



## Original Research

# Designing a Dual-Purpose Device for Strengthening Pectoralis Major and Triceps Muscles

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### ABSTRACT

The purpose of designing and manufacturing a dual-purpose push-up and mechanical triceps device is to increase the strength of the arm and chest muscles without pressing on the lumbar vertebrae and creating lordosis. It works when an sportsman sits over themachine and fastens the belt. So that the person can adjust the amount of pressure applied to the muscles by increasing or decreasing the upper and lower weights. Push-up is a common exercise which strengthens the central and upper body muscles. The central muscles are the muscles that control the spine, abdomen, back and lower back. This common exercise is present in many people's everyday workout program. Regular and daily practice of this exercise can increase muscle mass and physical strength and improve cardiovascular health. The central muscles of the body and legs are also involved in this exercise, although arm's muscles and shoulders are used. Therefore, push-up is useful for increasing the strength of all parts of the body. Designing a dual-purpose device for strengthening pectoralis major and triceps muscles can create a safe environment for performing this exercise.

**Keyword:** Push-Up, Dual-Purpose, Steel Alloy, Triceps

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## INTRODUCTION

A dual-purpose device for strengthening pectoralis major and triceps muscles with its unique design can be used by the ones who regularly perform push-up. This exercise is directly related to cardiovascular health. The more this exercise is done, the better the cardiovascular health will be. To turn push-up into a cardiovascular exercise, it can be replaced by a cardio exercise. If this exercise is done with an interval program, due to its aerobic properties it will be effective in weight loss.

Nowadays, because of the advances in technology and various bodybuilding machines in the field of push-up, we decided to take a step towards serving the sportsmen of this field and design a dual-purpose device for strengthening pectoralis major and triceps muscles.

## PUSH-UP TEST

This test measures the strength of the muscles of the upper torso (arms and shoulder girdle). The legs are not fixed anywhere and the movement in the defined range of motion continues without rest and interruption. Testee stretches the arms, goes up and down in one direction [1].

## HEALTH-RELATED PHYSICAL FITNESS

Cardiorespiratory fitness usually means the ability to perform oxygen-requiring physical activity without premature fatigue. This part of physical fitness is also called aerobic fitness because this group of exercises increases breathing capacity. According to the law of matter and energy, energy is not produced or eliminated, but is transformed from one state to another. In any muscle activity and energy production, the food eaten must be converted into units of chemical energy, namely sugar and fat molecules [2].

These energetic molecules through using oxygen release energy into muscle cells and cause muscle contraction. This will result in movement and physical activity. The organ that provides oxygen and air to the cells to burn is the heart, blood vessels, and lungs. Therefore, cardiovascular fitness is considered to be the most important aspect of physical fitness because it prevents heart disease and increases sportive performance [3].

## BENEFITS OF PUSH-UP

**Push-up increases flexibility:** When we lose weight, the back muscles are stretched, and body is pushed up, the biceps work. Doing this regularly increases flexibility and reduces the risk of injury.

**Improving the cardiovascular system:** Push-up helps the heart work faster and pumps more blood to the muscle tissue. Therefore, this movement also affects the functioning of the heart and arteries [3].

As sitting for long periods weakens the upper body muscles. People who spend more time at their desk, can include push-up into their exercise program.

**Calorie burning:** The push-up is not usually referred to as a fat burning movement, but it burns calories.

**Increased testosterone:** With age, the amount of hormones in the body changes. In men, testosterone secretion decreases. Push-ups regulate the release of hormones.

**Reduce the risk of osteoporosis:** Osteoporosis is caused by a decrease in bone density. Eating healthy and exercising can help reduce bone density. Push-up is a good exercise to prevent this disease.

**Reduce the risk of injury:** Shoulder and back injuries usually occur in people who do not have much flexibility.

Push-up makes the body stronger and more flexible. In this way, sportsmen are able to perform more complex movements without injury [5].

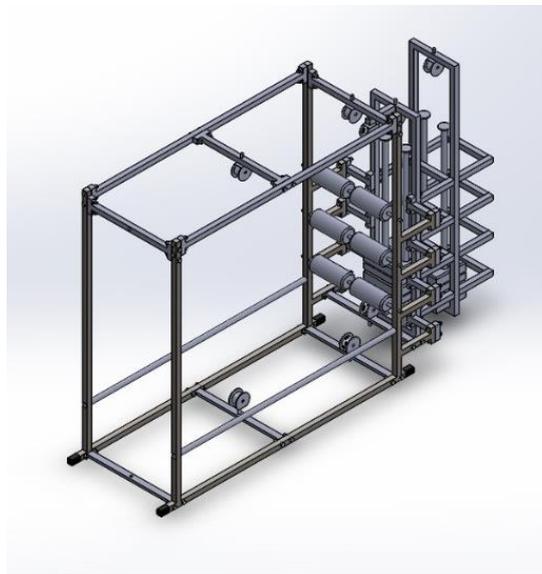
This dual-purpose device for strengthening pectoralis major and triceps muscles due to the having belt prevents shoulder and back injuries in beginners as well as individuals with flexibility problems, therefore have more safety.

