

## STUDY CONCERNING THE SAFETY OF GYM MACHINES AND EXERCISES: IDENTIFYING THE DANGERS OF THE EQUIPMENT IN PUBLIC GYMS

**Abstract:** Public gyms provide access to a variety of exercise machines designed to improve fitness, strength and endurance. However, improper use, poor machine design and lack of professional supervision can cause a significant number of injuries that add up to the yearly statistics. This study wishes to examine and highlight the safety of gym machines and exercises along with identifying the most dangerous equipment usually found in public fitness centers. Risks associated with equipment like smith machines, treadmill, pec deck and others will be analyzed to conclude with recommendations for safer alternatives injury prevention strategies to ensure gym safety.

**Keywords:** gym safety, workout injury prevention, exercise injuries, public gym hazards

### INTRODUCTION

Public gyms managed to provide in the last century individuals of all sorts with access to a variety of exercise equipment like exercise machines and free weights to support their passion for movement and their fitness goals.

According to fitness injury reports [1], in 2023 3.7 million people were admitted in emergency departments in order to be treated for injuries occurred during sports and usage of recreational equipment, the most common injuries being associated with exercise, cycling and basketball.

This study wishes to identify the most dangerous gym machines and exercises that can be found in public gyms by analyzing the injury risks and common patterns of misuse. The final purpose of this study is to cast light on the difficulties that public gym users face daily and provide a safer alternative of the exercising technique in order to help members of all levels to achieve their fitness goals and explore their hobby in a safer manner.

### 1. HIGH-RISK GYM MACHINES AND EXERCISES

#### 1.1. The Smith Machine

The smith machine is a complex gym machine, quite popular amongst gym users, thanks to the variety of exercises that can be executed on it.

As Figure 1 pictures, the smith machine is a barbell that is fixed on a guided vertical track.

Most used for deadlifts, squats, bench presses and shoulder presses, in appearance, the smith machine provides stability, but in reality, it can force the body into an unnatural movement pattern by restricting its range of motion. [3]

Common injuries:

- knee strains caused by improper squat depth and feet positioning
- excessive spinal loading followed by lower back pain
- shoulder impingements if used for upper body press exercises

Risk factors:

- beginners and amateurs tend to overload the smith machine, leading to poor form and loss of control

- the lumbar spine suffers dangerous pressure due to the rounding of the lower back during the lower body exercises



Figure 1-The smith machine [2]

- many users due to lack of knowledge, allow the knee to collapse inward during movement, increasing the risk of ligament tears.

Tips for a safer usage of the smith machine

- engaging the core during the movement, especially during lower body exercises, along with a neutral spine will avoid pressure on the back and help overall with a better form of exercise
- during squats, feet must be placed slightly forward compared to the bar to reduce knee strains
- using moderate weights, focusing on control of the movement instead of heavy loading of the machine will ensure the safety of the exercise

#### 1.2. The seated leg extensio machine

The seated leg extension machine (Figure 4) allows the user to isolate the quadriceps by extending their legs against the chosen resistance weight.



Figure 2-Seated leg extension machine [4]

Common injuries:

- ACL (Anterior Cruciate Ligament) strain - the exercise can place an excessive anterior stress on the knee joint leading to strains or damage of the ligaments
- inflammation of the patellar tendon
- knee cartilage damage

Risk factors:

- requiring a seated position, this exercise machine increases shear force to the knee joint by not allowing a natural movement of the knee
- knee ligament strains might occur due to overloading the machine
- the most vulnerable position for the knee joint is when the knee is fully extended, at the machine's highest resistance

Safety tips for the usage of the leg extension machine:

- slow, controlled movements along with the usage of moderate weights
- avoiding locking the knees at full extension
- excessive knee stress can be avoided by engaging in alternative quadriceps exercises such as free squats, step-ups or lunges.

