



**ABSTRACT:** Despite previous literature examining professional and collegiate athletes, there appears to be no research that has assessed the physical strength and power characteristics of high school lacrosse players by position and class. **PURPOSE:** To determine the physical characteristics (e.g., whole-body muscle strength, lower-body muscle power, and rotational power) of high school lacrosse athletes by position and class. **METHODS:** Nineteen male high school lacrosse players (age: 15.9±1.5 years) completed tests for handgrip strength (HGS) and fatigue (HGF), countermovement vertical jump height (CMJ), and rotational medicine ball throw distance (MBT). Participants were stratified by position: goalies/defenders (n=7) and attackers/midfielders (n=12) and class: lower classmen (n=10) and upper classmen (n=9). Pearson's correlational analyses and independent t-tests were used, with significance at p<0.05. **RESULTS:** No significant differences (p>0.05) were found between positions or class for handgrip strength and fatigue. Goalies/defenders and upper classmen had significantly (p<0.05) greater absolute CMJ height (59.5±6.4 and 58.1±8.1 cm) and MBT distance (641.4±94.6 and 646.3±92.7 cm) compared to attackers/midfielders (47.0±13.6 cm and 511.1±130.6 cm) and lower classmen (45.2±13.8 and 449.7±91.6 cm), but these differences were not significant when normalized for body mass (i.e., relative). Age (r=0.70), body mass (r=0.70), lacrosse experience (r=0.67), CMJ height (r=0.69), absolute and relative HGS (r=0.55-0.60), and HGF (r=0.66) were strongly correlated with MBT distance, highlighting this characteristics importance. **CONCLUSIONS:** Lacrosse performance, as measured by MBT distance, strongly relates to age, body mass, lacrosse experience, lower body power, and whole-body strength in high school lacrosse players by position and class. **PRACTICAL APPLICATION:** When training male high school lacrosse athletes' strength and conditioning professionals should focus on training programs to enhance lower body and rotational power as key performance outcomes.

## INTRODUCTION:

- Within lacrosse, studies have largely found muscular strength or power to be related to lacrosse performance, such as predicting starters over nonstarters (4), having greater shot velocity/technique (2, 6) and speed/agility (4,5), as well as prevention of injuries (6), although not always.
- However, the majority of research done on lacrosse has been on the collegiate, club, and professional levels (1, 2, 4, 5, 6).
- The minimal research done at the high school or youth levels of lacrosse has mainly focused on injuries (3, 5, 6) and/or technique aspects (6), with no work, to our knowledge, exploring performance characteristics by class and position.
- Thus, there is a need to understand physical characteristics at the high school lacrosse level as well as by position and class (i.e., year in school) in order to adequately train athletes for peak performance.

**PURPOSE:** To determine the physical characteristics (e.g., whole-body muscle strength, lower-body muscle power, and rotational power) of high school lacrosse athletes by position and class.

**METHODS:** Nineteen male high school lacrosse players (age: 15.9±1.5 years) completed tests for handgrip strength (HGS) and fatigue (HGF), countermovement vertical jump height (CMJ), and rotational medicine ball throw (MBT). Participants were stratified by position: goalies/defenders (n=7) and attackers/midfielders (n=12) and class: lower classmen (n=10) and upper classmen (n=9). Pearson's correlational analyses and independent t-tests were used, with significance at p<0.05.

**RESULTS:** No significant differences (p>0.05) were found between positions or class for handgrip strength and fatigue. Goalies/defenders and upper classmen had significantly (p<0.05) greater absolute CMJ height (59.5±6.4 and 58.1±8.1 cm) and MBT distance (641.4±94.6 and 646.3±92.7 cm) compared to attackers/midfielders (47.0±13.6 cm and 511.1±130.6 cm) and lower classmen (45.2±13.8 and 449.7±91.6 cm), but these differences were not significant when normalized for body mass (i.e., relative). Age (r=0.70), body mass (r=0.70), lacrosse experience (r=0.67), CMJ height (r=0.69), absolute and relative HGS (r=0.55-0.60), and HGF (r=0.66) were strongly correlated with MBT distance, highlighting this characteristics importance.

**Table 1.** Male high school lacrosse physical characteristic measurements and groupings (n=19).\*

Variable	All Participants (n = 19)	Goalie/Defender (n = 7)	Attacker/Midfielder (n = 12)	Position Cohen's d	Lower Classmen (n = 10)	Upper Classmen (n = 9)	Class Cohen's d
Absolute HGS (kg)	46.4±9.7	51.2±7.0	43.6±10.2	0.79	43.1±10.6	50.1±7.5	0.72
Relative HGS (kg/ m <sup>2</sup> )	70.9±12.4	16.7±2.5	13.8±3.8	0.83	13.7±3.7	16.1±3.2	0.67
Absolute HGF (Post-fatigue HGS, kg)	22.4±3.2	38.0±5.3	33.6±9.0	0.56	32.2±8.1	38.3±6.7	0.77
Absolute CMJ Height (cm)	51.7 ± 12.8	59.5±6.4	47.0±13.6*	0.98	45.2±13.8	58.1±8.1*	1.01
Relative CMJ Height (cm/ kg)	0.7 ± 0.2	0.8 ± 0.2	0.7 ± 0.2	0.36	0.7±0.2	0.8±0.2	0.68
Absolute MBT Distance (cm)	554.5 ± 134.9	641.4±94.6	511.1 ±130.6*	0.99	449.7±91.6	646.3±92.7*	1.46
Relative MBT Distance (cm/ kg)	7.8± 1.4	7.8±1.4	7.8±1.5	0.02	6.5±0.2	9.0±0.8*	1.78