### **MUSCULAR FITNESS**

Muscle fitness has three components; muscular strength, muscular endurance and flexibility. Muscular strength is the ability of a muscle or group of muscles to produce maximum force at a time against a resistance across the full range of motion of a joint. Muscular endurance means the ability of a muscle or group of muscles to repeat execution or sustain muscle contraction repeatedly over a period of time. Flexibility is the ability of a muscle or group of muscles to withstand sudden, continuous stresses and strains. An increase in muscle strength can increase muscle endurance [4].

### **MATERIALS AND METHODS**

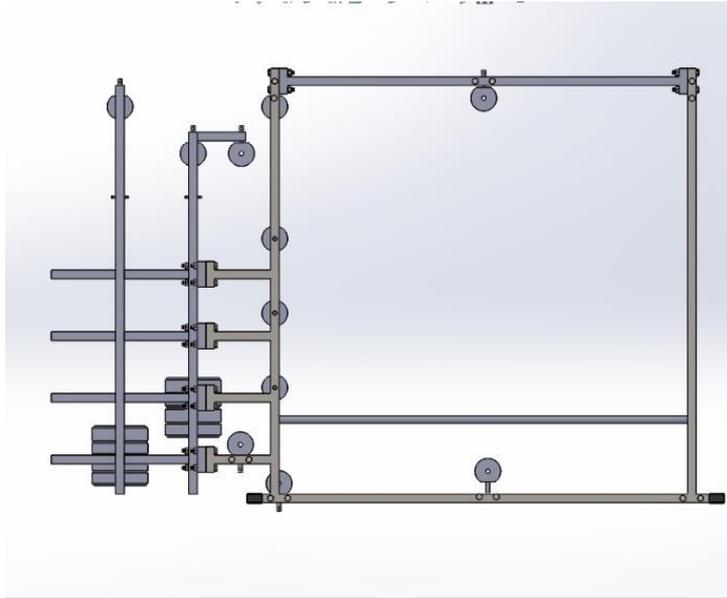
The components of the device are: push-up skeleton, weight holder, belt, wiring, pulley, weight, monitor



**Figure 1.** The dual-purpose device for strengthening pectoralis major and triceps muscles

#### **- Push-up machine skeleton:**

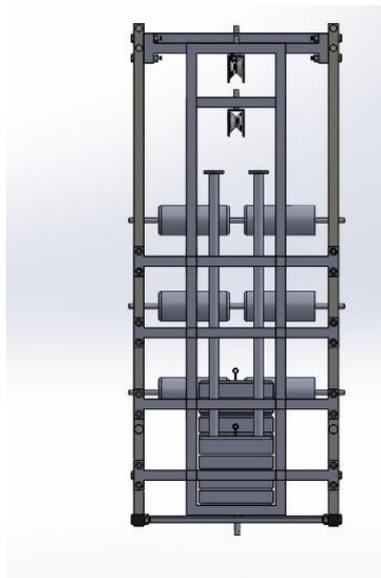
The skeleton of this machine is based on the previous machine using steel alloy which is designed as a 4 \* 4 square and CO<sub>2</sub> arc welding has been used for connecting bolts and nuts.



**Figure 2.** Skeleton of the push-up machine

**- Weight slate storage:**

This place is made of high carbon chromium alloy and has several holes for weight adjustment.



**Figure 3.** Weight plate storage

**- Belt**

This belt is made of straps used in parachuting, which has high strength.

**-Wiring:**

Wire ropes are used to move weights.

**- Pulleys:**

In this machine, pulleys made of steel alloy are used to move the weights.

**- Weights:**

On each side of the device standard steel weights of 6 kg5 and 5 kg10 are used.

**- Monitor:**

The user can receive his exercise program in relation to BMI and body composition. The sensor pads that are on the handle will indicate the amount of heart rate, the amount of consumed calories and the activity time in each set and in total set (in average).

### **Advantages**

1. Being economic
2. Easy installation
3. Being safe and secure
4. Solving the problems of sportsmen regarding push-up movements and mechanical triceps while working with weights
5. Increasing the pressure on the desired muscles

**The following items were found based on the performed searches in the desired sources:** Counter and intelligent control of movements in bodybuilding devices, inventor name: Majid Ismaili, registration number: 30097:

This device includes four parts: transmitter, receiver, a pulse command and a counter, and it controls the correct performance.

