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An Examination of Current Practices and Gender Differences in Strength and Conditioning in a Sample of Varsity High School Athletic Programs

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Abstract

Currently, little is known about strength and conditioning programs at the high school level. Therefore, the purpose of this research was to explore current practices in strength and conditioning for varsity high school athletes in selected sports. Specifically examined were: who administers programs for these athletes, what kinds of training activities are done, and whether the responsible party or emphasis changes depending on the gender of the athletes. Coaches of varsity soccer, basketball, and softball/baseball in three large Idaho school districts were asked to complete an online survey. Sixty-seven percent (32/48) of the questionnaires were completed and used for the study. The majority of coaches (84%) provided strength and conditioning opportunities for their athletes, although only 37% *required* participation. Strength training programs were designed and implemented primarily by either physical education (PE) teachers or head coaches. Compared to coaches of male athletes, coaches of female athletes were less likely to know the credentials of their strength coaches, and they were less likely to use certified coaches to plan and implement their strength and conditioning programs. Most programs included dynamic warm-ups and cool-downs, plyometrics, agility training, speed training, and conditioning, and most programs were conducted three days a week (76%) for sessions lasting between 30 and 59 minutes (63%). Compared to their female counterparts, male athletes were more likely to have required training, participate in strength training year round, and train using more sessions per week. This study provides additional information related to the practice of strength and conditioning in a sample of high school athletic teams.

Keyword: gender differences, resistance training, adolescents

Introduction

More than half (54%) of all high school students nationwide participated in school athletics during the 2005-2006 school year; out of the 7 million high school athletes, 4.2 million are male and 3 million are female (25). As high school sport participation continues to grow for both genders (20), so has the interest in improving athletic performance through strength and conditioning programs. Athletic strength and conditioning practices typically consist of progressive resistance training and other modalities for increasing athletic performance (e.g., plyometrics, dynamic warm-ups, etc.). Several experts maintain that in addition to improving athletic performance, strength and conditioning programs help athletes maintain a healthy body weight, strengthen ligaments and tendons, develop pliable soft tissue, increase motor fitness skills, develop lifelong exercise habits, and potentially decrease injury risk (2,10,12,30).

Given the growth in high school athletics and the emphasis on strength and conditioning in many programs, a need exists for more information about the practice of this profession. Researchers have examined strength and conditioning practices at the collegiate (17,18,22) and professional levels (7-9,24), and most of this research describes education, certifications, experience, job requirements, salary, and demographics of the coaches.

There is a wealth of information about running successful programs for high school athletes (1,13) and effectively training young athletes (10-12,27,28). However, there are only a handful of data-based studies about strength and conditioning practices at the high school level. In 1992, Finamore (14) examined high school strength and conditioning practices in Massachusetts high school football, but the information is less relevant for strength coaches who do not work with football athletes. In a more recent study, Duehring and colleagues (5,6) examined

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the demographics, practices, qualifications, and salaries of high school strength and conditioning coaches, but most of the individuals surveyed were certified by the National Strength and Conditioning Association (NSCA) as Certified Strength and Conditioning Specialists (CSCS) or by USA Weightlifting (USAW, Sports Performance Coach), and gender differences in strength and conditioning practices were not explored. There is a need to expand existing research by surveying a wider variety of coaches (including those who are not certified), examining sports other than football, and exploring gender differences in strength and conditioning practices. It is possible that programs at schools that do not employ certified coaches are significantly different from those that do employ certified individuals, that programs for sports other than football are different, and that gender differences exist that can impact programming.

Given the need for additional information about strength and conditioning programs in high school athletics, the purpose of the research was to: a) determine who is responsible for designing and implementing varsity high school strength training programs in soccer, basketball, and softball/baseball in three large school districts in Idaho, b) examine what kinds of programs they are using, and c) discern whether the responsible party and emphasis of strength and conditioning changes depending on the gender of the athlete.

