

## A Supplemental Strength and Power Program: Specifically Designed for the Back Tuck in Gymnastics

The sport of gymnastics is one that has grown drastically in popularity throughout the years. The general term gymnastics encompasses a variety of activities including artistic men's and women's gymnastics, acrosport, trampolining and rhythmic gymnastics. The focus of this paper will be on artistic men's and women's gymnastics, such as that seen in the Olympic Games. All of the above mentioned forms of gymnastics require coordination, body awareness, strength, power, endurance, flexibility, poise and courage (Gluck, 6). When designing a training program for a gymnast, it is important to train all of these aspects of the sport. It is also necessary that the gymnast and the coach recognize four important points. They are: 1) It takes a long time to become a good gymnast; 2) Gymnastics is a sport of individual performances; 3) Your body must be in peak condition; and 4) The best gymnasts are those who have learned gymnastics step by step (Aykroyd, 18). The ultimate goal of this paper is to design a supplemental strength training program for a gymnast learning to perform a standing back tuck. The paper will begin with the dynamics of the back tuck and the specific areas that need to be trained. It will then provide a specific eight week training program for a gymnast who has completed a base strength training program. This program is designed specifically to improve the components of the back tuck. While it may be helpful in other skills, specificity should always be kept in mind so that each action of any particular skill may be improved.

The back tuck is a very important skill to master for the competitive gymnast for numerous reasons. First, it is the most basic of numerous backward aerial skills. Second, after completing the back tuck, and especially after completing the round off-back handspring-back tuck, the athlete will move to more difficult, higher point skills. These

include the back layout, back layout with a full twist and the double back tuck. See figure 1. Also, the back tuck is used as a dismount on the other events. It can also be used a very high level skill on the balance beam.

When designing a strength program for a competitive gymnast, one must keep the strength to weight ratio in mind. The strength to weight ratio is important because the gymnast must be strong enough to manipulate his or her own weight in order to successfully perform the skills (Gluck, 15). In comparison to other athletes of various sports and of the same age, gymnasts are typically the smallest and the lightest (Salmela, 185). Also, in comparison to other athletes, gymnasts are typically some of the strongest when the data is normalized for weight (Salmela, 193). It is this high strength to weight ratio that allows the gymnasts to perform the high difficulty skills. When the athlete begins a resistance program, there will likely be an increase in weight due to hypertrophy of the muscles. [It is essential that this hypertrophy is accompanied by an increase in strength.] This can be achieved by doing a high percentage of the individuals one repetition maximum with a low number of repetitions (Fleck & Kraemer, 103). If the individual does not see an adequate increase in strength to overcome the weight gain, it will be detrimental to the gymnasts performance. The increase in strength can be tested by occasionally performing one repetition maximums to determine if there has been an increase.

good start here ↓

To successfully design a program, one must first understand the mechanics of the back tuck. In regard to anatomical position, the back tuck is a rotation about the transverse axis in the sagittal plane (Gluck, 24). See figure 2. The steps in performing the back tuck are:

- a) Stand upright. Feet together, arms extended over the head.
- b) Squat slightly. Flex the shoulders, bringing the arms straight down in front of the body.
- c) Push with the legs using the hip, knee and ankle extensors to perform a maximal vertical jump while extending the arms over the head.
- d) Bring the knees to the chest at maximal height of the jump. It is important not to grab the knees, wait until they come to the arms during rotation.
- e) While rotating, leave the head in neutral position until the full rotation is almost completed. When the rotation is almost completed, the neck is extended so that the gymnast can see the floor for landing.
- f) Straighten the body for landing, keeping the knees soft (Brown, 262)  
See figure 3.

Salmela describes one of the essential components of the back tuck as impulse. This is the area under the force-time curve. See figure 4. "The acceleration, velocity and momentum given to a body is directly related to the magnitude of the impulse acting upon it. When time is brief, a large force must be developed if the impulse is to be large" (Salmela). The two factors which hinder maximum impulse are: 1) the time during which the force is generated is brief, which prevents the attainment of peak muscular force; and 2) the increasing velocity of movement decreases the force that can be generated. The most successful gymnast would be one who could generate force rapidly, overcoming the time limitation of the skills, and who could generate force at high velocities of movement, overcoming the force-velocity factor (Salmela, 224). This notion of impulse is similar, if not the same as, power. Power is defined as force multiplied by velocity. As force increases, velocity decreases and vice-versa. This can be seen in the force-velocity curve. See figure 5. The most successful gymnast, as stated by Salmela, would be one who could produce high forces at high velocities. This will be the focus of the training program. ✓

Another aspect of the training is improving the neural control of the muscles. Three factors contribute to this neural control. They are:

- 1) Increasing the number of motor units recruited.
- 2) Increasing the rate of firing, or frequency, of the motor units.
- 3) Increasing the degree of synchronization of the motor unit.

