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Investigation of the Injury Rate of Female Fitness Competitors

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ABSTRACT

BACKGROUND: Female fitness competitions are increasing in popularity. Athletes are participating in weight-cutting protocols to help reduce body fat percentage to improve muscle definition and physique.

METHODS: The goal of the study was to investigate weight-cutting practices and determine if these practices were associated with increased injury rates. A survey was distributed at a New England fitness competition.

RESULTS: Thirty-five female fitness competitors participated in the survey at a single competition. The calculated injury rate for female fitness competitors is 0.18 injuries per 1000 hours of training. Age over 35 (p=0.014) and a history of or current eating disorder (p=0.005) were significant risk factors for sustaining an injury. Menstrual cycle abnormalities were present in 11 of 35 individuals (31.4%).

CONCLUSIONS: Female fitness competitor injury rates are low; however, injuries were more common in athletes over age 35 and those with either a history of or a current eating disorder.

KEYWORDS: female athlete triad, bone health, injuries

INTRODUCTION

Female fitness competitions are an emerging form of physique competitions with distinct goals in comparison to female bodybuilding competitions. Competitors are graded on their physiques with hopes to obtain professional status and endorsements. There are different categories to compete, which vary between organizations but generally are based on the participants' muscle mass. Multiple organizations around the world sponsor these competitions. Preparing for these competitions requires rigorous discipline in both exercise and diet, possibly predisposing these athletes to the female athlete triad: decreased energy availability, abnormal menstrual function, and decreased bone mineral density.[1] Female bodybuilders and fitness competitors are also at risk for developing addictive behaviors characterized by exercise dependence and muscle dysmorphia.[2]

Female athletes participating in activities, such as ballet or gymnastics, or those who exhibit prolonged restrictive eating are especially vulnerable to developing conditions of the female athlete triad.[1] Females with these physiologic sequelae have a higher risk for sustaining an injury. A recent prospective multicenter study suggested that in young girls participating in prolonged exercise and demonstrating risk factors related to the triad had a 30%–50% increase in the incidence of bone stress injuries.[3]

To date there is no literature available on the increasing popular activity of female fitness and physique competitions. The safety of their practices has yet to be evaluated because there is currently no research investigating how females are preparing and training for the events. During the weight-cutting phase of training prior to an event, these competitors will restrict their caloric intake, and to date there is no evidence of how low a caloric intake they will consume and how often they exercise. In our study, we sought to evaluate the rate of injuries in females competing in fitness modeling and to identify potential risk factors associated with these injuries so that healthcare professionals and coaches can better counsel this athletic population.

METHODS

A written fill-in-the-blank style survey was designed to investigate female fitness competitor demographics, dietary habits, eating disorder history, and injuries sustained during the last year of training. (**See Appendix Questionnaire**) The survey was done in United States customary units and mathematically converted to SI units. Our first step to understanding this problem was to use the survey to characterize the injuries that women develop during active participation in training for these competitions. The survey was designed by the authors and distributed to amateur and professional fitness competitors in person at a USA Northeast regional fitness competition. Informed consent and risks of participation in the survey were discussed with the participants. Participation in the study was voluntary and anonymous. The study was reviewed by the Institutional Review Board at Lifespan/Rhode Island Hospital.

Statistical analysis was performed utilizing Microsoft Excel (Microsoft Corporation, Redmond, WA) and StatPlus: LE (AnalystSoft Inc, Walnut, CA). A P value of <0.05 was defined as statistically significant. Analysis of the injury

rates over the defined time period allowed calculation of incidence. Fischer Exact tests were performed to identify differences between subgroups. The age subgroup calculations were performed by categorizing the age based on categories 20–25, 25–30, 30–35, 35 and older. Overall injury rate per athlete per year and number of injuries per 1000 hours of exercise were calculated.

RESULTS

Thirty-five surveys (31 amateur and 4 professionals) were distributed and completed (100% response rate) by female fitness competitors at single fitness competition (**Table 1**). The average age was 26.9±3.8 (range 22-38). The average height was 63.3±2.1 inches (range 60-68) [160.8 cm (range 152.4–172.72)] and the average precutting weight was 131.1±8.7 lbs. (range: 120-160) [59.3 kg (range 55.4-72.6)].

Table 1. Demographics of Female Fitness Competitors

Best describes you?	35 fitness competitor (100%)
Amateur or professional?	31 amateur, 4 professional
Average Age	26.9±3.8 yr.
Average Height (in.)	63.3±2.1 in.
Average pre-weight cutting weight (lb.)	131.1±8.7 lb.
Competition weight (lb.)	109.4 lbs. ±20.6

There was a significant decrease in average weight at time of competition (109.4 lbs. ±20.6 [range: 100–145]) [8.5 kg (range 2.7–13.6)](p<0.0001). The average lowest calorie consumption during weight cutting was 1137.6±137 (range: 800–1450). Eleven (31.4%) reported abnormal menstrual cycles. Two (5.7%) reported an eating disorder (1 bulimia nervosa, 1 binge eating). Calcium and vitamin D supplements are taken by 62.9% of all competitors. No competitors reported ever using anabolic steroids. The average hours of training per day were 2±0.62 (range: 1–3). The total hours of training for the group (n=35) was 625.3 hours per competitor and the total number of injuries reported by all the participants in the last year was 4 (1 rotator cuff tear/tendonitis, 1 shin splints, 2 low back strains) resulting in incidence of 0.18 injuries per 1,000 hours of training. No fractures or stress fractures were reported. Fischer Exact tests revealed that eating disorders are associated with injuries (P=0.014) and age older than 35 is associated with injuries (P=0.005).