By determining who is designing and implementing varsity high school strength training programs and what they are doing in this sample, we can make more informed decisions about how to run comparable programs or how to improve upon existing programs. Additionally, this information can be used to determine the best ways to gather data from a large regional or national sample. When more data are gathered, state high school athletic associations and school districts can be provided with recommendations for standards, rules, and regulations for the safety of the athletes and the development of more successful programs. If there are gender differences throughout programs used for high school athletes, this research will increase awareness among individuals in the strength and conditioning field so that they can work optimally with athletes, regardless of gender or sport coached.

Methods

Experimental Approach to the Problem

The aim of this study was to explore various aspects of high school strength and conditioning programs in three major sports offered for males and females at the state level. Specifically, we sought to examine who is conducting strength and conditioning programs for varsity high schools in the selected sports and schools, what kinds of programs they are using, and whether the person responsible and/or emphasis of strength and conditioning changes based on whether the athlete is male or female. This study was a cross-sectional descriptive study that asked participants to complete a questionnaire on surveymonkey.com. Varsity high school coaches of baseball/softball, basketball, and soccer from three large school districts in the Southern Idaho Conference participated in this study. These sports were chosen because they are offered by all the schools in the three districts and they are similar for both males and females. The school districts were chosen because they represent three of the largest districts in the state of Idaho. The three school districts selected were Boise Independent (4 high schools), Meridian Joint (5 high schools), and Nampa (3 high schools).

Subjects

Seventy-five coaches of girls' and boys' baseball/softball, basketball, and soccer in the three targeted school districts were considered potential subjects. Because approval was obtained from only 8 of the 12 targeted schools, the pool of potential subjects decreased to 48. Approval for the project was obtained from the university's institutional review board prior to starting data collection, and it was assumed that the subjects consented to participate when they completed the questionnaire for this study.

Head coaches surveyed were responsible for coaching both male (52%) and female athletes (45%). One head coach worked with both male and female athletes. Head coaches who completed the survey had significant experience as head coaches. More than one-third (39%) had 12 or more years of coaching experience, and 81% played the sport they coach in high and/or college. A summary of the demographic characteristics and experience of the head coaches is presented in Table 1.

[INSERT TABLE 1 ABOUT HERE]

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Procedures

Data Collection. Superintendents, Principals and Athletic Directors were contacted to receive permission to conduct the study. Once permission was obtained, the Idaho High School Athletics website was used to obtain coaches' contact information. Athletic directors provided coaches' contact information when necessary. Coaches were then contacted via email with a link to the questionnaire on surveymonkey.com. Code numbers were given to coaches and they were asked to provide these on the completed questionnaire so their completion rate could be tracked and follow-ups to enhance response rate could be conducted as necessary.

Questionnaire. The questionnaire for this study was based upon and designed following a thorough literature review. Questionnaires examining similar issues were given particular attention, especially as they related to high school strength and conditioning. To enhance the construct and content validity of the questionnaire, three experts in the field provided feedback and consultation and the questionnaire was pilot-tested with a small sample of coaches from the Mountain Home School District in Mountain Home, Idaho. The researchers used a mixed-method quantitative and qualitative approach whereby surveyed coaches were asked to reflect upon and tell their own perspective and story. The questionnaire consisted of open-ended, semi open-ended, and closed questions.

Response Rate. Response rate was increased by sending at least three additional "reminder" emails, approximately one week apart, to those coaches who had not yet responded to the initial email (4). When the study was completed, questionnaire data in aggregate form was available to the researchers through surveymonkey.com. As an incentive, coaches who responded to the survey were provided with results of the study as soon as it was completed. Thirty-four of the 48 possible coaches responded to the online survey, resulting in a response rate of 71%. Upon further examination, two surveys were eliminated because of the lack of information completed by the coach, thus the useable response rate was 67% (32/48).

