

## Evaluation of Concussion History in Semi-Professional Female Soccer Players

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### Abstract

**Objective:** To examine the concussion history through a questionnaire for female soccer players in order to formulate potential risk factors and discover characteristics unique to this population.

**Design:** Administer a survey based questionnaire evaluating concussion history among the athletes in the New York Metropolitan Women's League.

**Results:** Of 105 individuals, 65 (61.9%) reported concussions during their career. Of that 65, only 33 were medically diagnosed with a concussion and the majority of individuals suffered three or less concussions (63.1%). Five players reported that they suffered from 10 or more concussions. Only 41 of 105 individuals reported the presence of a medical team on site to aid with injuries. Further analysis revealed correlations between increasing age ( $p=0.0162$ ), increasing experience ( $p<0.0053$ ), and increasing number of headers ( $p=0.0107$ ) with concussion rates. Those who played multiple positions were more likely to suffer from concussions ( $p=0.03556$ ).

**Conclusions:** The lack of education about concussions is a major area of concern with the population studied. Only 52% of individuals surveyed reported ever receiving any education about concussions, highlighting a need for better concussion education for players and ancillary staff. Providing basic training to coaches and ancillary staff to evaluate for concussions might be a viable option to prevent early return to play and increased rates of concussions.

**Keywords:** concussion, traumatic brain injury, athletic training, rehabilitation.

### INTRODUCTION

In a study of concussions amongst a population of semi-pro female soccer players, the data collected seeks to find identifiable risk factors that correlate with concussion frequency, possible long terms effects of concussions, and ways to increase awareness.

A concussion is a transient loss of normal brain function in response to brain injury. It is a subset of mild traumatic brain injury that is self-limited. Concussions are commonly encountered injuries associated with sports from direct contact with the head. Symptoms may not start right away, but can involve nausea, vomiting, dizziness or tiredness lasting up to days or

weeks. Soccer is a contact sport that involves kicking, dribbling and heading a ball. There is contact with the opposing team especially during dribbling and challenging for aerial balls. Concussions could occur in such circumstances.

Soccer is becoming increasingly popular in the United States, especially among females due to their recent success in the FIFA World Cup and Olympic Games. The incidence and nature of concussions in female players must be evaluated, as female players have a higher incidence of concussions in soccer<sup>1</sup> and overall when playing sports.<sup>2,3</sup> In high school athletes, womens' soccer has the second highest rate of concussions, behind only American football.<sup>4</sup> Among female middle

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school children, concussion rates are increased in younger players than older players.<sup>5</sup> Heading the ball accounted for about 30% of these symptoms with no differences in symptom pattern when compared to contact related concussions.<sup>6</sup> While the majority continued to play with the symptoms, some also seek medical attention. Education tends to be a significant problem, as many players are not aware when to stop playing and seek medical attention: a checklist for self-diagnosing concussion can be a reliable primary source for athletes and coaches.<sup>7</sup>

Primary data regarding past concussions must be gathered in order to identify risk factors among the female soccer player population and perhaps devise ways to prevent, better identify, and better care for athletes with concussions.

### METHODS

Data was collected over the Fall 2015 and Spring 2016 season of the New York Metropolitan Women's

**Table 1.** Data revealed through surveying female athletes, showing correlation between concussions and increasing age, experience, and practice hours per week.

	Players Reporting Concussions (n = 65)	Players Without Concussions (n = 40)	p-values
<b>Age (years)</b>			
18 - 24 (n = 23)	8	15	0.0162
25 - 26 (n = 23)	16	7	
27 - 30 (n = 27)	19	8	
31+ (n = 30)	22	8	
<b>Experience (years)</b>			
2 - 19 (n = 26)	9	17	< 0.0053
20 (n = 24)	16	8	
21 - 25 (n = 28)	21	7	
26+ (n = 25)	19	6	
<b>Practice (hours/week)</b>			
0 (n = 41)	19	13	0.2680
1 - 2.5 (n = 32)	18	12	
3+ (n = 30)	28	13	
<b>Game play (hours/week)</b>			
0 - 2 (n = 39)	24	15	0.0887
2.5 - 3.5 (n = 27)	21	6	
4+ (n = 37)	20	17	
<b>Headers/game</b>			
0 - 3.5 (n = 51)	25	26	0.0107
4 - 9 (n = 31)	25	6	
10+ (n = 21)	15	6	

Semi-Professional Soccer League. This cross sectional, retrospective study obtained data from 105 individuals from eight teams in the top division through a survey based questionnaire of the players.