### 1.3. The pec deck (chest fly) machine

The pec deck machine will target the chest muscles requiring the user to bring its arms together in a fixed movement, motion that can be depicted in figure 5. However, this unnatural, fixed movement path can place excessive strain on the shoulder joints. [7]

Common injuries:

- tear of the pectoral muscles due to excessive weight and poor exercise form
- shoulder impingement due to an unnatural range of motion
- rotator cuff strain due to excessive weight load and stress on the rotator cuff muscle

Risk factors:

- due to the machine design, the user is encouraged to overstretch the muscle at the beginning of the exercise, inducing strain on the shoulders
- the heavy resistance of the machine can lead to injury by loss of control

- this machine in many public gyms is not suited for a the large public/individual body differences due to its lack of available settings

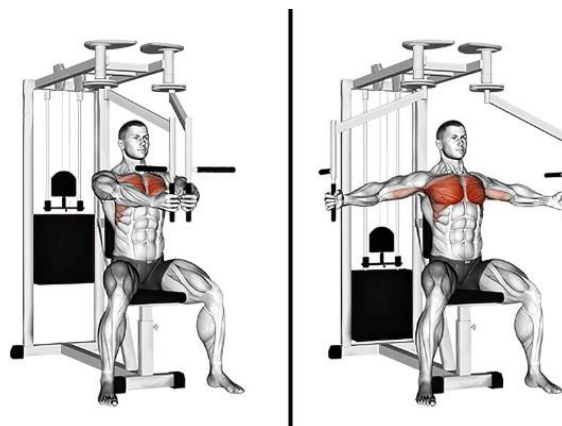


Figure 3-Pec Deck machine [6]

Tips for a safer usage of the pec deck machine:

- the user should limit the range of motion and excessive weight overload in order to avoid unnatural shoulder stretch
- in order to execute a more natural movement, the unexperienced user must consider a much safer, beginner friendly alternative exercise such as dumbbell chest fly by using the equipment from the free weight zone in the gym.
- using moderate resistance and avoiding explosive, uncontrolled movement can also be a solution for avoiding shoulder strains and other injuries.

### 1.4. The treadmill

The treadmill (Figure 4) is one of the most widely used cardio machines that can be found in public fitness centers. The user can be both beginner, experienced, and can perform on it simple walking, running and even sprinting.



Figure 4 -The Treadmill [8]

This machine offers the user a variety of settings and exercise options, along with various fitness indexes to interact with, examples being the speed at which they walk

or run, incline, pulse rate, calories burned and the time they wish to devote to the exercise.

The treadmill also has various automatic and manual fitness programs that allow the user to customize according to its preferences, and is usually equipped with two buttons that can turn it off in an emergency.

Despite the safety options and settings available to the user, treadmills are one of the most common sources of accidents such as falls, sprains and exhaustion injuries [9]. Common Injuries:

- missing steps at high speeds can lead to serious falling and injuries including limb and cranial fractures
- poor running form, excessive incline of the treadmill, poor foot placement at sudden speed change can cause ankle sprains, shin splints, lower back pain and knee pain

Risk Factors:

- users tend to distract themselves during treadmill exercises by using the phone or watching a screen, action that can cause missteps
- by setting the speed or incline too high, the user might risk falling or excessive joint stress
- inadequate footwear can lead to distress of the joints and prolonged discomfort

Safety tips for treadmill usage:

- the user is encouraged to increase the speed and incline gradually instead of starting at a high pace
- if the public gym has several types of treadmills, the user should choose the version that displays handrails and emergency stop buttons
- proper running footwear and good running posture by avoiding excessive forward leaning should spare the user of injuries and ankle sprain

### 1.5 The benchpress

The bench press exercise (Figure5) is a classic exercise that works the upper body, more specifically the pectoral muscles, that remains one of the most popular yet dangerous exercises in the fitness culture.

Compared to other fitness machines that work the same muscles, providing stability and controlled movement, the bench press requires total control over the exercise bar, often loaded with significant extra weight.