Statistical Analysis

After four weeks of collecting data on surveymonkey.com, descriptive statistics (e.g., means, standard deviations, percentages, etc.) were calculated. Gender differences in those who served as strength and conditioning coaches for male and female athletes based on education, certifications, and years of experience were examined using Fisher's exact test. Fisher's exact test is a statistical analysis used to determine the relationship between two categorical variables (e.g., gender and education groups in this study) when the observed frequencies in cells are low (19). SAS 9.2 was used to calculate means, standard deviations, and percentages for the quantitative data and to conduct Fisher's exact test. For the open and semi-open ended qualitative questions, three of the authors of the study examined the results, triangulated their findings, and identified important information that was relevant to the study.

Results

Person Responsible for Designing and Implementing Strength Training Programs

Individuals who most commonly designed and implemented varsity high school strength training programs were physical education teachers or head coaches. A small percentage of individuals who designed these programs had other credentials and only one of the individuals delivering programs was a full time certified strength and conditioning professional. Interestingly, 5 of the coaches specified that they did not offer strength and conditioning programs to their athletes (4 were coaches of female athletes and 1 was a coach of male athletes).

Strength Training Practices

The majority of coaches responded that their athletes participated in strength training (84%). The coaches of male athletes were more likely to *require* their athletes to strength train than coaches of female athletes. Even though coaches had concerns that they technically could not require their athletes to strength train, 50% of coaches of male athletes still required their athletes to strength train compared to only 9% of coaches of female athletes.

When examined in aggregate, strength training programs for high school athletes were evenly distributed between being year round (35%) or periodically throughout the school year (31%). Additionally, programs were typically completed three times or more a week (76%) for 30-59 minute sessions (63%). However, when separated by

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gender, fifty percent of the coaches of male athletes had their athletes strength train year round compared to only 17% of coaches of female athletes. Coaches were also more likely to have their male athletes strength train 3 or more days per week (93%) compared to their female counterparts (55%).

The most frequently used type of training was general conditioning (83%), followed by agility training (79%), plyometrics (75%), dynamic warm-up/cool-down (71%) and speed training (71%).

Table 2 presents the resources utilized by the individuals who design strength and conditioning programs for high school athletes in selected sports. The largest percentage of coaches utilized their own ideas (65%), but many also used information from a physical education teacher (62%), the internet (58%), and published books (50%) to design their programs.

[INSERT TABLE 2 ABOUT HERE]

Gender Differences

Table 3 presents data related to gender and strength and conditioning program delivery. Statistically significant gender differences were established relative to who designs and implements strength and conditioning programs (χ^2 (2, 25)=7.71, p=.032). Further partitioning confirmed that coaches of female athletes were more likely to utilize physical education teachers to design and implement their programs and less likely to design their own programs compared to their male counterparts (χ^2 (1, 18)=7.29, p=.013).

[INSERT TABLE 3 ABOUT HERE]

Table 4 presents information about the educational background of individuals who design and implement strength and conditioning programs for these high school athletes. Overall, there were significant gender differences in the educational background of the strength and conditioning coaches in this sample (χ^2 (2, 24)=6.60, p=.039). Interestingly, coaches of female athletes were significantly less likely than coaches of male athletes to know the education level of the individual providing the strength and conditioning programs; additionally, coaches of male athletes were significantly more likely than coaches of female athletes to have a degree in an area unrelated to physical education (χ^2 (1, 10)=6.67, p=.047). Both male and female athletes were equally likely to be coached by a person with a degree related to physical education (χ^2 (1, 19)=3.13, p=.13). For strength and conditioning coaches of female athletes, the most common credential was a Bachelors Degree in Physical Education, and for male athletes, the most common education level of strength and conditioning coaches was a Masters Degree in Physical Education, followed closely by a Bachelors Degree in Physical Education (data not shown).

