Should Female Gymnasts Lift Weights?

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Gymnastics coaches and administrators in the US are reluctant to include weight training with female gymnasts because they believe it produces detrimental increases in muscle mass. However, weight training based on high-intensity low-repetition sets is likely to improve the performance of most gymnasts by increasing strength with minimal muscle hypertrophy.

KEYWORDS: gymnastics, weight training, hypertrophy, body size, strength

Gymnastics must remain on the lean side of lean to be effective competitors at the highest level (Nelson et al., 1983; Sands et al., 1992, 1995). Not surprisingly, concern about excess body weight is common in gymnastics (Anorexia/Bulimia Association, 1994; American College of Sports Medicine, 1997; Leglise, 1998; Nattiv & Lynch, 1994). Female gymnasts and their coaches in the US are therefore reluctant to use weight training, in spite of abundant evidence of the benefits of weight training for sports requiring strength. Their concern is that the gymnast will develop excessive body and muscle mass (“bulk up”) and thus become too heavy to perform effectively.

Gymnasts and other athletes who must move their body weight as the primary resistance need to train for strength relative to body mass rather than absolute strength (Poliquin, 1991; Sands, Mikesky, & Edwards, 1991). As the gymnast matures, she is likely to gain absolute strength but lose relative strength as her body mass increases (Sands et al., 1991; Irvin et al., 1992; Zatsiorsky, 1995). Female gymnasts can increase reliance on motor skills to compensate for a decline in relative strength (Poliquin, 1991; Zatsiorsky, 1995), but strength training aimed at increasing relative strength is another important approach.

While some gymnastics coaches are reluctant to prescribe weight training, most include strength training in the form of repetitions of strength-oriented gymnastics skills (Howard & Evans, 1990; Hullner, 1989; Menkhin, 1978; Sands, 1990; Sands et al., 1995; Sands & McNeal, 1997; Singh et al., 1987). Many gymnastics skills have a large strength component, so separating the skill performance from strength training is somewhat arbitrary (Chu, 1994; George, 1980; Hullner, 1989). All gymnastics coaches would agree that development of strength through repetition of gymnastics skills is appropriate. However, skills at the elite level are becoming ever more difficult, and extra time for training is at a premium. Weight training would be orthopedically less demanding than extra skill repetitions and require less time for these gymnasts. In this article we will describe weight training that can develop
strength with minimal hypertrophy, and we will address coaches' concerns about the
effects of weight training on muscle size and body build.

Training for Maximal and Minimal Hypertrophy

Training prescribed to encourage muscle hypertrophy usually involves large numbers
of sets of repetitions with light to medium loads, movement speeds from rapid to
slow, repetitions to maximum effort, and short rest periods (e.g., Bloomer & Ives,
2000; Hatfield, 1984; Poliquin, 1991; Schmidtleicher, 1992). In contrast,
prescriptions for maximizing strength and minimizing hypertrophy usually involve
heavier loads, smaller numbers of repetitions, and longer periods of rest. Table 1
shows Poliquin's guidelines for the two extremes of training.

<table>
<thead>
<tr>
<th></th>
<th>Maximal hypertrophy</th>
<th>Minimal hypertrophy</th>
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<tbody>
<tr>
<td>Intensity (% 1-RM)</td>
<td>60-80</td>
<td>85-100</td>
</tr>
<tr>
<td>Repetitions</td>
<td>6-20</td>
<td>1-5</td>
</tr>
<tr>
<td>Sets</td>
<td>3-6</td>
<td>5-12</td>
</tr>
<tr>
<td>Rest between sets (min)</td>
<td>2-4</td>
<td>4-5</td>
</tr>
<tr>
<td>Concentric tempo (sec)</td>
<td>1-10</td>
<td>1-4</td>
</tr>
<tr>
<td>Eccentric tempo (sec)</td>
<td>4-10</td>
<td>3-5</td>
</tr>
<tr>
<td>Total set duration (sec)</td>
<td>40-70</td>
<td>&lt;20</td>
</tr>
<tr>
<td>Exercises per workout</td>
<td>6-12</td>
<td>1-4</td>
</tr>
</tbody>
</table>

The guidelines in Table 1 are not a guarantee for developing or avoiding
hypertrophy. Individual responses in the degree of hypertrophy appear to be related
to an individual's sex, maturity, distribution of fiber types, somatotype, initial
training status, duration of training, and intensity of training (Beunen & Malina,
1996; Blinkie & Bar-Or, 1996; Blimki & Sale, 1998; Goldspink, 1992; Hakkinen &
Pakarinen, 1995; MacDougall, 1992; Moritani, 1992; Tittel & Wutscherk, 1992;
Zauner et al., 1989). Periodization (the timing and sequencing of training) may also
be an important determinant of the development of strength and hypertrophy.
There are numerous types of periodization (e.g., Baker et al., 1994; Bompa, 1993;
Fleck & Kraemer, 1987; Koch, 1994), but little research has been performed to
determine their influence on hypertrophy. Not all gymnastics coaches use
periodization, and there is no agreement on the kind of periodization that results in
maximal strength and minimal hypertrophy.