\*D data are mean±SD; HGS = handgrip strength, kg = kilograms, m = meters, HGF = handgrip fatigue, CMJ= countermovement jump, cm = centimeters, MBT = medicine ball throw. \* = significant differences between position, ^ = significant differences by class.

**Table 3.** Correlations between absolute medicine ball throw distance and each parameter measured (n=19).\*

Variable	r Value
Age (yrs)	0.70**
Height (cm)	0.37
Body Mass (kg)	0.70**
BMI (kg/ m <sup>2</sup> )	0.62*
Lacrosse Experience (yrs)	0.67**
Resistance Training Experience (yrs)	0.49

\*Values are Pearson correlation coefficients (r values) using Pearson correlation analyses. Level of significance was p<0.05; \*p<0.05, \*\*p<0.01.

**Table 2** Correlation matrix of strength and power measures in all male high school lacrosse participants (n=19).\*

	Absolute CMJ Height (cm)	Relative CMJ Height (cm/ kg)	Absolute HGS (kg)	Relative HGS (kg/ HT <sup>2</sup> )	Absolute HGF (Post-fatigue Max. HGS, kg)	Absolute MBT Distance (cm)	Relative MBT Distance (cm/ kg)
Absolute CMJ Height (cm)	1.0	0.17	0.44	0.40	0.48	0.69**	0.76**
Relative CMJ Height (cm/ kg)		1.0	0.12	0.16	0.06	0.17	0.64*
Absolute HGS (kg)			1.0	0.99****	0.90****	0.60*	0.33
Relative HGS (kg/ HT <sup>2</sup> )				1.0	0.85****	0.55*	0.33
Absolute HGF (Post-fatigue Max. HGS, kg)					1.0	0.66**	0.33
Absolute MBT Distance (cm)						1.0	0.74**
Relative MBT Distance (cm/ kg)							1.0

\*Values are Pearson correlation coefficients (r values) using Pearson correlation analyses. CMJ= countermovement jump, HGS = handgrip strength, HT=height in meters<sup>2</sup>, HGF = handgrip fatigue, MBT = medicine ball throw. Level of significance was p<0.05; \*p<0.05, \*\*p<0.01, \*\*\*\*p<0.0001

**CONCLUSIONS:** Age, body mass, and lacrosse experience are strong predictors of lacrosse performance, as measured by MBT distance, in high school lacrosse players by position and class. These findings highlight the importance of developing training programs that enhance lower body and rotational power, considering youth male lacrosse athletes.

**PRACTICAL APPLICATION:** Strength and conditioning professionals can use this information to design resistance training programs that focus on the key attributes that most impact a youth lacrosse player's performance.

## References:

1. Akiyama K, Sasaki T, Mashiko M. Elite Male Lacrosse Players' Match Activity Profile. J Sports Sci Med 18(2): 290-4, 2019.
2. Akiyama K, Yamamoto D. The relationship between shot velocity and physical characteristics of lacrosse players. J Sports Med Phys Fitness 59(9): 1472-8, 2019.
3. Kerr ZY, Roos KG, Lincoln AE, Morris S, Yeargin SW, Grant J, et al. Injury Incidence in Youth, High School, and NCAA Men's Lacrosse. Pediatrics 143(6): e20183482, 2019.
4. KULAKOWSKI E, LOCKIE RG, JOHNSON QR, LINDSAY KG, DAWES JJ. Relationships of Lower-body Power Measures to Sprint and Change of Direction Speed among NCAA Division II Women's Lacrosse Players: An Exploratory Study. Int J Exerc Sci 13(6): 1667-76, 2020.
5. Sell KM, Prendergast JM, Ghigiarelli JJ, Gonzalez AM, Biscardi LM, Jajtner AR, et al. Comparison of Physical Fitness Parameters for Starters vs. Nonstarters in an NCAA Division I Men's Lacrosse Team. J Strength Cond Res 32(11): 3160-8, 2018.
6. Wasser JG, Bruner ML, Chen C, Vincent HK. Identifying Risk Factors for Preexisting or Developing Low Back Pain in Youth, High School, and Collegiate Lacrosse Players Using 3-Dimensional Motion Analysis. Orthop J Sports Med 12(3): 23259671241231960, 2024.