[INSERT TABLE 4 ABOUT HERE]

Certifications of strength and conditioning professionals in this sample were examined by gender coached. Some individuals held more than one certification but the most frequently held certification for coaches of male athletes was Bigger, Faster, Stronger (BFS) (n = 3) and the National Strength and Conditioning Association's Certified Strength and Conditioning Specialist (NSCA, CSCS) (n = 3). The next most commonly reported certifications were Personal Trainer from the American College of Sports Medicine (ACSM) (n = 1) and Personal Trainer from the International Sport Science Association (ISSA) (n = 1). The only certification held by a strength coach working with female athletes was BFS (n = 1). Overall, a large proportion of individuals who provide strength and conditioning coaching were not certified (n = 8).

Table 5 presents a statistical comparison of the certifications of individuals who provide strength training for these athletes. There were statistically significant differences in certifications by gender coached (χ^2 (2, 29) = 8.59, p=.017). Further partitioning indicated that compared to coaches of male athletes, coaches of female athletes were less likely to know the credentials of their strength coaches (χ^2 (1, 21)=5.74, p=.030) and less likely to be certified (χ^2 (1, 18)=5.95, p=.025).

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[INSERT TABLE 5 ABOUT HERE]

Coaches were then asked an open-ended question about other experience and/or qualifications possessed by the individual who designs and implements their strength training programs. Coaches of both male and female athletes answered that they attended clinics held by college coaches and trainers, workshops, professional development opportunities, or pursued further credentials (e.g., in soccer training and plyometrics).

Table 6 presents a summary of the number of years of experience that individuals had designing and implementing strength training programs. In girls' athletics, half of the coaches (5 or 50%) were unsure of the number of years of experience held by the strength and conditioning coach, whereas only one coach of male athletes did not know about the number of years of experience. Gender differences in years of experience were not statistically significant (χ^2 (2, 24)=6.81, p=.069).

[INSERT TABLE 6 ABOUT HERE]

When coaches were asked if they believed there was a different approach to designing and implementing programs for male versus female athletes at the high school level, the majority (60%) of coaches of male athletes said there was no difference, whereas the majority of coaches of female athletes (86%) said there was a difference. Qualitative perspectives on gender differences in the approach to strength training are presented in Table 7. The most frequently mentioned gender differences that should be accounted for in a training program included physiological gender differences (e.g., muscle fiber type, tendons, bones), injury tendencies (e.g., ACL injuries and muscle imbalances), and motivational differences between males and females.

One coach, who worked with both male and female athletes, was concerned that "girls are not challenged to work as hard as the boys, perhaps due to the perception girls are to be 'dainty' and 'not to sweat too hard.' With that noted, a coach of female athletes commented that male athletes are often times pushed more to participate in high school fitness programs either in strength training with coaches or physical education classes for athletes. A coach of female athletes stated, "I wish I could get more of my athletes involved in a good program. I am not sure that I have serious enough athletes to do that." Another coach of female athletes expressed that, "I believe that although strength training would help some athletes, the majority of them do not have a strong enough skill base to warrant serious strength training." In sum, the responses of the coaches of female athletes who commented on this open-ended question infer that female athletics are not as important or that female athletes are less serious than their male counterparts.

[INSERT TABLE 7 ABOUT HERE]

Among the coaches of males and females who believed that there is a difference in strength training practices, a significant proportion (43% and 57%, respectively) thought the differences were accounted for in current strength training practices. Ways in which gender differences in strength training were accounted for include: additional jump landing training provided to prevent ACL injuries, "female-preferred" conditioning practices were added/adopted (e.g., pilates, yoga, training for muscular endurance) to enhance motivation, and weight loading was adjusted based on body size and muscular strength of females. Additional suggestions for continuing to improve upon strength and conditioning practices for male and female high school athletes include offering gender and/or sport specific conditioning programs (n = 4), offering physical education classes that focus on strength and conditioning for athletes (n = 3), and offering more training/certifications for high school coaches in strength and conditioning so they can design and implement their own programs (n = 3).

Discussion

The most important findings in this research were that: (a) the majority of coaches (84%) provided strength and conditioning opportunities for their athletes and they are using somewhat typical activities for their programs; (b) physical education teachers and head coaches conducted most of the programs; (c) of those delivering programs, few are certified, and, (d) many gender differences existed in terms of who designed and implemented programs (and how much was known about those individuals), whether or not the programs were provided and/or required, and how often training was conducted.