Increasing these three factors will help increase the power output of the muscle. This should be achieved using the program designed.

The following program is designed to accompany the existing training of the gymnast. It has been designed, however, for an individual who meets certain criteria. Before training for the back tuck, the gymnast should be able to perform specific skills, including the forward and backward roll, handstand, forward and backward walkover, cartwheel, round off and back handspring. These skills are important because, as previously mentioned, the best gymnasts are those who learn step by step. The back tuck would be the next logical step in the sequence. Also the individual must have previously completed a strength program that focused on increasing the force of the muscles. This will serve as the base for this program.

Another important thing to remember is that the individual should learn to perform the back tuck with proper body positioning. This is important because the nature of the judging of gymnastics is purely aesthetic. For example, if the gymnast grabs the knees while in the tuck and pulls the legs apart, which helps in rotation, points will be deducted. This is a common mistake made by gymnasts when learning the back tuck. Thus, it is important the individual develops good habits from the beginning (Gluck, 9).

The components of the tuck that will be trained in this program are the vertical jump and the muscles involved in the tuck position. To train the muscles involved in the vertical jump, one must train the hip, knee and ankle extensors. The athlete has previously completed a training program to increase force, so this program will focus on

increasing the velocity of the contraction. This will be done using high velocity exercises, such as stretch-shortening cycles, or plyometrics. This will help the gymnast attain the greatest power from the extensor muscles. Exercises of this type provide the greatest increase in the vertical jump (Fleck and Kraemer, 42). The tuck phase involves the hip flexors and stabilizing muscles of the abdomen and the arms. The hip flexors are used to forcefully pull the knees to the chest. The stabilizing muscles are used to hold the proper body position while in the tuck.

Below is a description of the recommended exercises to help develop the above mentioned aspects of training. It will include how the exercises should be performed, the recommended weight and number of repetitions and what the exercises are training. Also included are optional exercises that will help the gymnast in performing other skills done in sequence with the back tuck, such as the back handspring. Following the descriptions will be the eight week program laid out week by week. This will provide a description as to when the exercises should be performed.

#### LEGS—VELOCITY

- 1) Loaded squat jumps: Use a weighted vest, no more than 40% of the gymnast's weight. It is preferable to start with a lower weight so that the velocity is kept high. Have the gymnast squat one-quarter of the way down and jump vertically as high as possible. This should be done with a spotter. The spotter grabs the waist of the gymnast at maximum height and helps control the gymnast's landing. Do 3 sets of 8. This trains the extensor muscles in the jump.
- 2) Ankle jumps: Keeping legs straight, knees soft, perform ankle extensions, however, they should be done explosively so the individual leaves the floor. Do 3 sets of 8. This trains the ankle extensors.
- 3) In-depth jumps: Jump from a box and immediately do a maximum vertical jump upon landing. The jump should be performed from a height less than 110 cm. Jumps higher than this have shown to be counterproductive (Fleck and Kraemer, 36). Do 3 sets of 10.
- 4) Maximum vertical jumps: Perform maximum jumps exactly as done in the vertical jump phase.

*injury?  
on mat?*

- Do 3 sets of 10. This will train the extensors involved in the jump.
- 5) Maximum vertical jumps using the spotting belt. Perform maximum vertical jumps while someone pulls slightly at either hip, knee or ankle extension. Do 3 sets of 8 focusing on each extensor for one set. This will train the extensor muscles to perform at higher velocities.
  - 6) Tuck jumps: Perform a maximum vertical jump and bring the knees to the chest at maximum height. Do 3 sets of 10. This will work the extensor muscles and the hip flexors used in the tuck phase.
  - 6) Inverted sit-ups: Lay on stomach on a raised platform so that the legs are on the platform being held above the knee. The upper body should be hanging down so that the head is towards the floor. Using the gluteus muscles, not the back, raise the upper body so that the body is horizontal to the floor. This should be done at a high velocity, yet staying completely controlled. Do 3 sets of 8. This will work the hip extensors.

