. Whether someone participates in bodybuilding, powerlifting, or Olympic-style weightlifting, previous injury history is part of the human condition, not a bias specific to one modality. As such, while it may raise the overall injury rates across all groups, it does not systematically distort comparisons between modalities.

Moreover, most large-scale analyses and reviews include enough participants and studies that these individual variations average out. When multiple studies are considered together, the sample size becomes large enough to provide a more stable and reliable estimate of injury risk—even when some participants have a history of prior injuries (2,9). In practical terms, this means that although prior injury influences individual risk, it does not undermine the broader conclusion; across diverse populations, study designs, and geographic regions, resistance training modalities show consistent patterns in relative injury rates.

4. INFLUENCE OF SEX AND AGE ON INJURY RISK

It is important to note that most studies did not find an association between the practitioner's sex and the occurrence of injuries (11). Across the available research, there is little evidence to suggest that men and women differ meaningfully in their overall risk of injury from resistance training. Keogh and Winwood concluded that injury rates and anatomical sites were broadly similar between sexes across strength sports, with observed differences reflecting participation patterns more than biological susceptibility (9). Prospective studies in powerlifting likewise found nearly identical injury incidences per 1,000 training hr between men and women (1).

With regards to age, most research in this area includes adults in their mid-30s to early 40s, with relatively balanced male-to-female participation depending on the modality. Age appears to matter slightly more than sex—but again, only in magnitude, not direction. In Strongman athletes, for example, those aged ≤ 30 years showed a somewhat higher injury rate (0.5 ± 0.8 injuries per athlete per year) compared to athletes over 30 (0.3 ± 0.6) (15).

Younger participants likely train more aggressively or take more risks, whereas older lifters may train more conservatively. Still, these within-modality differences do not overturn the consistent finding that heavy, competitive barbell sports generally show higher injury rates than general resistance training or bodybuilding.

Finally, when large-scale reviews combine data across many studies and populations, any small demographic effects tend to average out. Keogh and Winwood concluded that age, sex, and competitive level are "intrinsic factors that may have only a relatively minor influence on the injury epidemiology of the weight-training sports," (9). In other words, these are background variables worth noting—but they do not change the overall landscape of relative risk between modalities.

5. VARIATION IN COACHING QUALITY AND PROGRAMMING

Another valid argument is that injury rates might reflect the quality of coaching or program design rather than the inherent risk of a training modality itself. That is absolutely true—there are

good and bad coaches and well-structured and poorly structured programs in every field.

However, aggregated injury data still have value because they reflect real-world practice, not idealized conditions. In other words, the data capture how people actually train within those modalities, not just how they could train if everything were perfect. For practical risk assessment, this "ecological validity" makes such data meaningful: it shows the injury rates typically experienced, given the average coaching standards and training environments those modalities tend to involve.

With this reality in mind, this article provides practical injury risk mitigation suggestions that can be utilized by personal trainers and coaches in order to minimize potential training-related injury risk.

6. DIFFERENT EXPERIENCE LEVELS

Beginners often experience higher rates of injury than trained individuals, regardless of modality. Studies that include mixed experience levels will therefore report higher overall rates. This again highlights why contextual interpretation—rather than raw comparison—is essential.

7. COMPETITORS VS. NON-COMPETITORS: DOES COMPETITION STATUS DRIVE INJURY RISK?

A common question is whether the higher injury rates observed in some resistance training modalities are simply due to the inclusion of competitive athletes—who tend to train harder, heavier, and more frequently—compared to general participants. It is a fair question, but the available evidence suggests that injury rates are not systematically higher in competitive athletes compared with non-competitive participants within the same modality.

8. EXPOSURE MEASUREMENT DIFFERENCES

Injury incidence in resistance training studies is typically expressed as the number of injuries per 1,000 hr of participation. However, the way these "exposure hours" are determined can vary considerably between studies. Some researchers estimate total training exposure based on participants' self-reported weekly training frequency and average session duration, while others directly record or prospectively track actual session lengths.

These methodological differences can slightly alter the absolute injury incidence figures—particularly if one study's sample trains more frequently, longer per session, or includes higher training volumes than another. Nevertheless, such inconsistencies rarely affect the relative ranking of injury risk between modalities. This is because whether exposure is estimated or directly measured, the same trend consistently emerges.

For this reason, while absolute injury rates should be interpreted cautiously, the comparative hierarchy across training types remains a reliable reflection of real-world injury risk patterns.

SAFE AND EFFECTIVE TRAINING FOR THE GENERAL FITNESS CLIENT

Now that it is clear that there is variability, bias, and inconsistency in the data, when viewed collectively, these studies still offer a useful map of relative risk. No single number is definitive—but the consistent trend that heavy, competitive barbell sport-based training report higher injury rates than general resistance training or bodybuilding remains robust across methodologies and populations.

With this reality in mind, not every client needs to engage in Olympic-style weightlifting, Strongman training, or extreme conditioning programs to achieve meaningful results. For individuals whose primary goal is general fitness and longevity, the research suggests that general resistance training and bodybuilding-style programs are highly effective while carrying a relatively low injury risk (1,2,3,7,9,11,15).