Indoor fitness equipment for standard sports movements and bodybuilding, inventor name: Alireza Norouzi, registration number: 68624: this device consists of a bench and a movable arm that has an adjustable internal resistance and resists against bending. This resistance can be easily used to perform bodybuilding exercises.

Power supply mechanism of bodybuilding machines without need for weights with the ability to change the force, inventor name: Seyed Javad Hosseininia, registration number: 81514: power supply mechanism of bodybuilding machines without need for weights with the ability to change the technical field force: Category A: human needs - Subcategory: entertainment and recreation

Category: Mechanical Engineering - Subcategory: engineering in the general sense

Currently, the equipment and devices used in homes and bodybuilding clubs have a large number of weights with different weights and accessories. Problems arise while using these devices and weights. In this device, a screw coil spring with a flat cross-section is used. So that by rotating the center axis of the spring and the side support of the spring in opposite directions, the force and torque can be changed in the side support and the center axis, as a result, can be used in bodybuilding machines to change the force without any change in weights.

### **INSTALLATION STEPS OF THE DEVICE**

First, the wall (1) are connected to the columns (2), (5), (8) and (9) with standard screws and nuts.

Then the weights (16) are arranged over weights (13) and (14). Initially, the weight (13) and then the second weight (14) are attached to the wall (1).

To install a digital monitor, first the retaining arm (18) is connected to the upper external interface (9) and then monitor (19) is connected to the retaining arm (18).

When it comes to the installation of the pulleys, the weight wires are also connected.

### **PATENT CERTIFICATE**

Unique ID: 14005034000300057

Confirmation password: 617221

## RESULTS AND DISCUSSION

The aim of the present study was to design and manufacture a dual-purpose device for strengthening pectoralis major and triceps muscles to increase the strength of the arm and chest muscles without putting pressure on the lumbar vertebrae.

Since push-up is directly related to cardiovascular health, the more it is done, the better the cardiovascular health will be. push-up into a cardiovascular exercise, it can be replaced by a cardio exercise. If this exercise is done with an interval program, due to its aerobic properties it will be effective in weight loss. Using dual-purpose device for strengthening pectoralis major and triceps muscles, you can easily choose the weight you want. Smooth and safe function of this device helps you to perform good and useful exercises.

**Author Contributions:** Conceptualization, DKh. and FSh.; methodology, FSh. and AF.; formal analysis, AF. and H-MH.; investigation, DKh and AF.; resources, FSh.; data curation, AF.; writing—original draft preparation, DKh. and FSh.; writing—review and editing, AF.; supervision, DKh. and H-MH.; project administration, FSh. All authors have read and agreed to the published version of the manuscript.

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**Institutional Review Board Statement:** The Intellectual Property Department of the Real Estate Registration Organization (Tehran - Iran) was placed.

**Informed Consent Statement:** Informed consent was obtained from all subjects involved in the study.

**Data Availability Statement:** Data will be available upon request.

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## طراحی دستگاه دو منظوره شنا سوئدی و پشت بازو مکانیکی

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### چکیده

هدف از طراحی و ساخت دستگاه دو منظوره شنا سوئدی و پشت بازو مکانیکی افزایش قدرت عضلات بازویی و سینه‌ای بدون فشار آمدن به مهره‌های کمر و ایجاد گودی کمر طراحی گردیده است که دستگاه به این صورت عمل می‌کند وقتی ورزشکاری روی دستگاه قرار می‌گیرد و کمر بند را به خود وصل می‌کند با کم و زیاد کردن وزنه‌های بالا و پایین می‌تواند میزان فشار وارد شده به عضلات را تنظیم نماید و حرکت ورزشی خود را انجام دهد.

شنا سوئدی یک ورزش محبوب می‌باشد و موجب تقویت عضلات مرکزی و بالاتنه می‌گردد. عضلات مرکزی ماهیچه‌هایی هستند که ستون فقرات، شکم، کمر و پایین کمر را کنترل می‌کنند. این ورزش محبوب در برنامه ورزشی روزانه بسیاری از افراد وجود دارد. انجام مرتب و روزانه آن موجب افزایش توده عضلانی و قدرت بدنی و بهبود سلامت قلب و عروق می‌شود. گرچه در این ورزش، بیشتر از عضلات بازوها و شانه‌های خود استفاده می‌کنیم، ولی عضلات مرکزی بدن و پاها نیز درگیر می‌شوند؛ بنابراین شنا سوئدی برای افزایش قدرت تمام قسمت‌های بدن مفید است.

دستگاه دو منظوره شنا سوئدی و پشت بازو مکانیکی با طراحی منحصر به فرد خود محیطی ایمن را برای انجام شنا سوئدی ایجاد می‌کند.

**واژگان کلیدی:** شناسوئدی - دو منظوره - آلیاژ فولادی - پشت بازو