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GLP-1 Receptor Agonists in Recreational Athletes: Emerging Weight-Reduction Strategy or Potential Health Risk? A Review of Current Evidence

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Abstract

Background: Glucagon-like peptide-1 receptor agonists (GLP-1 RAs) are effective pharmacological agents for obesity treatment and are increasingly used beyond clinical indications. Their growing popularity among recreational athletes seeking rapid fat loss raises concerns regarding potential effects on muscle mass, exercise capacity, and overall health.

Aim: This review summarizes current evidence on the metabolic, musculoskeletal, and performance-related effects of GLP-1 receptor agonists in recreationally active individuals.

Material and Methods: A narrative review of PubMed-indexed studies published between 2015 and 2026 was conducted. Randomized controlled trials, meta-analyses, and experimental studies evaluating GLP-1 RAs in relation to body composition, skeletal muscle outcomes, metabolic adaptation, exercise tolerance, and safety were included. English-language full-text articles were analyzed.

Results: GLP-1 receptor agonists consistently induce significant weight reduction, primarily through fat mass loss, although decreases in lean body mass are also reported. Improvements in insulin sensitivity and cardiometabolic markers may support exercise tolerance. However, concerns include potential muscle mass reduction, inadequate energy availability, gastrointestinal adverse effects, and limited data on strength, recovery, and long-term performance adaptation in recreational athletes.

Conclusions: GLP-1 receptor agonists are effective for weight reduction, but their use in recreational sport requires caution. Potential metabolic benefits should be balanced against risks related to muscle preservation and exercise capacity. Sport-specific longitudinal studies are needed to clarify safety and performance implications.

Keywords:

GLP-1 receptor agonists; recreational athletes; body composition; exercise performance; resistance training; weight loss; skeletal muscle

1. Introduction

The increasing prevalence of overweight and obesity has intensified interest in pharmacological weight-reduction strategies, including glucagon-like peptide-1 receptor agonists (GLP-1 RAs) [1, 2, 3, 4]. Originally developed for type 2 diabetes treatment, agents such as semaglutide, liraglutide, and dulaglutide have demonstrated substantial and sustained body-weight reduction in randomized controlled trials [1, 2, 3, 4, 5, 6].

At the same time, the growing popularity of recreational sport, fitness culture, and physique-oriented training has increased interest in rapid body composition modification strategies, including pharmacological approaches.

Beyond clinical populations, these medications are increasingly used by recreationally active individuals seeking rapid fat loss and improved physique. Unlike elite athletes, who typically have access to medical supervision, structured nutritional planning, and performance monitoring, recreational athletes often train without professional oversight. Consequently, pharmacologically induced weight loss in this group may involve specific risks related to inadequate energy intake, impaired recovery, and unintended alterations in body composition.

GLP-1 RAs promote weight loss primarily through appetite suppression, delayed gastric emptying, and improved insulin sensitivity [2, 5, 7]. While these mechanisms are advantageous in individuals with obesity, they may have different implications in physically active populations. Clinical trials indicate that although fat mass accounts for most weight

reduction, decreases in lean body mass are consistently reported [6, 8, 9, 10]. Even moderate muscle loss may be relevant in active individuals, given the importance of skeletal muscle for strength, metabolic stability, and injury prevention.

Importantly, most available evidence concerns patients with obesity or metabolic disease and focuses on cardiometabolic outcomes [1, 2, 3, 4]. Data assessing the effects of GLP-1 receptor agonists on exercise capacity, strength development, muscle adaptation, and recovery in recreational athletes remain limited. It therefore remains unclear whether the metabolic benefits observed in clinical settings translate into neutral, beneficial, or potentially adverse effects in sport-oriented contexts.

In response to this gap, the present review critically evaluates current evidence regarding the metabolic, musculoskeletal, and performance-related effects of GLP-1 receptor agonists, with particular emphasis on their relevance and safety in recreationally active individuals.

2. Materials and Methods

This study was conducted as a narrative review of the scientific literature addressing the metabolic, musculoskeletal, and performance-related effects of glucagon-like peptide-1 receptor agonists (GLP-1 RAs), with particular emphasis on their relevance to recreationally active individuals.

A structured literature search was performed using the PubMed/MEDLINE database for articles published between January 2015 and February 2026. The search strategy included combinations of the following keywords: “GLP-1 receptor agonists,” “semaglutide,” “liraglutide,” “body composition,” “lean mass,” “skeletal muscle,” “exercise performance,” “resistance training,” “aerobic capacity,” “energy availability,” and “RED-S.”

Eligible studies included randomized controlled trials, systematic reviews, meta-analyses, and original human studies published in English. Experimental studies were included when relevant to mechanistic interpretation. Studies exclusively focusing on pediatric populations or unrelated endocrine disorders were excluded.

