



# A Comparison of Muscle Activity during Free-Motion versus Fixed-Resistance Exercises

*The FreeMotion Fitness™ Dual Cable Cross chest press compared to barbell bench press and fixed chest press machine.*

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## **Demonstrated Benefits of Free Versus Fixed Resistance Machines**

This research demonstrates:

- *Overall muscle activation is significantly greater during free-motion exercise as compared to both fixed-machine and free-weight exercises.*
- *Free-motion cable exercises represent the safest, most effective/efficient mode of exercise for enhancing functional fitness.*

## **Importance Functional Fitness**

Resistance training has been shown to have valuable effects on functional abilities in people of all ages. This impact is especially important among an aging population where physical activity patterns have a great influence on the prevention of chronic disease. If an individual lacks the muscular fitness (power, strength, muscular endurance) to perform basic activities of daily living or to participate in a basic cardiovascular exercise routine, their health will suffer. Quality of life is also closely tied to muscular fitness in an aging population with individuals found to have higher levels of strength reporting much greater life satisfaction.

Research with athletes and demanding occupational groups such as firefighters has shown the need to be able to stabilize joints and body-segments during the exertion of force in numerous planes and angles. This form of functional fitness is directly tied to optimal performance and the safety/health of the performers. Exercise is often prescribed as a protective mechanism and performance enhancement tool. While significant interpersonal preferences among exercise professionals exist throughout our field, definitive differences exist in the forms of exercises prescribed. Free-weight exercises have traditionally been touted as the most effective mode of training for enhancement of dynamic movements due to the need to stabilize and control the movement of the weight. Fixed-machines are often suggested to be safer, where losing control or dropping the weight presents little danger, and allow for focus to be placed on a specific muscle group. However, no need to coordinate activity among stabilizing muscle groups exists. A combination of the benefits of each mode of training would represent a valuable exercise mode available to exercise professionals.

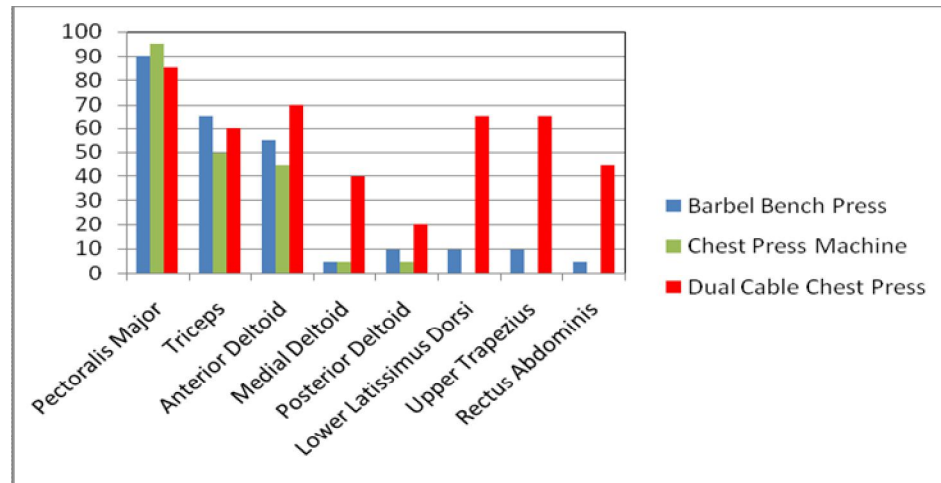
Free-motion exercises potentially offer this combination. Cables are utilized to allow different movement paths but incorporate the machine safety features. If free-motion exercises demonstrated equal or greater muscle activation than free-weight and fixed-machines, exercise professionals could confidently prescribe such exercise as the most effective and efficient form of exercise to develop functional fitness.

### **Examining Changes in Muscle Activity during Different Exercises: A Case-Study**

Recent research conducted under the direction of Dr. Matthew Rhea, Director of Human Movement at A.T. Still University, demonstrates that the use of free-motion exercises such as the Dual-Cable Cross chest press significantly enhances muscle activity in synergistic and stabilizing muscle groups. A 10-RM load was identified for each exercise in a separate exercise session to identify an equal load for comparison. Then, EMG measures were taken in different muscle groups during each exercise and analyzed for differences.

When compared to the fixed-machine chest press and the barbell bench press, muscle activity in supportive muscle groups averaged less than 10% the activity in the same muscle groups during the Dual-Cable chest press. Muscle activity in the primary muscle groups of the chest press (pectoralis major, triceps, and anterior deltoid) was similar between the exercises with the fixed machine chest press having a slight advantage for targeting the pectoralis major.

Figure- Changes in Overall Muscle Activity (data presented in microvolts)



These measurements demonstrate that overall muscle activity is significantly greater in free-motion exercises as compared to fixed-, and even barbell free-, weight exercise. The fixed-machine did show a slightly greater activation of the principle chest muscle and may be the most applicable choice of exercise is focus on the pectoralis major is the primary goal of the training exercise; however, if developing functional fitness (which is characterized by the ability to move, stabilize, and coordinate numerous joints and body segments) is the goal, the free-motion exercise offers the optimal stimulus. The free-motion exercise requires a great deal of stabilization, not only around the shoulder and upper torso, but at the core and lower body as well, which requires coordinated muscle activation surrounding all joints. That activation and coordination enhances the overall stimulus of the exercise and is expected to enhance the degree to which functional fitness is developed.

### Implications for Exercise Prescription

The difference in muscle activity and overall stimulus demonstrated in this case-study carries several implications when considering choice of exercises. If an individual desires to focus, or “isolate”, one single muscle group for maximal activity, the fixed-machine exercise offers that capability. Due to the fixed nature of the movement path, no stabilizing groups are needed (or will limit performance) to perform the exercise. There is also a psychological factor when the risk of injury is limited during the machine exercise which may enable greater muscle activation of the primary muscle group. However, the fixed-machine exercise results in very limit additional muscle activity and does not require stabilization or coordinated muscle activation. Thus, the transfer to real-life stresses/situations will also be limited.

If the goal of the training program is to enhance performance in dynamic situations (i.e. real-life, sports, etc.) then the free-motion exercise is much more conducive to enhancements in stabilization, coordination, and overall activation of the neuromuscular system.

Safety is often a justifiable factor in selection of exercises. Free-weights have often been avoided to reduce the risk of dropping or losing control of weights. Machines offer protection from this scenario but limit the need to stabilize/control the movement. With the ability to simply release the handles and drop the weight (to avoid injury), the free-motion exercise basically takes the safety of the fixed-machine and the stabilization requirements of the free-weight exercise, combines them, and then amplifies the overall muscle activation requirements. The result is the most functional, safe, efficient, and effective form of exercise available.