DISCUSSION

Injury rate studies have been performed on a variety of fitness related competitors and participants. Siewe et al surveyed 71 competitive and elite male bodybuilders and found they had 0.24 injuries per 1000 training hours.[4] Our reported rate of injury in female fitness competitors is 0.18 injuries per 1000 hours. Our female fitness competitors surveyed had a lower injury rate than other competitive fitness and sporting activities, but we recognize that we only had a survey size of 31 athletes. Siewe surveyed 245 competitive and elite powerlifters and found a 0.3 injuries per 1000 training hours.[5] Winwood surveyed 213 strongman athletes and found 5.5 injuries per 1000 hours.[6] Australian competitive calisthenics was found to have an injury rate of 1.1 per 1000 training hours in a prospective 12 month study by Leaf et al in 550 elite and non-elite participants.[7] The calculated injury rate per 1000 hours of training in our group of female fitness competitors was lower than the previous studies of powerlifters, strongmen, and competitive calisthenic participants. [5-7]

Risk factors for sustaining an injury in female fitness competitors were found to be athletes with either a history of an eating disorder or age over 35. However, due to the nature of the study design, we were unable to delineate if the injuries were related to overuse or the direct result of a traumatic event. There was not a statistical significant difference with the presence of a regular menstrual cycle and injury rates. None of the athletes included in the study had a history of fracture in the past year. The injuries found in this study were similar to other injuries described in other studies involving a resistance training population.[5,8,9]

The bodybuilding culture is predominated by muscle size which inevitably has a relationship to anabolic steroid use.[10] The prevalence of steroid use among female fitness competitors and bodybuilders is not truly known as there is little evidence of testing these competitors in the literature and on competition websites. Male steroid users have been noted in the literature to have an increased rate of cardiac complications including early heart failure and an increased risk of tendon ruptures.[11,12,13] Our study on female fitness competitors did not identify any anabolic steroid use among the participants surveyed.

The range of lowest caloric intake during competition preparation was 800 to 1450 kcal with the average being 1138.3 kcal. Given the retrospective nature of the survey, we relied on estimation by the athlete and did not inquire how they calculated these numbers. This represents a severe caloric restriction during preparation. The athletes on average lost 18.7 lbs [8.5 kg] from pre-competition weight to competition weight. We did not inquire about the number of weeks preparing for the competition or types of supplements used to obtain this weight. Further studies should be done prospectively to specifically evaluate how these competitors lose weight for competition and how they gain weight after competition in hopes to learn more about the physiology and if there is a propensity towards developing an eating disorder.

There are several limitations to our study, which may explain why our injury rate was lower than other studies. Participants may not have admitted to having injuries or answered other questions in a biased way. There is an inherent recall bias when asking athletes to remember how

many injuries they suffered in the past year. The survey was anonymous to attempt to achieve the most accurate responses from the participants. Our survey was designed by this research team and has not been formally validated in any previous studies. Trends in training and philosophy on preparation for the competitions can lead to inherent limitations of the study results. Our study participants were from a regional competition where there are a limited number of coaches for these athletes. Furthermore, long-term risks of competing in multiple competitions also needs to be evaluated in regards to long-term safety, injury risk, and possibility of developing an eating disorder as this is unknown to date in this population of athletes. Finally, 31 surveys are not enough to generalize causality between training hours and injury rates among female athletes. A larger national study should be performed to better characterize the population of female fitness competitors in regards to injury rates and training/competition preparation characteristics. However, this survey acts as the starting point to understanding training patterns, diet, and physique characteristics among a specific population of female athletes that will guide subsequent surveys and even potential interventions.

CONCLUSION

Female fitness competitors have a low injury rate of 0.18 injuries per 1000 hours of training in the short-term. Long-term injury risk and health complications were not evaluated as part of this study. The risk factors associated with injury in our study were age over 35 and athletes either with an active eating disorder or history of an eating disorder. Coaches and healthcare professionals should be aware of the unique training and nutrition characteristics of this group of athletes to improve the safety of this sport. Coaches can use the data on average amount of weight lost per competition to help improve the protocols they give to athletes preparing for competition to ensure that weight loss is not too rapid. Further studies need to be performed to improve practices and learn from these competitors to better provide coaching support and appropriate healthcare recommendations.

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Female Fitness Questionnaire

http://rimed.org/rimedicaljournal/2020/09/2020-09-68-contribution-waryasz-appendix.pdf