Strength Training for Gymnasts

In our long experience of gymnastics, gymnasts do not and cannot follow the
guidelines for minimizing hypertrophy in Table 1 by using body weight as the only
resistance. The typical elite female gymnast can perform far more than 1-5
repetitions of gymnastic-specific skills. For example, in physical-ability field tests
prior to the Sydney Olympics, the US senior national team produced the following
maximum numbers of repetitions: handstand push ups, 13 ± 8 (mean ± standard
deviation); press handstands, 7 ± 4; and cast handstands, 10 ± 5 (unpublished data,
WA Sands, 2000). Paradoxically, these results show that typical gymnastics strength
training consisting of repetitions of skills is more likely to maximize hypertrophy
than relative strength.

Training with added weights is the only practical way to bring the repetitions-
maximum into the range for minimizing hypertrophy. Zatsiorsky recommended
"training with the greatest weights possible, with a small number of repetitions and
large intervals of rest between sets" (quoted by Trifonov & Yessis, 1986, p 44).
Zatsiorsky's ideas are entirely consistent with Poliquin's guidelines for minimizing hypertrophy.

An increase in maximal strength "is always connected with an improvement of relative strength and therefore with improvement of power abilities" (Schmidtbleicher, 1992, p 384). Strength gained by any means should therefore be beneficial, as long as the strength conforms to gymnastic-specific movements. However, strength training of irrelevant muscles and movements may add size and weight to a gymnast without benefiting performance. Unfortunately, gymnastics weight training programs have often reflected a body-building approach, by incorporating too many exercises involving muscles and movements that are scarcely involved in gymnastics skills (Pearl, 1986). Gymnastics-relevant lifts and exercises may be reduced to only four: squats, presses, pull downs, and deadlifts. Two common exercise variations that can be included are a front raise and straight-arm pull down. Weight-training programs that follow the guidelines of Poliquin for maximizing relative strength are available for gymnasts (Plotkin et al., 1989; Sands & McNeal, 1997).

**Effects of Weight Training on Body Build**

The literature on weight training and gymnastics includes conditioning programs and case studies (Chu, 1994; James, 1987; Colombo, 1999; Marina and Rodriguez, 1999; Pearl, 1986; Plotkin et al., 1989; Sands et al., 1997; Trifonov & Yessis, 1986), but there are no reports on the effects of weight training on body build. Anthropometry on gymnasts during preparation camps prior to the Sydney Olympics indicates that weight training does not cause gymnasts to bulk up (unpublished data, WA Sands, 2000). The gymnasts were 33 US national team members, 14 of whom weight trained for two or more sessions per week. In spite of being older (18.1 ± 2.0 vs 16.5 ± 1.0 y), these gymnasts were lighter (48.0 ± 5.4 vs 52.1 ± 5.9 kg), had a lower body mass index (20.3 ± 1.9 vs 21.7 ± 1.9), and were slightly shorter (153.5 ± 4.0 vs 154.9 ± 4.3 cm) than the members of the team who did not weight train. More detailed anthropometry on these gymnasts was not permitted, owing to concerns about body fat and the potential for triggering eating disorders (Nattiv et al., 1994; Nattiv & Mandelbaum, 1993; Noden, 1994; Rosen & Hough, 1988; Wilmore, 1996).

**Effects of Weight Training on Adolescent Growth**

A major concern of gymnastics coaches is that weight training will magnify the increases in muscle and body mass that occur during the adolescent growth spurt. Unfortunately research has not provided clear answers to the link between growth and training-related size increases (Blimkie & Sale, 1998), and coaches can rarely determine if an increase in rate of change of size, mass, or shape is due to training or maturation. Attribution of normal growth to the effects of weight training may have led to the concerns about the effects of weight training on body build.

**Conclusion**

Coaching folklore condemning weight training for gymnasts is probably misguided. Weight-training workouts that develop strength with minimal muscle hypertrophy are likely to enhance the performance of female gymnasts. The current skill-repetition approach to developing strength in female gymnasts may cause more hypertrophy than a well-designed program of weight training in the short term, but the relative effect of these forms of training on muscle growth during maturation is unknown.

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Edited and webmastered by Will Hopkins.
Published December 2000.
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