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It was encouraging that based on our research, the majority of coaches are providing opportunities for high school athletes to participate in strength and conditioning programs. This opportunity for strength and conditioning programs is not surprising because research suggests that strength training has a profound benefit on athletic performance (15). When strength training is combined with other types of activities such as plyometrics, dynamic warm ups, or speed training, the benefits increase exponentially (3,23,27,29). Therefore, it is positive that the majority of high school athletes in these Southern Idaho districts and sports surveyed are providing strength and conditioning opportunities for their athletes. Unfortunately, there were five coaches who did not offer strength and conditioning programs for their athletes. A disproportionate number of coaches of female athletes did not offer these programs compared to their male counterparts. This finding could lead to increased and unnecessary injuries and/or a failure of athletes to reach their potential, all of which could negatively impact their decision to remain active in sport. The lack of strength and conditioning in female athletes could also be due to some of the perceptions about gender brought to light in the qualitative data presented. To date, there are no national or state-wide databases that track information on strength training practices, especially at the high school level. Clearly, this study demonstrates a need to develop surveillance systems that track strength and conditioning practices at the high school level.

Unfortunately, this study was not able to discern whether or not these programs are safe and/or successful. It was disconcerting that so few providers of strength and conditioning programs at the high schools surveyed were certified and that such a large percentage of coaches of male athletes had degrees in areas outside of physical education or exercise science. Although most physical education teachers have coursework and experience relative to designing, implementing, and evaluating strength and conditioning programs, coaches have various levels of background and training (6). One coach stated, “As a coach I have to trust that the people hired for the fitness job are educated to train my athletes right.” Another coach added, “All strength training teachers should be certified by a nationally recognized organization.” Due to the constant influx of new conditioning strategies and programs, it is helpful for coaches and teachers to pursue education and/or certifications in the area of strength and conditioning. This should enable professionals in this area to have a wider array of knowledge that will be beneficial to their athletes. While studies exist that track the safety and effectiveness of college-level programs, few studies exist that track the safety and effectiveness of programs at the high school level, especially with female athletes.

We reported that individuals who design and implement strength training programs for varsity athletes in the Southern Idaho Conference possess a wide range of education, credentials, and experience. Despite these differences, our findings are in agreement with Twist and Hutton (27) who reported that team coaches, not necessarily certified or credentialed professionals, are designing and implementing high school strength training programs.

It was not surprising that physical education teachers and coaches are providing the majority of design and instruction in strength training and conditioning for both male and female high school athletes in Southern Idaho. A recent study by Duehring and colleagues (5) that surveyed certified high school strength and conditioning coaches found that 76% of those coaches also taught a physical education conditioning class. An Athletic Director in one of the districts surveyed stated that schools typically offer an “accelerated” physical education class for athletes. An “accelerated” physical education class is a class that provides advanced skills, concepts, and activities to students because of the advanced physical/athletic abilities of the student. In many cases the students have to be playing a sport during the semester they are enrolled in the class. “Accelerated” physical education is also referred to as the Athletic Fitness class and the Advanced Physical Education class. With that said, two coaches were concerned that their school did not offer this type of class for their athletes and a coach of female athletes had the concern that there is a bigger push for male athletes than female athletes to get into these classes.

Perhaps the most remarkable findings from this study were the gender differences in the strength and conditioning programs in the schools surveyed. Specifically, gender differences were found in who designed and implemented programs, whether or not the programs were required, and how often training was performed. Some of the attitudinal differences about how gender might impact strength training were noteworthy as well. Coaches of soccer, basketball, and baseball/softball in Southwestern Idaho were more likely to know the education level and certifications of their strength training coach if they coached male athletes than if they coached female athletes. This lack of knowledge about strength training coaches’ background may indicate the low priority placed on strength training for coaches of female athletes. In addition, compared to their female counterparts, male athletes were more

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likely to strength train year round and train using more sessions per week. These findings are in agreement with studies conducted at the collegiate level (16,21,26).