#### STOMACH-STABLIZING

- 1) Crunch sit-ups: Lay on back, knees bent, feet flat on floor approximately 8-12 inches apart. Put hands behind head and lift shoulders completely off the floor. Concentrate on the stomach muscles. Do 50. This will strengthen the stabilizing muscles of the stomach.
- 2) Leg flex sit ups: Lay on back, legs straight and together, hands behind head. Contract stomach muscles and lift shoulders off the ground and hold. Keeping legs straight, lift feet off the ground to approximately a 45 degree angle from the ground. Do 3 sets of 10. This will work the hip flexors and the stomach muscles.

#### ARMS-STABLIZING

- 1) Bench press: Do with greater than 80% of one repetition maximum. Do 3 sets of 6. To determine the amount of weight to use, test to see how much weight it takes for 6 repetitions to lead to exhaustion.
- 2) Bar Dips: Do 3 sets of 10.
- 3) Military Press: Do 3 sets of 6. Determine the proper amount of weight to use just as you did for the bench press.
- 4) Front arm extensions. Holding dumbbells in hands, lift arms in front of the body extending to horizontal. Do 3 sets of 6. Determine the proper amount of weight as described above.

#### THE PROGRAM

##### General Information

1. The program should be performed 3 times per week. Preferably Monday, Wednesday and Friday.
2. The exercises can be performed in succession during a specified time or during practice while waiting to work on other skills.

3. The exercises should be done on a floor similar to that of the competition floor. The floor is designed to absorb some of the shock from the jumps to help prevent injury. It also provides some spring to the gymnast.
4. This program should be done in the preseason so that the focus during the season can be on perfecting the skills, not learning them.

Weeks 1 and 2:

1. Legs:
  - a) squat jumps
  - b) ankle jumps
  - c) in-depth jumps
  - d) maximum verticle jumps
2. Arms
  - a) Bench press
  - b) Bar dips
  - c) Military press
  - d) Front arm extensions
3. Stomach
  - a) Crunches
  - b) Leg flex sit ups

Weeks 3 and 4:

1. Legs:
  - a) squat jumps
  - b) ankle jumps
  - c) in-depth jumps
  - d) maximum verticle jumps
  - e) tuck jumps
  - f) inverted sit-ups
2. Arms
  - a) Bench press
  - b) Bar dips
  - c) Military press
  - d) Front arm extensions
3. Stomach
  - a) Crunches
  - b) Leg Flex sit-ups
4. Trampoline work
  - a) With a spotter, complete 30 back tucks on the trampoline. This is done to learn the proper body position and to learn to locate ones place in space during rotation.

WEEK 5

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Take it easy this week! Stop work on the trampoline and move to a mini tramp. With a spotter complete 30 back tucks from the mini tramp landing on the floor. Continue working on body position. This is a good week to do one repetition maximum testing. Take the week off from the program, however, continue regular training.

## WEEKS 6 and 7

1. Legs
  - a) Squat jumps
  - b) Ankle jumps
  - c) In-depth jumps
  - d) Maximum vertical jumps
  - e) Tuck jumps
  - f) Inverted sit ups
2. Arms
  - a) Bench press
  - b) Bar dips
  - c) Military press
  - d) Front arm extensions
3. Stomach
  - a) Crunches
  - b) Leg flex sit ups
4. Floor work
  - a) With a spot begin working on the back tuck on the floor. Remember the basic steps: vertical jump and knees to chest. These should be mastered due to the training program, so it should achieving the back tuck should not be difficult.

## WEEK 8

1. Legs
  - a) Squat jumps
  - b) Ankle jumps
  - c) In-depth jumps
  - d) Maximum vertical jumps
  - e) Tuck jumps
  - f) Inverted sit ups
2. Arms
  - a) Bench press
  - b) Bar dips
  - c) Military press
  - d) Front arm extensions
3. Stomach
  - a) Crunches
  - b) Leg flex sit ups
4. Floor work
  - a) Continue floor work. The gymnast will probably be able to perform the skill without a spotter by now. The skill will be mastered with repetition.
5. Bounding
  - a) Bounding is done by kicking up into a hand stand and, using the shoulders not the elbows, hopping on the hands. Do 3 sets of 10. This will help to get more power from the round off and the back handspring so that the series skills will be performed more successfully.

While participating in any exercise program it is essential that the gymnast spends a great deal of time stretching. Gymnastics requires a great deal of flexibility and doing strength training can make the muscles more taut and decrease flexibility. The gymnast should be sure to stretch all the trained muscles to ensure this decrease in flexibility does not occur. It is a problem that is easily remedied if time is taken to prevent it.