### RESULTS

Table 1 illustrates the female athlete characteristics. The average age of our population was 28.5 years old (range 18-54 years). There was an average of 21.6 years of experience (range 2-45 years). The majority played a midfielder position (39.0%) followed by those playing several or combined positions (21.9%). Defenders made up 18.1% of our population followed by forwards at 15.2% and goalkeepers at 5.7%. On average, participants practiced 2.9 hours/week (range 0-20 hours) and participated in game play 4.6 hours/week (range 1.5-20 hours). An average of 4.5 headers were done per game (range 0-15).

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Table 2 displays the symptoms reported by each athlete. Of 105 individuals, 65 individuals (61.9%) reported that they suffered from concussions during their career. In the concussed group, the majority of individuals suffered three or less concussions (63.1%). Five players from this group reported that they suffered from 10 or more concussions. Though most individuals from the concussed group reported symptoms, only 33 were medically diagnosed with a concussion. Of those individuals, the majority did receive treatment (n=26), however a large group of individuals who reported concussions regardless of a medical diagnosis did continue to play after onset of concussive symptoms (n=25). Despite a high concussion rate in this population, only 32 of

the 65 individuals who did report concussions were prohibited from playing. The average amount of days in prohibition from play after concussion was 13.4 days (range 0-180 days). Of those who were prohibited from playing, the majority did have a medical diagnosis of a concussion (78.8%). These individuals, however, were inhibited from playing for an average of 18.4 days (range 0-120 days) in comparison to their non-medically diagnosed concussed counterparts who were prohibited from playing for an average of 65.8 days (range 7-180). While this difference was not statistically significant (p=0.186), it might indicate that medical management of concussions is needed to speed recovery time and return to play.

**Table 2.** Symptoms reported by survey respondents.

	Players Reporting Concussions (n = 65)	Players Without Concussions (n = 40)	p-values
Dizziness (0 – 21 days)	57 (87.7%)	12 (30.0%)	< 0.00001
Lasting < 1 day	19 (29.2%)	6 (15.0%)	
Lasting ≥ 1 day	38 (58.5%)	6 (15.0%)	
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Nausea (0 – 14 days)	29 (44.6%)	4 (10.0%)	0.00021
Lasting < 1 day	7 (10.8%)	4 (10.0%)	
Lasting ≥ 1 day	22 (33.8%)	0 (0%)	
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Blurry vision (0 – 120 days)	34 (52.3%)	5 (12.5%)	< 0.00004
Lasting < 1 day	10 (15.4%)	5 (12.5%)	
Lasting ≥ 1 day	24 (36.9%)	0 (0%)	
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Confusion (0– 14 days)	33 (50.8%)	6 (15.0%)	0.00023
Lasting < 1 day	7 (10.8%)	4 (10.0%)	
Lasting ≥ 1 day	26 (40.0%)	2 (5%)	
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Medical team present	31 (47.7%)	10 (25%)	0.02063
Medically diagnosed	33 (50.8%)		
Not medically diagnosed	32 (49.2%)		
Received Treatment	26 (78.8%)		
No Treatment	7 (21.2%)		
Continued to play despite symptoms	25 (75.8%)		

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The most common symptom reported was dizziness followed by blurry vision, confusion, and nausea with the majority of each symptom lasting for 1 day or more. Despite the commonality of concussions, only 23 out of 33 individuals medically diagnosed with concussions reported that they received any concussion education before or after their injury. While the education rate is still higher than our general population (52.9% to 69.7%), this may highlight a possible strategy to decrease concussion rates in the female soccer community.