Titles and abstracts were screened for relevance, followed by full-text assessment. Due to heterogeneity in study populations, interventions, and outcome measures, findings were synthesized narratively rather than quantitatively.

3. Mechanisms of Action Relevant to Exercise Physiology

GLP-1 receptors are expressed in pancreatic β-cells, central appetite-regulating centers, cardiovascular tissue, and potentially skeletal muscle [7, 11]. Their activation enhances glucose-dependent insulin secretion, suppresses glucagon release, delays gastric emptying, and increases satiety [2, 7, 12]. These mechanisms collectively contribute to reduced energy intake and clinically meaningful weight loss.

Importantly, weight reduction induced by GLP-1 receptor agonists results primarily from decreased caloric intake rather than increased energy expenditure [5, 13]. In recreational athletes, this distinction is physiologically relevant, as spontaneous reductions in energy intake may occur without corresponding adjustments in training load. While improved glycemic control and insulin sensitivity may enhance metabolic flexibility and substrate utilization during exercise [3, 14], insufficient caloric intake can negatively affect recovery, glycogen replenishment, and muscle protein synthesis.

GLP-1 receptor agonists have also been shown to reduce systemic inflammation and improve endothelial function [15, 16, 17]. In theory, these effects may support cardiovascular efficiency and overall metabolic health, particularly in individuals with excess adiposity. However, the translation of these cardiometabolic benefits into measurable improvements in strength, endurance performance, or training adaptation in recreational athletes has not been clearly established.

A key concern is appetite suppression in the context of regular physical training. When combined with increased energy expenditure from exercise, reduced energy intake may predispose individuals to low energy availability, a recognized risk factor for hormonal disturbances, impaired bone health, decreased muscle mass, and suboptimal performance adaptation [18]. Recreational athletes, who often lack structured dietary supervision, may be particularly vulnerable to this imbalance.

Therefore, while the mechanisms of GLP-1 receptor agonists offer metabolic advantages in clinical populations, their physiological implications in sport settings require careful consideration, particularly regarding energy balance, muscle preservation, and recovery capacity.

4. Effects on Body Composition and Skeletal Muscle

Large randomized trials demonstrate that GLP-1 RAs induce clinically meaningful weight loss, with fat mass constituting the majority of total mass reduction [1, 4, 6]. The STEP trials evaluating semaglutide reported average weight reductions of 10–15% over 68 weeks [1, 6].

Body composition analyses reveal that approximately 20–40% of total weight loss may derive from lean mass reduction [6, 8, 19]. Although relative muscle preservation is generally acceptable compared with caloric restriction alone [20], reductions in absolute lean mass raise concerns in physically active individuals.

Experimental studies suggest GLP-1 signaling may influence mitochondrial function and reduce intramuscular fat infiltration [21, 22]. Some data indicate improvements in muscle "quality" despite reduced total mass [22, 23]. However, direct human studies assessing strength, power, or recovery in recreational athletes remain scarce [9, 24].

In populations with obesity, improved mobility and functional capacity following weight reduction have been observed [25, 26], but extrapolation to normal-weight recreational athletes is inappropriate.

5. Metabolic Adaptation and Exercise Capacity

GLP-1 receptor agonists (GLP-1 RAs) consistently improve insulin sensitivity, lipid profiles, blood pressure, and systemic inflammatory markers [3, 15, 27]. In individuals with obesity or cardiometabolic disease, these effects may enhance metabolic flexibility and improve peripheral glucose utilization, theoretically supporting aerobic capacity and overall exercise tolerance.

Indeed, clinical studies in patients with heart failure or metabolic disorders report modest improvements in VO_2peak and functional capacity following GLP-1 RA treatment [28, 29]. However, these benefits are observed primarily in metabolically impaired populations. In recreational athletes with normal baseline cardiometabolic function, the magnitude and relevance of such improvements remain uncertain. It is unclear whether enhanced insulin sensitivity translates into measurable performance gains in already healthy, trained individuals.

An important consideration is the interaction between pharmacologically induced appetite suppression and exercise-induced energy expenditure. GLP-1 RAs reduce spontaneous caloric intake [5, 13], which may create a persistent energy deficit if not carefully managed. In recreational athletes maintaining regular training loads, chronic low energy availability may impair glycogen restoration, reduce training quality, and attenuate anabolic signaling necessary for adaptation.

Gastrointestinal adverse effects—including nausea, early satiety, and delayed gastric emptying—may further complicate peri-exercise nutrition strategies [2, 30]. Delayed gastric emptying can impair pre-training carbohydrate intake and fluid tolerance, potentially compromising high-intensity or endurance performance [31]. Additionally, inadequate carbohydrate availability may increase reliance on fat oxidation at the expense of high-power output, which could be detrimental in sports requiring repeated high-intensity efforts.

