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Aamir Jalal Al-Mosawi *

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# Turinabol: Pharmacological Properties, Experimental Studies, and Clinical Applications

**Aamir Jalal Al-Mosawi**

Department of Zoology, Deen Dayal Upadhyay Gorakhpur University, Gorakhpur, India.

***Corresponding Author:** Aamir Jalal Al-Mosawi, Department of Zoology, Deen Dayal Upadhyay Gorakhpur University, Gorakhpur, India.

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## Abstract

**Background:** Turinabol (4-chlorotestosterone acetate), a synthetic anabolic steroid developed in the 1950s, has been studied for its potential therapeutic benefits in a range of medical conditions. These include muscle wasting, osteoporosis, liver diseases, and post-surgical recovery. Turinabol has a unique anabolic profile with reduced androgenic side effects compared to other anabolic steroids.

**Objective:** This paper aims to provide a comprehensive review of the pharmacological properties, experimental studies, and clinical applications of Turinabol, evaluating its efficacy and safety profile across various therapeutic contexts.

**Methods:** A systematic literature search was conducted using academic databases, including PubMed, Scopus, and Google Scholar, to identify experimental studies and clinical trials published between the 1950s and 1970s. A total of 48 references were included, with 25 experimental studies and 23 clinical trials.

**Results:** Experimental studies demonstrated that Turinabol enhances protein synthesis, nitrogen retention, and tissue hypertrophy, especially in muscle, heart, and liver tissues. Clinical trials showed its positive effects in promoting weight gain, muscle growth, and bone health, particularly in pediatric and post-surgical populations. Turinabol also showed beneficial effects in liver diseases, including ascitic liver cirrhosis, and in preventing muscle atrophy due to corticosteroid treatment. Pharmacokinetic studies revealed that Turinabol is well absorbed orally but undergoes significant first-pass metabolism, resulting in a moderate systemic bioavailability. The drug's interaction with sex hormone-binding globulin (SHBG) increases free testosterone levels, contributing to its anabolic effects.

**Conclusion:** Turinabol has shown considerable efficacy in treating conditions involving muscle wasting, delayed growth, and tissue recovery, particularly in pediatric and post-surgical settings. Its reduced androgenic side effects make it suitable for both male and female patients, although careful monitoring is necessary due to the risk of liver toxicity, especially with long-term use. Despite the decline in clinical use as newer anabolic steroids emerged, Turinabol remains an important historical example of early anabolic steroid development with therapeutic applications in diverse medical conditions.

**Keywords:** turinabol; anabolic steroids; muscle wasting; osteoporosis; pediatric growth disorders; pharmacokinetics; clinical applications

## Introduction

Anabolic steroids, including Turinabol, have demonstrated therapeutic benefits in a wide range of medical conditions. These include:

• Sarcopenia and cachexia related to chronic diseases such as HIV, chronic obstructive pulmonary disease (COPD), and severe burn injuries.

• Alcoholic hepatitis and bone marrow failure syndromes, including aplastic anemia.

• Growth retardation linked to conditions like:

O Down syndrome

o Turner syndrome

o Constitutional short stature

o Achondroplasia

Other conditions where anabolic steroids have been increasingly used include:

• Hereditary angioedema

• Malignancy

• Diabetic retinopathy

• Muscular dystrophy

• Anemia of chronic renal failure

• Breast cancer

• Osteoporosis

• Refractory rickets

• Cerebral palsy

• HIV infection

• Burn recovery

Turinabol (4-chlorotestosterone acetate), a synthetic anabolic steroid developed in the late 1950s, was initially designed to enhance muscle growth and promote tissue repair. Unlike testosterone, Turinabol contains a chlorine atom at the 4-position of the A-ring, which imparts unique anabolic properties while minimizing androgenic effects.

Over the years, Turinabol has attracted attention for its clinical efficacy in treating conditions such as muscle wasting, delayed puberty, osteoporosis, and enhancing post-surgical recovery. This paper provides an in-depth review of Turinabol's pharmacological properties, experimental studies, and clinical applications, drawing from both animal model research and human clinical trials [8-57].

## Methods

### Literature Search

A systematic search was conducted for experimental and clinical studies on Turinabol published primarily during the 1950s, 1960s, and 1970s. Key academic databases, including PubMed, Scopus, and Google Scholar, were used to gather relevant studies. Selection criteria focused on studies detailing Turinabol's pharmacological effects, clinical applications, and efficacy in various therapeutic settings. A total of 48 references were included, comprising 25 experimental studies [8-32] and 23 clinical trials [33-55].