Performed incorrectly and without supervision, nor safety precautions, this exercise can lead to serious injuries. [11]

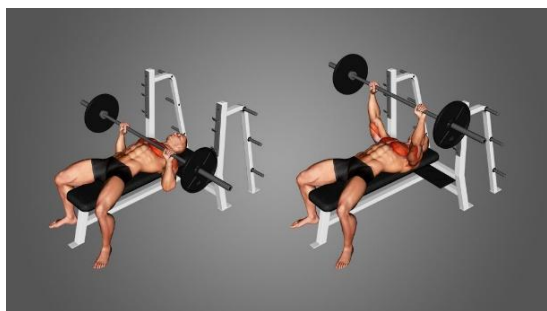


Figure 5 –The Bench press exercise [10]

Common Injuries:

- barbell collapse injuries and fractures, due to muscle failure, improper grip and lack of assistance, resulting in the barbell dropping on the neck, chest or face
- in case of bar overload and wide grip the user risks pectoral tears
- improper exercise form such as lowering the bar too deep or incorrect elbow positioning can load the shoulder joint with excessive stress and lead to shoulder dislocations
- tendon, rotator cuff and ligament injuries due to excessive bar overload and poor wrist positioning

## 3. INJURY PREVENTION AND SAFER ALTERNATIVES

Even though equipment in public gyms offers a well-structured system and pattern of movement to the wide public, it also presents a high risk to the body, especially if used in a non-conform and unknowingly way. Fitness trainers, gym managers and fitness equipment designers should aim to explore injury prevention strategies to provide clients with a safe environment in which they can explore their passion for movement and fitness.

### 3.1. General gym safety guidelines

Preventing injuries in public gyms starts with understanding and applying fundamental safety principles. Proper warm-ups and cool downs are essential for preparing muscles and joints for exercise and reducing post-workout stiffness. Additionally, progressive overload should be applied with caution to avoid exhaustion of the muscles, along with prioritizing proper form and technique to prevent muscle imbalances and joint strains.

Regardless of the level of experience, every member of a public gym is advised to use safety equipment such as gloves, lumbar belts or wrist straps along with a supervisor especially when it comes to high-risk exercises such as bench press or squats. Fitness enthusiasts should also listen to their bodies and recognize early signs of overuse injuries and body fatigue.

Finally, public gym facilities must ensure proper equipment maintenance along with proper hygiene, as improperly adjusted equipment and defective machines can lead to serious accident, while poor hygiene can encourage the spread of a variety of viruses and contact diseases.

### 3.2. Safer alternative to high risk gym machines

Because some gym equipment restricts natural anatomical movements while increasing injury risk, switching to safer exercise alternative can be beneficial. For example, the free weight zone, which features a variety of barbells and dumbbells, can encourage the user to safe-substitute the Smith machine while engaging in a more natural range of motion and focusing on stabilizing the working muscles.

Treadmill-related injuries can also be avoided by engaging in alternative cardio exercises such as elliptical trainers or rowing machines, which also provide to the user a lower-impact cardiovascular workout.

### 3.3. Gym policies, equipment improvements and staff responsibility

First, public gyms are required to implement safety measures to protect their members. Sports equipment engineers should integrate new and improved adjustable safety mechanisms, such as safety stops for Smith machines or emergency stops with scanning for treadmills to detect poor running form early and emergency-stop the belt.

At the same time, the staff of these facilities play a key role in educating members regarding correct and safe techniques in using the available equipment. The introduction of mandatory equipment fitting and adjustment sessions could significantly reduce the risk of injury faced by fitness center members.

Finally yet importantly, psychological factors can negatively influence behaviors that lead to a high risk of injury, with some individuals preferring to overload the equipment instead of focusing on correct and slow execution of the exercises. The trainers should promote a healthy and balanced mindset over fast ways to lose weight or grow muscles.

### 4. CONCLUSIONS

This article presented a study of high injury risk activities and gym equipment along with the importance of finding alternatives and solutions. Future advancements in equipment design, increased awareness and better gym policies will play a crucial role in making public fitness centers safer for all gym enthusiasts.

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