PRACTICAL RECOMMENDATIONS FOR GENERAL FITNESS

For training a client for general fitness, the author suggests the following practical recommendations:

FOCUS ON EVIDENCE-BASED, LOW-RISK MODALITIES

- Bodybuilding-style training:
  - » Moderate-to-high repetitions (8 – 15 repetitions) with controlled tempo
  - » Emphasize joint-friendly isolation and compound movements
  - » Allow progressive overload with minimal technical complexity, reducing risk of acute injury
- General strength training:
  - » Compound lifts (e.g., squat, hinge, push, pull, carry) performed with proper form
  - » Moderate loads (60 – 80% of one-repetition maximum [1RM]) and controlled progression
  - » Prioritize functional strength gains without extreme loading

PROGRAMMING PRINCIPLES FOR MAXIMUM SAFETY

1. Consistency over novelty: Stick with exercises that clients can perform safely and confidently.
2. Progressive overload: Gradually increase weight, repetitions, or volume to stimulate strength and hypertrophy adaptations without overloading tissues suddenly.
3. Recovery management: Include rest days and avoid excessive high-intensity sessions back-to-back.
4. Monitoring pain or discomfort: Adjust exercises if clients experience persistent joint or muscle pain.

OPTIONAL VARIABILITY

- Personal trainers can incorporate occasional higher-risk movements (e.g., kettlebell swings, medicine ball throws) at low intensity if desired for variety and engagement—but it is not always necessary for results.
- The core program can remain fully effective using the safe, evidence-based modalities described above.

WHY THIS APPROACH WORKS

- High efficacy: These modalities provide excellent strength, hypertrophy, and fitness adaptations.
- Low technical demand: Clients do not need to master complex Olympic-style lifts or heavy maximal lifts to see results.
- Minimal risk: Injury rates in general strength and bodybuilding-style training are among the lowest in resistance modalities, making them ideal for clients who prioritize long-term health.

GENERAL PROGRAM DESIGN AND COACHING STRATEGIES FOR MINIMIZING INJURY RISK

The injury data summarized above show that while some resistance training modalities carry relatively higher risk (e.g., Olympic-style weightlifting, Strongman-style training), no modality is inherently "dangerous" if approached correctly. The goal for personal trainers is to provide safe, effective, and engaging programming that appropriately challenges clients without unnecessarily increasing injury risk. The author suggests the following practical recommendations:

START WITH THE FUNDAMENTALS

- Achieve competency in the basics first: Prioritize foundational movement patterns (e.g., squat, hinge, push, pull, carry) with proper technique and controlled loads.
- Progress gradually: Increase volume, intensity, or complexity slowly to allow clients' joints, muscles, and connective tissues to adapt.
- Individualize programming: Consider age, sex, previous injuries, mobility, and training experience to tailor exercise selection and load.

MITIGATE RISK IN HIGHER-RISK MODALITIES

For modalities with higher potential injury rates (e.g., Olympic-style weightlifting, Strongman, heavy powerlifting):

1. Olympic Weightlifting/Advanced Barbell Movements
    - » Start with lighter loads or variations (e.g., hang cleans, dumbbell snatch, or trap bar exercises) to teach technique.
    - » Use progressions (e.g., teach pulling and catching mechanics separately before integrating full lifts).
    - » Keep sessions shorter, and monitor fatigue closely, since technical breakdown often drives injury.
2. Strongman/Loaded Carrying/High-Intensity Power Training
    - » Limit heavy maximal lifts initially and focus on unilateral or bilateral functional lifts with moderate loads.
    - » Introduce carries, pushes, and pulls gradually, emphasizing correct posture and core stability.
    - » Use proper equipment and footwear to reduce slips, falls, or joint stress.
3. High-Intensity Functional Training (HIFT)
    - » Emphasize scaled versions for clients with limited experience.
    - » Prioritize technique over speed—especially in Olympic-style lifts, rope climbs, or plyometrics.
    - » Incorporate rest intervals and monitor cumulative fatigue.

GENERAL COACHING PRINCIPLES

- Supervision and cueing: Close supervision and high-quality coaching reduce risk significantly, especially when introducing complex movements.
- Warm-up and mobility work: Incorporate dynamic warm-ups and mobility drills specific to the planned session.
- Variation and recovery: Rotate modalities, load types, and intensity to prevent overuse injuries while keeping programming engaging.
- Feedback loop: Encourage clients to report pain or discomfort and adjust programming promptly.

BALANCE CHALLENGE WITH SAFETY

Clients do not need to avoid higher-risk modalities entirely to build strength, power, and fitness. The key is smart integration:

- Use higher-risk exercises sparingly and only when the client is ready technically and physically.
- Combine these exercises with lower-risk, high-volume work (e.g., general strength training and bodybuilding-style movements) to maintain overall training stimulus.
- Focus on quality over quantity—maintaining proper technique consistently is more effective and safer than chasing heavier loads or faster repetitions.

THE BOTTOM LINE

For clients who want results without unnecessary risk, sticking primarily to general strength training and bodybuilding-style training provides a safe, efficient, and effective pathway. There is no need to pursue higher-risk modalities unless desired for variety, sport-specific goals, or personal interest.

Safety and effectiveness in resistance training are less about avoiding certain modalities and more about progression, technique, individualization, and coaching oversight. Personal trainers can incorporate challenging, engaging exercises from

all modalities while keeping injury risk manageable by using the strategies provided in this article.

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