It was interesting that strength and conditioning coaches of female athletes were less likely to be certified compared to their male counterparts. This finding could point to a trend in this sample toward hiring high school strength training coaches for male sports who are certified. It is also possible that strength training coaches of male athletes are more likely to obtain certifications after they are hired in an effort to enhance their skills in the highly competitive world of male high school sports. Despite so few individuals having credentials such as CSCS or USA Weightlifting, a large percentage of strength training coaches in this sample were interested in obtaining certifications and enhanced education. It was also encouraging to note that coaches of both male and female sports sought continued education through workshops and other training. Perhaps a key to improving both male and female high school sports is to continue to educate athletic directors, principals, and others in charge of hiring about the importance of appropriate training for strength and conditioning coaches, whether in the form of academic degrees, credentials, experience, or certification.

The fact that strength training was less likely to be required for girls than boys, and that female teams conducted less strength training than their male counterparts is disconcerting. One coach of female athletes explained the belief that athletes at high levels "got to such a high level through playing the sport as opposed to strength training." However, findings from this study concurred with the results of Poiss et al. (21), who determined that coaches of male athletes were more likely to require strength training than coaches of female athletes. Poiss et al. (21) also concluded that adolescent male athletes believed only male athletic performance could be improved with strength training whereas female athletes believed that female *and* male athletic performances could benefit, which indicates that traditional gender identities exist at all levels.

Given the health and performance benefits of strength training (2,10,12,30), it is unclear why coaches of females emphasize this important aspect of athletic success less than coaches of males. Perhaps factors such as traditional gender identities (e.g., the fear of young female athletes "bulking up") and the lack of female role models who know and understand the importance of strength training for both genders are impeding progress in strength and conditioning for female athletes. However, because these hypotheses were not specifically tested, these concepts need further exploration.

Coaches of male athletes also viewed strength training differently than coaches of female athletes. The majority of coaches of male athletes (60%) think that the approach to strength training should not differ based on gender, whereas the majority of coaches of female athletes (86%) think that gender does matter when it comes to strength training practices. Coaches' ideas of gender differences in approach could impact female athletes significantly because there may be a noteworthy difference between results, adherence, and participation in female athletes who are being coached by strength coaches who perceive gender differences compared to those who do not perceive such differences.

According to Faigenbaum (11), improvements in physique, body composition, and physiological responses are three of the main differences between males and females that need to be considered when designing and implementing strength training programs. In this study, coaches of female athletes were well aware of a possible difference in approach to designing and implementing programs whereas less than half of coaches of male athletes were aware of these potential differences. Because so little research exists in this area (e.g., gender differences in approaches to strength training), there is a need to expand the research base and educate individuals responsible for designing and implementing strength training programs for both male and female athletes.

Although several novel findings were reported, this study is not without limitations. The sample size was small, it was not random, and it was representative only of three of the largest school districts in Idaho in three sports. If this study was conducted in a state such as California or Texas, where a much larger proportion of the school-aged population participates in athletics, and where strength coaches may be more likely to need certifications to obtain employment, these results may have been different.

Despite limitations, the response rate of the schools that were eligible to participate was relatively high (67%), the distribution of coaches of male and female sports was relatively equal, and the findings are novel. In the future, it would be beneficial to expand the survey to the regional or national level using a random sample of coaches. It

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would also be interesting to examine whether strength training practices differ based on the size of the school (e.g., 5A versus 1A), or across different sports or conferences.