Further analysis revealed several statistical correlations between increasing age ( $p=0.0162$ ), increasing experience ( $p<0.0053$ ), and increasing number of headers ( $p=0.0107$ ) with concussion rates. Of particular interest was the disparity between concussions and position as shown in Table 3. Our preliminary data suggested that the midfield position players had less instances of concussions, but it was then revealed that those who played multiple positions or combined positions (i.e. all positions, defense and midfielder, midfield and forward) were more likely to suffer from concussions ( $p=0.03556$ ).

Individuals in this group who did report a previous concussion were younger than their counterparts (average 27.3 years vs. 30.43 years). This observation was reversed in those playing more traditional, single positions as the average age of those without concussions was 25.8 years old and those with concussions tended to be older, at 30.5 years old. While this result is not statistically significant ( $p = 0.51$ ), it was still notable in that it was a distinct departure from normal trends in concussions and player history. This disparity is also present when comparing average experience between those playing combined positions and those playing single positions. Combined position players with concussions have an average of 21.6 years of experience compared to their non-concussed counterparts at 22.8 years. In those not playing combined positions, non-concussed individuals have a lower average number of years of experience at 17.9 years in comparison to their concussed counterparts at 23.9 years. Direct comparison of the two groups in age, experience, hours spent in practice, hours spent in game play, concussion education, number of headers, and total concussions did not yield statistical significant results. However, both the number of concussions and amount of hours spent in practice were promising ( $p=0.172$  and  $p=0.141$  respectively)

and could benefit from a large sample size as less than a quarter of our participants play a combined position.

Sixty-five out of 105 individuals reported a concussion over their playing career. An additional 16 players also reported concussion symptoms during their playing career despite lacking a reported concussion. Despite the awareness about the high incidence of concussion and potential injury concerns in women's soccer, only 23 out of 105 reported the presence of medical personnel in the soccer games. True medical personnel predominate this group at 34.8% followed by coaches at 26.1% and trainers at 17.4%. Coaches and medical professionals were also reported to play a combined coach/trainer or medical professional/trainer role in five individual reports.

## DISCUSSION

To perform this study, the 105 players were asked a series of questions ranging from the position they played and the number of hours they practiced per week to their awareness of concussive symptoms. The results were shocking in that a staggering 62% reported having experienced concussions while a few players experienced ten or more concussions. Of those concussed, less than 50% reported having medical staff on-site to evaluate the concussion. Increasing age, experience, headers and playing multiple positions were found to be related to increasing rates of concussion in our study compared to past studies where older participants reported less instances of concussion.<sup>5</sup>

An important aspect to address in the concussion issue is the athlete. Several of the soccer players in this study were unclear whether or not they had experienced a concussion, suggesting that the 62% who reported at least one past concussion may be a conservative estimate. To begin combating this issue, athletes and coaches could be offered basic educational workshops on recognizing basic symptoms of head injuries and concussions. By implementing an educational series, this could change the culture of "just walking it off" to a culture of understanding and recognizing brain injuries.

It is important to have a certified athletic trainer, team physician or healthcare provider at an athletic event in order to evaluate whether a player should be removed from play to prevent further risk of injury. Hiring medical staff with this certification has quickly become

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the norm of professional leagues. Unfortunately, hiring staff with these qualifications would not be practical or sustainable in leagues with minimal funding. An alternative solution could be to give rudimentary training to ancillary staff on concussion protocol to determine whether a player should continue playing or when they are safe to return to play.

### CONCLUSION

Despite the recent attention given to traumatic brain injuries in the media and professional sports, the understanding of the long-term effects are still unclear. There is no denying that soccer is a physical sport and that concussions cannot be entirely prevented. Two things are certain though: on site medical staff and player education both play clear roles in identifying and properly caring for a concussion. It is always to the players' benefit to have medical staff on site to administer a proper medical evaluation to determine whether they should remain in the game or sit out. Player and coach education on head injuries, recognition of its symptoms, and caring for concussions should be a necessary part of training in order to raise awareness and knowledge. In the future, identifying long term effects of concussions within the female soccer population will help to further raise awareness and devise treatment plans for patients.

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