Gymnastics is a sport that uses mainly anaerobic energy sources. It is composed of a short duration of high power skills that use both the ATP-PC energy sources and anaerobic glycolysis. This program will help to train both of these energy pathways which is essential to the athlete. The aerobic energy system is not trained during the sport. It is recommended that the gymnast take part in some aerobic training, such as jogging or cycling, for better health. This will help to strengthen the cardiovascular system, which ultimately leads to better health.

As stated earlier, it is important that proper care is taken to prevent injury to the gymnast both in practice and in performing specific training programs. The same precautions should be taken to ensure the ankles and knees are protected in training and in practice. If the gymnast tapes the ankles or wears any sort of protective brace in practice, they should also do so in strength training.

After completing this program the gymnast should be able to successfully perform the back tuck. If the individual begins to feel fatigue then the training is too extreme and should be cut back. It is important to prevent overtraining. This could greatly hinder the athlete's performance. However, if all the proper precautions are attended to, the ability to complete the back tuck should be achieved rather easily. It will

avoid a lot of frustration and set backs. Also, the increased strength and power will enable the gymnast to perform a variety of skills more easily.

Cristie,  
Excellent well written paper  
reflecting your combined expertise

Grade A

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## RESOURCES

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- Brown, J.R. 1980. *Teaching and Coaching Gymnastics for Men and Women*. New York, NY: John Wiley and Sons.
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- Gluck, M. 1982. *Mechanics for Gymnastics Coaching: Tools for Skill Analysis*. Springfield, IL: Charles C. Thomas.
- Salmela, J.H. 1976. *The Advanced Study of Gymnastics*. Springfield, IL: Charles C. Thomas.