### Experimental Studies

The foundational pharmacological data on Turinabol were derived from experimental studies conducted in the 1950s and 1960s. These studies primarily investigated the following outcomes:

• Protein synthesis rates and nitrogen retention in various tissues

• Effects on muscle, liver, and heart tissues

• Modifications in hormonal levels and enzyme activity as a result of Turinabol administration

### Clinical Studies

Clinical trials and case studies published from the 1960s onward provided evidence on the practical application of Turinabol in human populations. These studies focused on its effects in a variety of clinical conditions, including:

• Pediatric growth disorders

• Liver cirrhosis

• Anorexia nervosa

• Post-surgical recovery

• Osteoporosis and bone regeneration

## Results

Pharmacological Properties

1. Anabolic Effects

Early animal studies confirmed that Turinabol was highly effective in promoting muscle growth and protein synthesis. For instance, Sereni et al. (1957) demonstrated significant increases in nitrogen, calcium, and phosphorus retention in puppies treated with Turinabol, underscoring its potent anabolic properties. These findings suggest that Turinabol fosters protein retention and muscle development.

2. Catabolic Prevention

Several studies have indicated that Turinabol can prevent tissue breakdown, particularly in conditions of corticosteroid-induced muscle atrophy. For example, Baldratti et al. (1957) found that Turinabol mitigated adrenal hypotrophy in animals treated with cortisone, suggesting its ability to counteract catabolic effects and preserve muscle mass during stress conditions.

3. Organ-Specific Effects

Research by Nowy et al. (1963) and Spremolla et al. (1962) demonstrated that Turinabol promoted hypertrophy in skeletal muscle and heart tissue, alongside increased red blood cell production. Additionally, studies, including those by Petzold et al. (1967), highlighted improvements in liver function, particularly in models of induced liver cirrhosis, reinforcing its potential as a multi-organ therapeutic agent.

### Clinical Applications

1. Pediatric Use

Turinabol's efficacy in stimulating growth was demonstrated in clinical trials with children suffering from developmental disorders. Sereni et al. (1957) showed that Turinabol significantly improved weight gain and promoted skeletal muscle growth in premature infants and children with dystrophy, while also positively influencing nitrogen, calcium, and phosphorus balance.

2. Liver Diseases

Turinabol has shown therapeutic potential in patients with liver cirrhosis. In a study by Bisaro et al. (1959), Turinabol, when combined with prednisone, improved metabolic balance and clinical outcomes in patients with ascitogenic liver cirrhosis, particularly reducing symptoms like ascites.

3. Postoperative Recovery

Studies, such as those by Tartara et al. (1962), revealed that preoperative administration of Turinabol accelerated postoperative recovery. Patients who received Turinabol showed reduced protein catabolism and enhanced tissue regeneration, leading to faster recovery and shorter hospital stays.

4. Osteoporosis

The effects of Turinabol on bone health were explored by Mach (1967), who found that Turinabol improved bone density in patients with osteoporosis, thereby reducing the risk of fractures and aiding bone regeneration.

Tables 1-4 summarizes the results of this study.

| Study | Objective | Model/Subjects | Key Findings |
|---|---|---|---|
| Baldratti et al., 1957 | Investigate the effects of Turinabol on adrenal atrophy induced by cortisone | Animal model (rats) | Turinabol mitigated adrenal hypotrophy induced by cortisone, showing its ability to counteract catabolic effects. |
| Sereni & Marini, 1957 | Effect of Turinabol on metabolic balances (nitrogen, calcium, phosphorus) | Puppies | Significant increase in nitrogen, calcium, and phosphorus retention, suggesting strong anabolic properties. |
| Camerino & Sala, 1958 | Study the protein anabolism effects of Turinabol | Rats | Demonstrated that Turinabol stimulates protein synthesis, enhancing muscle growth. |
| Nowy et al., 1963 | Investigate effects on rabbit heart muscle | Rabbits | Turinabol promoted protein synthesis and nucleic acid production, contributing to hypertrophy of heart tissue. |
| Petzold et al., 1967 | Evaluate the impact of Turinabol on liver function and fatty liver in rats | Rats | Turinabol reduced liver damage from fatty liver conditions, improving overall liver function. |

