

Foot, Ankle, and Lower Leg Injuries in Young Male Track and Field Athletes

François Fourchet, PT, MSc; Cosmin Horobeanu, PT; and Heiko Loepelt, PT • ASPIRE Academy – Doha, Qatar; Redha Tair, PhD • University of Reims, France; and Grégoire P. Millet, PhD • University of Lausanne, Switzerland

A substantial number of adolescents are injured each year as a result of participation in sports.^{1,2} Adolescents participating in competitive track and field had a high rate of lower extremity injuries: approximately 40% affecting the foot/ankle/lower leg, 30% affecting the knee, and 10% affecting the thigh.^{1,3}

KEY POINTS

▶ 40% of injuries that occur in track and field affect the foot, ankle, and lower leg.

▶ The relationship of maturation status to injury is unclear.

▶ Late maturation athletes sustained more foot, ankle, and lower leg injuries than their peers.

▶ In track and field, injury prevention strategies should consider maturity status.

Difficulty arises when comparing various studies, because differing criteria have been used to define injury severity.^{1,4} Time loss has been reported to range from more than five days for 30% of injuries to one week or longer for 50% of adolescents' injuries.⁴

Maturation status has been reported to influence injury rate in several sports, but the

relationship between maturation and injury incidence probably varies among sports.⁵⁻⁸ When providing guidance for young athletes, the athletic trainer or therapist should consider the biological maturation stage of the athlete and adjust individual training loads.⁹ Anthropometric data have been shown to be good determinants of Peak Height Velocity (PHV), which can provide valuable infor-

mation when determining an appropriate training volume for adolescents at a given maturation stage.¹⁰ The PHV method requires serial measurements (i.e., chronological age, height, sitting height, and weight) during the years around the occurrence of peak growth velocity. Because standard deviations for age at PHV tend to be about one-half of values reported by longitudinal studies of maturation, this method appears to provide good accuracy for determination of maturation stage.^{10,11} The procedure is noninvasive, simple to administer, and inexpensive.

Michaud et al.⁵ reported that risk of injury appeared to be more closely associated with biological development (pubertal stage) than chronological age, body mass index (BMI), height, or weight. Many studies dealing with soccer have explored the relationship between biological age and injuries.⁶⁻⁸ Backous et al.⁸ measured height and grip strength in young soccer players and assumed that tall young males who exhibited a strength deficiency were experiencing "late maturation" (i.e., assumption that they were still in an early maturation stage). They did not determine the maturation stages of their subjects but made the assumption that skeletally mature and weak young males were more susceptible to injury when playing soccer with peers of the same chronological age. Johnson et al.⁶ assessed the skeletal age of

a similar population and found more injuries among individuals who exhibited early maturation (EM) than those who exhibited normal maturation (NM) or late maturation (LM). Unfortunately, they did not provide sufficient detail about the players' characteristics. Le Gall et al.⁷ reported greater injury incidence for EM and NM individuals than those who exhibited LM, but the difference was not statistically significant. Limitations of this study included a possible overestimate of exposure time and lack of information about injury mechanisms. Although a relationship between maturation and injury risk has not been clearly established, EM athletes who participate in a team sport appear to possess elevated injury risk. Maturation level must be considered when working with adolescent athletes, but the possible influence on injury risk has not been investigated in young track and field athletes.

The purposes of this study were to describe the type and severity of foot/ankle/lower leg injuries sustained by young track and field athletes and to investigate the influence of maturation on injury occurrence. Contrary to the reported trend for elevated injury risk among EM athletes who participate in a team sport, we hypothesized that LM athletes would have a higher injury rate than EM athletes, due to a lesser capability to cope with training load.

Procedures and Findings

This study involved prospective collection of injury data over a period of three years for 110 adolescent males who were track and field athletes: sprint/hurdles ($n = 25$), jumps and combined events ($n = 15$), distance ($n = 24$), throws ($n = 23$), and beginners ($n = 23$; i.e., first-season athletes not assigned to a specific event). Prior to data collection, all subjects and their parents were provided with information about the study, and informed consent was obtained. A total of 74 injuries were reported among 110 male athletes who were between 13 and 18 years of age (15.7 ± 1.7 yr).

Anthropometric measurements were obtained by an accredited anthropometrist (International Society for the Advancement of Kinanthropometry). Age of PHV was used to define maturation, which was derived from the predictive equation for males developed by Mirwald et al.¹⁰ Age of PHV was subtracted from chronologic age to classify the athletes in three maturation categories: early, normal, or late. EM and LM classifications were made on the basis of estimated PHV

age in relation to mean PHV age for the entire cohort (i.e., more than one year older or younger). NM was defined as PHV age within one year of the mean PHV age for the entire cohort. Values for estimated PHV age were ≤ 13.2 for EM ($n = 17$), between 13.2 and 15.2 for NM ($n = 79$), and ≥ 15.2 for LM ($n = 14$).

An "injury" was defined as a trauma occurring during track and field training or competition, which required one or more physiotherapy treatments and prevented the athlete from participating in one or more training sessions or competitive events. Injury severity was defined on the basis of time loss: an injury was considered minor if the athlete was out of training/competition for one to three days, moderate if the duration of absence was four to seven days, major if the absence lasted one to three weeks, and severe if the absence was greater than three weeks. Injury categories included the following: (a) foot/ankle/lower leg, (b) pelvis/hip/lumbar, (c) hamstrings/quadriceps, (d) knee, (e) shoulder, and (f) other. Only injuries affecting the foot/ankle/lower leg were analyzed. Absences related to illness or injuries that were unrelated to training were excluded from the analysis.

One-way analysis of variance was used to assess differences in height, sitting height, body mass, skinfold thickness, and injury incidence among the three maturation categories. A Kruskal-Wallis nonparametric test was utilized when a dependent variable failed to demonstrate a normal distribution of values. An alpha level of 0.05 was used for all statistical tests. A significantly higher incidence of foot/ankle/lower leg injuries was found for athletes who were experiencing late maturation than those who were experiencing normal and early maturation (Figure 1). Tables 1-5 present data for year-by-year enrollment, maturation categories, anthropometric characteristics, injury incidence, injury distribution among body parts, and injury severity.

Discussion

LM athletes demonstrated a higher incidence of foot/ankle/lower leg injuries than EM athletes, which confirmed our hypothesis. We believe that our findings support the importance of giving consideration to maturation status for the prevention of injuries.¹²⁻¹³ The period of prepubertal growth is longer for LM athletes than EM and NM athletes. The immature musculoskeletal system of LM males may be less able to cope with repetitive biomechanical stress.¹⁴ Seven