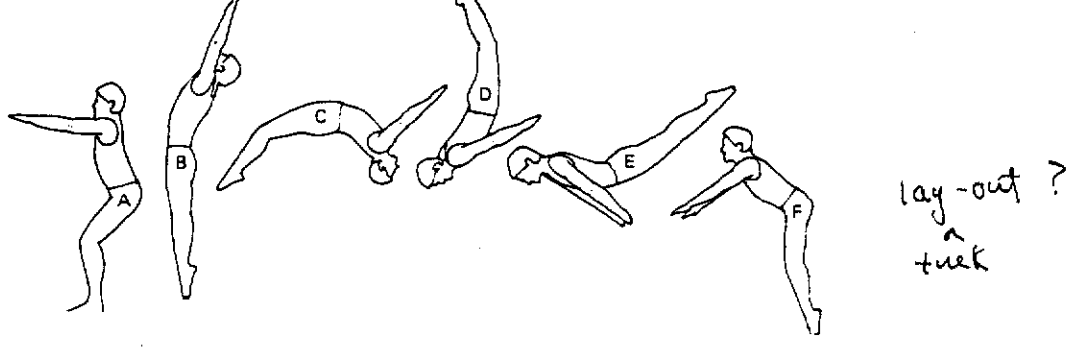


Figure 1. Standing Back Tuck. Straus et al

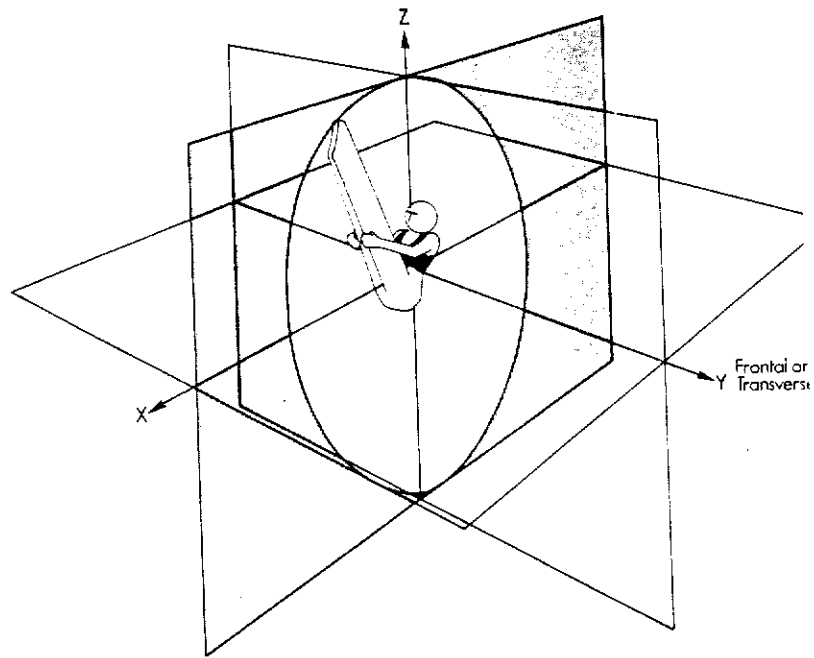


Figure 2: Gluck et al

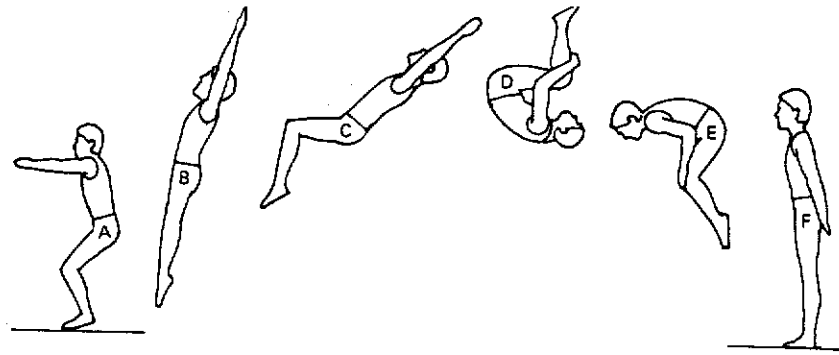


Figure 3. Brown et al

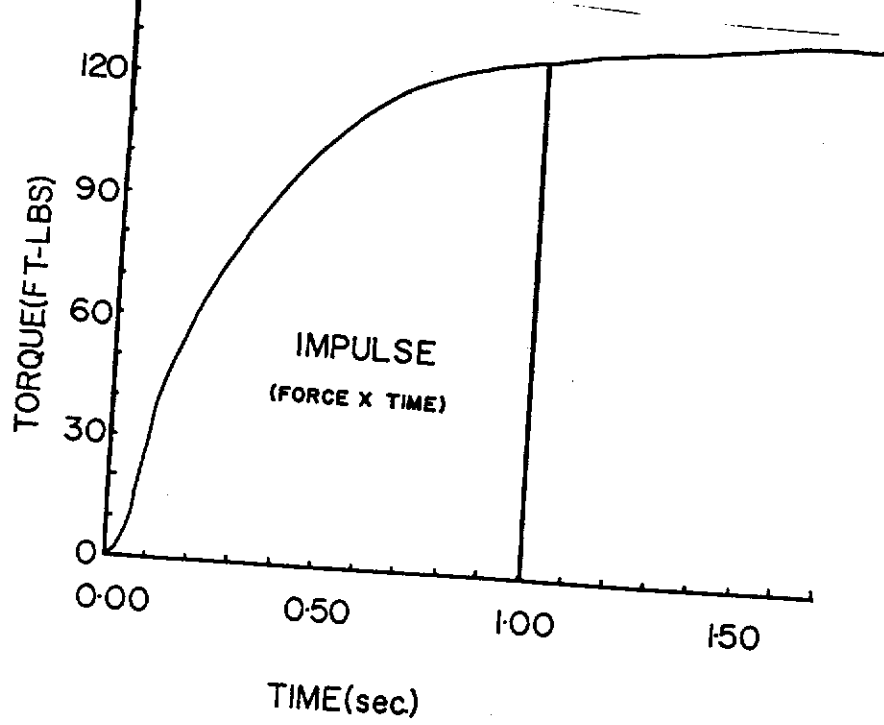


Figure 4. Salmela et al

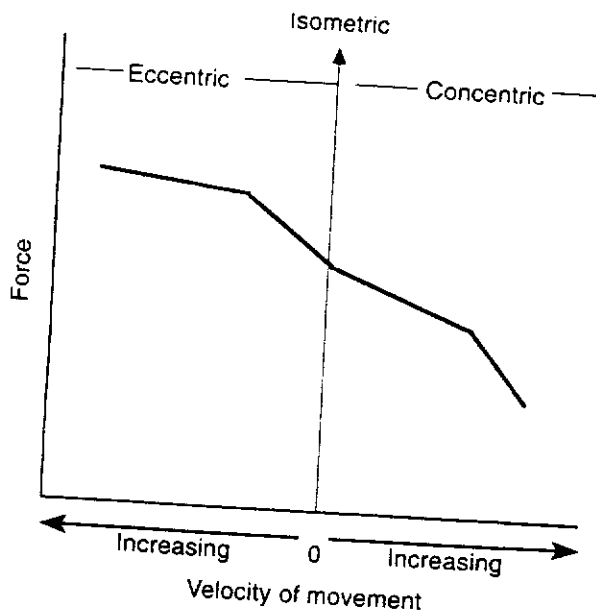


Figure 5: Fleck & Kraemer