Thus, while GLP-1 RAs may improve cardiometabolic health in clinical populations, their impact on metabolic adaptation and exercise capacity in recreational athletes appears context-dependent. Without structured nutritional monitoring, potential metabolic benefits may be offset by insufficient energy intake and suboptimal recovery.

6. Safety Considerations in Recreational Sport

Common adverse effects include nausea, vomiting, diarrhea, and constipation [2, 30]. Rare but serious risks include pancreatitis and gallbladder disease [32].

Rapid weight loss combined with insufficient protein intake may accelerate lean mass decline [8, 19]. In athletes with high training frequency, this could compromise recovery, increase injury risk, and impair strength adaptation [24, 33].

Low energy availability is associated with endocrine disturbances, decreased bone mineral density, and impaired immune function [18, 34]. Recreational athletes using GLP-1 RAs without medical supervision may be particularly vulnerable.

Currently, GLP-1 receptor agonists are not prohibited by the World Anti-Doping Agency, but their growing non-medical use in sport raises ethical and regulatory considerations.

7. Discussion

GLP-1 receptor agonists represent highly effective pharmacological tools for obesity treatment [1, 2, 3, 4]. In recreational athletes with overweight or metabolic dysfunction, medically supervised therapy may improve cardiometabolic health, reduce systemic inflammation, and enhance functional capacity [25, 28]. In such cases, weight reduction combined with structured resistance and endurance training may contribute to improved movement efficiency and overall exercise tolerance.

However, in normal-weight or physique-oriented individuals, the risk–benefit ratio appears less favorable. Pharmacologically induced appetite suppression may lead to insufficient total energy and protein intake, particularly in individuals maintaining regular resistance exercise training (RET). Given that muscle protein synthesis and hypertrophic adaptation depend on adequate protein availability and a positive net protein balance, chronic energy deficit may attenuate anabolic signaling pathways and limit strength and muscle gains.

Evidence from resistance training literature indicates that sufficient daily protein intake and appropriate nutrient timing are essential to preserve lean mass during weight reduction [24, 33]. In the context of GLP-1 RA use, spontaneous reductions in appetite may hinder achievement of recommended protein targets, potentially accelerating lean mass decline observed in clinical trials [8, 19]. This interaction is especially relevant for recreational athletes seeking both fat loss and muscle preservation.

Furthermore, chronic low energy availability may impair recovery kinetics, reduce training quality, and disrupt endocrine balance [18, 34]. Over time, this may increase the risk of overuse injuries and suboptimal adaptation to RET. While some metabolic benefits of GLP-1 RAs could theoretically support substrate utilization, there is currently no direct evidence that these agents enhance muscle hypertrophy, power development, or performance adaptation in physically active populations.

Importantly, existing literature predominantly focuses on individuals with obesity or diabetes. Longitudinal sport-specific studies evaluating interactions between GLP-1 RA therapy, protein intake, resistance training adaptations, and body composition changes in recreational athletes are lacking [9, 24]. Without such data, conclusions regarding performance neutrality or potential impairment remain speculative.

Overall, the integration of GLP-1 RA therapy with structured resistance training and adequate protein intake may mitigate some risks related to lean mass loss; however, this approach requires careful nutritional planning and medical supervision. Until robust sport-specific evidence becomes available, caution is warranted when considering GLP-1 receptor agonists for non-clinical, physique-oriented purposes.

8. Conclusions

GLP-1 receptor agonists are effective agents for body weight reduction and cardiometabolic improvement. In recreational athletes with overweight or metabolic dysfunction, supervised therapy may provide health-related benefits, particularly when combined with structured exercise.

However, in physically active individuals without clear medical indications, the potential advantages of fat mass reduction must be carefully weighed against risks related to lean mass preservation, chronic low energy availability, impaired recovery, and uncertain long-term effects on performance adaptation. Appetite suppression and reduced spontaneous caloric intake may compromise the ability to meet protein and energy requirements necessary for optimal resistance training responses.

Until sport-specific longitudinal data become available, the use of GLP-1 receptor agonists in recreational sport should be individualized, medically supervised, and integrated with adequate nutritional planning—particularly sufficient protein intake—and structured resistance training to mitigate potential muscle loss.

Future research should prioritize:

- Long-term randomized controlled trials in recreationally active populations;
- Direct assessment of strength, hypertrophy, and endurance performance outcomes;
- Evaluation of recovery kinetics, hormonal responses, and injury incidence;
- Development of nutritional strategies aimed at preserving lean mass during pharmacologically induced weight loss.

A clearer understanding of the interaction between GLP-1 receptor agonist therapy, exercise adaptation, and energy balance is essential before these agents can be considered performance-neutral or safe in non-clinical sport contexts.

Disclosure

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