Practical Applications

This study increased knowledge about the strength and conditioning practices and credentials of coaches of female and male athletes in three major high school sports in a selected sample at the state level. The most important findings were that physical education teachers and coaches designed and implemented strength training programs for high school athletes, and that gender differences exist in the education, certifications, and time commitment and emphasis of strength and conditioning programs in high school athletics. It was also noteworthy that so few individuals in Idaho who provide strength and conditioning to high school athletes were certified by the NSCA or other qualified organizations and that five coaches did not offer strength and conditioning programs for their athletic teams. These findings point to a need for activity at the state level to increase education and outreach efforts. States need more tools, information, and data to advance the science and practice of strength and conditioning with high school athletes.

If individuals with higher levels of experience, education, and credentials at the high school level are providing programs, athletic success should increase, and high rates of overuse, overtraining, and burnout may be prevented. However, we cannot make these types of claims without knowing more about existing practices at the high school level. By making a case for using credentialed individuals in strength training, and using data to support this premise, additional policies and procedures could be implemented, which would enhance the reputation of our field and perhaps provide additional job opportunities for credentialed individuals. By educating administrators responsible for hiring strength and conditioning professionals, both male and female athletes could benefit—in terms of reduced injury rates, enhanced performance, and perhaps even new career considerations (10,11,28,30).

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Table 1. Subject Characteristics.

Variable	**Mean ± SD**	**Percentage (%)**	**Number (n)**
Age (y)	38.75 ± 8.13		
School District Employee			
Yes		81	26
No		19	6
Highest Education Level			
Some College		13	4
BS in Physical Education/Related Area		22	7
BS in Unrelated Area		31	10
MS in Physical Education/Related Area		9	3
MS in Unrelated Area		25	8
Gender Coached			
Male Sport		52	16
Female Sport		45	14
Both Male and Female Sports		3	1
Playing Experience in Sport			
College and High School (HS) Experience		59	19
High School Experience Only		22	7
Played Other Sports-College & HS		13	4
Played Other Sports-HS		6	2
Years Experience as a Head Coach			
0-3		16	5
4-7		26	8
8-11		19	6
12 or more		39	12

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Table 2. Resources Used by the Individuals Who Design Strength and Conditioning Programs.

Resource	**Percentage (%)**	**Number (n)**
Own Ideas	65	17
Physical Education Teacher	62	16
Internet	58	15
Published Book(s)	50	13
Certified Professional	46	12
Journals of Professional Organization	35	9
Magazines	23	6
Unsure	23	6
Other	12	3

Notes. Respondents could reply that they utilize more than one resource. Other resources included: experience playing college sports, help from other coaches, and information from Bigger, Faster, Stronger and university-level strength and conditioning programs.

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Table 3. Individual Responsible for Designing and Implementing Strength and Conditioning Programs by Gender Coached.

Individuals Who Design and Implement Programs	**Percentage (%) for Female Athletes**	**Number (n)**	**Percentage (%) for Male Athletes**	**Number (n)**
Physical Education Teacher	64	7	29	4
Head Coach (Self)	0	0	50	7
Other (including other coach or staff or a certified professional)	36	4	21	3

Notes: Because observed frequencies in cells were low, some cells were collapsed and Fisher's exact test was used to examine statistical differences (McDonald, 2009). Statistically significant gender differences were established with χ^2 (2, 25)=7.71, p=.032. Further partitioning confirmed that coaches of female athletes were more likely to utilize physical education teachers to design and implement their programs and less likely to design their own programs compared to coaches of male athletes (χ^2 (1, 18)=7.29, p=.013). Five (5) coaches did not offer programs for their athletes. Two (2) coaches did not answer this question so the percentages were calculated based on complete questionnaires for 11 for coaches of female athletes and 14 for coaches of male athletes.

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Table 4. Educational Background of the Strength and Conditioning Professional by Gender Coached.