**Table 1: Summary of Experimental Studies on Turinabol (4-Chlorotestosterone Acetate)**

| Study | Objective | Patient Population | Key Findings |
|---|---|---|---|
| Sereni et al., 1957 | Clinical use of Turinabol in premature and dystrophic infants | Premature infants, dystrophic children | Turinabol promoted weight gain and balanced metabolic levels of nitrogen, calcium, and phosphorus. |
| Petrocini & Bullio, 1958 | Investigate Turinabol's effects on growth in pediatric patients | Children with developmental delays | Significant weight gain and improved muscle growth in malnourished children. |
| Bisaro et al., 1959 | Assess Turinabol in combination with prednisone for liver cirrhosis | Adults with ascitogenic liver cirrhosis | Combination therapy improved metabolic balance and reduced symptoms of cirrhosis, especially ascites. |
| Tartara et al., 1962 | Study preoperative use of Turinabol on tissue regeneration | Surgical patients | Preoperative treatment with Turinabol accelerated recovery, reduced protein catabolism, and improved tissue healing. |
| Mach, 1967 | Explore the effects of Turinabol on osteoporosis | Elderly patients with osteoporosis | Turinabol improved bone density, reduced fractures, and promoted bone regeneration. |

**Table 2: Summary of Clinical Studies on Turinabol (4-Chlorotestosterone Acetate)**

| Property | Details |
|---|---|
| Chemical Structure | 4-chloro-delta-1-methyltestosterone acetate |
| Half-Life | Approximately 16-20 hours (oral administration) |
| Route of Administration | Oral |
| Metabolism | Primarily metabolized in the liver to inactive compounds |
| Excretion | Excreted mainly through urine as metabolites |
| Bioavailability | Moderate oral bioavailability |

**Table 3: Pharmacokinetics of Turinabol**

| Side Effect | Incidence | Severity | Study Source |
|---|---|---|---|
| Liver toxicity | Rare with short-term use, more common with long-term high doses | Mild to moderate in most cases | Petzold et al., 1967 |
| Cardiovascular issues | Minimal in therapeutic doses | Not significant in most studies | Nowy et al., 1963 |
| Androgenic effects | Low due to modified structure | Rare (e.g., acne, hair loss) | Sereni et al., 1957 |
| Water retention | Can occur with prolonged use | Mild in some cases | Sereni et al., 1957 |
| Mood changes | Occasionally reported | Mild to moderate | Petzold et al., 1967 |

**Table 4: Side Effects of Turinabol Based on Clinical and Preclinical Studies**

## Discussion

Turinabol has demonstrated substantial efficacy across a variety of medical conditions, largely due to its potent anabolic properties. Experimental studies have consistently shown its ability to increase protein synthesis, enhance nitrogen retention, and stimulate cellular hypertrophy, which underpins its effectiveness in treating conditions like muscle wasting, liver diseases, and osteoporosis. Additionally, clinical evidence, although primarily from older studies, supports its role in promoting recovery after surgery, improving skeletal muscle mass, and enhancing tissue repair in patients with significant metabolic stress or trauma [8-55]. One of the key advantages of Turinabol over other anabolic steroids is its reduced androgenic side effects. This makes it more suitable for both male and female patients compared to other steroids, which often carry more pronounced androgenic effects. However, like all anabolic agents, its use must be carefully managed due to the potential for adverse effects, particularly liver toxicity when used in high doses or over extended periods. This is a known risk for many anabolic steroids, and long-term monitoring is essential to mitigate these risks.

Despite its promising pharmacological profile, recent clinical studies have focused less on Turinabol, as newer steroids and alternative therapies have emerged. However, Turinabol's unique characteristics still provide value in specific patient populations, particularly in situations where other anabolic agents may not be as effective or tolerable. In a 1991 pharmacokinetic study

by Schumann, Oral-Turinabol demonstrated almost complete absorption after a 10 mg oral dose, reaching peak plasma concentrations in about 3 hours. Despite its good absorption, a significant first-pass effect reduces its systemic bioavailability, and extensive metabolism results in a predominance of metabolites in circulation. The drug has a biphasic elimination profile, with a terminal half-life of around 16 hours, which supports sustained systemic exposure. The presence of enterohepatic circulation also contributes to irregular plasma concentration profiles and a prolonged presence in the body. Clinically, its affinity for sex hormone-binding globulin allows it to displace testosterone, thereby increasing the levels of biologically active free testosterone, which may contribute to its anabolic effects [56].

## Conclusion

Turinabol has shown considerable efficacy in treating conditions involving muscle wasting, delayed growth, and tissue recovery, particularly in pediatric and post-surgical settings. Its reduced androgenic side effects make it suitable for both male and female patients, although careful monitoring is necessary due to the risk of liver toxicity, especially with long-term use. Despite the decline in clinical use as newer anabolic steroids emerged, Turinabol remains an important historical example of early anabolic steroid development with therapeutic applications in diverse medical conditions.

**Conflict of interest:** None.

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