Highest Level of Education	Percentage (%) for Female Athletes	Number (n)	Percentage (%) for Male Athletes	Number (n)
Bachelors, Masters, or Doctoral Degree In Physical Education or Related Field	60	6	57	8
Unrelated Bachelors, Masters, or Doctoral Degree	0	0	36	5
Unsure	40	4	7	1

Notes. Because observed frequencies in cells were low, some cells were collapsed and Fisher's exact test was used to examine statistical differences (McDonald, 2009). Statistically significant gender differences were established with χ^2 (2, 24)=6.60, p=.039. Further partitioning indicated that compared to coaches of male athletes, coaches of female athletes were more likely to be unsure about the educational background of their strength and conditioning coaches, and they were less likely to have a person with a degree unrelated to physical education designing their programs (χ^2 (1, 10)=6.67, p=.047). There were no statistical gender differences between the number of strength and conditioning coaches who had a degree in physical education or a related field (χ^2 (1, 19)=3.13, p=.13). Three (3) coaches did not answer this question so the percentages were calculated based on 24 complete questionnaires (10 for coaches of female athletes and 14 for coaches of male athletes).

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Table 5. Certifications Held by Professionals Providing Strength and Conditioning Programs by Gender Coached.

Certifications	**Number of Certifications for Coaches of Female Athletes**	**Number of Certifications for Coaches of Male Athletes**
Certified (See below for list of certifications held)	2	9
Not Certified	1	7
Unsure	7	3

Notes. Certifications held: American College of Sports Medicine (Personal Trainer Certification); National Strength and Conditioning Association (Certified Strength and Conditioning Specialist); International Sport Science Association (Personal Trainer Certification); Bigger, Faster, Stronger; Other certification (Non-Specified)

Because observed frequencies in cells were low, some cells were collapsed and Fisher's exact test was used to examine statistical differences (McDonald, 2009). Statistically significant gender differences were established with $\chi^2(2, 29)=8.59$, $p=.017$. Further partitioning indicated that compared to coaches of male athletes, coaches of female athletes were less likely to know the credentials of their strength coaches and less likely to be certified ($\chi^2(1, 21)=5.74$, $p=.030$).

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Table 6. Years of Experience for Strength Coaches by Gender Coached.

Years of Experience	Percentage (%) for Female Athletes	Number (n)	Percentage (%) for Male Athletes	Number (n)
Unsure	50	5	7	1
Less Experienced (0 – 3 yrs)	0	0	14	2
Experienced (4 – 7 yrs)	10	1	29	4
Highly Experienced (8 or more years)	40	4	50	7

Notes. Because observed frequencies in cells were low, some cells were collapsed and Fisher's exact test was used to examine statistical differences (McDonald, 2009). Gender differences in years of experience were not statistically significant with $\chi^2(2, 24)=6.81$, $p=.069$. Three (3) coaches did not answer this question so the percentages were calculated based on 24 complete questionnaires (10 for coaches of female athletes and 14 for coaches of male athletes).

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Table 7. Qualitative Perspectives on Gender Differences in the Approach to Strength Training.

Qualitative Perspective	Supporting Quotes
Gender Difference in Approach to Strength Training (Specific Reasons Given)	Physiological gender differences (muscle fiber type, tendons, bones, etc.) (n = 6)
	Gender difference in injury tendencies (ACL injuries, muscle imbalance, etc.) (n = 4)
	Female athletes are not as motivated or encouraged to perform strength training compared to males (n = 3)
	Compared to male athletes, female athletes have less experience in strength and conditioning so coaches need to spend more time training them (n = 3)
	There is a gender difference in weights utilized based on body size and strength (n = 2)
	Males are pushed to join strength and conditioning programs more than females (n = 1)
	Strength and power are promoted for males and muscular endurance and other activities (e.g., core, yoga, aerobic exercise) are promoted for females (e.g., core, yoga, aerobic exercise) (n = 2)
	Sport emphasis in males is different from that in females (e.g., physical contact vs. finesse) (n = 1)
Gender Difference in Approach to Strength Training (Unspecified)	(n = 3)
No Gender Difference	There is no difference in strength training relative to sport or gender (n = 3)
	There is no gender difference in strength training – but there is a difference by sport (n = 3)
	Workouts are specific to individuals based on experience and sport, not gender (n = 3)