because the biological activity of IGF-I in the body is now known to be substantially influenced by the family of IGF binding proteins.[3] For example, recent work on the effects of hypoxia on rat growth suggests that it is, in fact, the impact of IGF binding protein-3 that is more closely related to overall growth than is IGF-I itself.[7]

There is also a more troubling aspect of IGF-I that has only recently begun to emerge. In addition to a direct anabolic effect on skeletal muscle—for example, the production of more protein—it has become clear that IGF-I is also capable of stimulating the proliferation and differentiation of muscle stem cells (satellite cells). In animal studies, there is evidence to suggest that this process is obligatory for muscle hypertrophy to proceed. However, this evidence that IGF-I is mitogenic should serve as a cautionary note to those who would use this agent to promote an anabolic state. There is increasing evidence to suggest that IGF-I signalling may also participate in cellular transformation.[2] Specifically, elevated IGF-I levels have been linked to prostate, colorectal, and lung cancers.[5]

In the light of the large number of potentially negative impacts, ranging from disruption of the insulin system to cancer, it would seem that the exogenous augmentation of IGF-I does not represent a very attractive or effective method of increasing muscle mass or function. Clearly, the therapeutic use of these powerful growth factors awaits more focused research on the mechanisms through which these mediators actually influence growth in the context of the whole organism.

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Transmission of cutaneous infections in athletes

Myriad dermatoses can affect athletes. One of the most common cutaneous manifestations of athletic activity are skin infections. Bacteria,[1–4] viruses,[1 2 4–8] and fungi[1 2 4 9–11] cause these infections. Many are contagious and may have serious ramifications for team practices and competitions. Knowledge of these infections facilitates implementation of rapid treatment and preventive measures to ensure the least disruption in daily team activities.

Several specific sports related dermatological conditions are caused by bacterial infection. Staphylococcal infection is the most common but streptococcal infection also commonly occurs.[1–4] Both organisms may present as varying clinical entities including impetigo, erysipelas, folliculitis,[1 2 4] and furunculosis.[3] In general, they are probably contagious to some degree. Impetigo, characterised by well defined, erythematous, yellow crusted, scaling plaques, and erysipelas, characterised by well defined, advancing, erythematous plaques, can be treated with topical warm soaks and oral antibiotics.[1 4] Folliculitis presents as small follicular pustules that can be treated with topical or oral antibiotics.[1] These bacterial infections occur in sports in which close personal contact occurs, including rugby, judo, and wrestling.[2 4] Furunculosis outbreaks, however, have been noted also in football and basketball athletes. One study showed that 25% of high school athletes in these sports developed furunculosis.[3] Direct contact with furuncles was significantly associated with transmission, while exposure to equipment seemed to be less important in its transmission. Some authors, however, have suggested that athletic bags and wrestling mats may also facilitate transmission of the organisms.[4] Rapid treatment and isolation of the affected athlete from other competitors is of major importance in decreasing the rapid spread of the bacteria.[1 2 4] Other authors have suggested that if the incidence of infection is low, then bandaging techniques may be a reasonable means to prevent transmission.[3] If outbreaks continue within a team, the bacterial carrier status of the members can be evaluated by culturing crural and nasal passages,[4] and appropriate treatment can be instituted.

The three main viral infections that affect athletes are verruca (warts), molluscum contagiosum, and herpes simplex. Verruca can occur on any skin surface and can be transmitted by direct contact, but shared showers and locker room floors may also act as reservoirs.[4] Swimmers may be particularly susceptible to plantar verruca.[4] Destroying verruca will help to prevent it from growing and possibly causing pain. Furthermore the destruction may decrease transmission of the virus to other members of the team. Athletes with plantar verruca should wear sandals while showering in shared facilities.[4] Molloscum contagiosum presents similar problems for athletes. This disease is characterised by discrete, white to skin coloured papules, and can be found particularly in wrestlers. Molloscum contagiosum can be, through direct contact, quite contagious and should be promptly treated with destructive methods to decrease the transmission to other athletes.[1 4] Herpes simplex infection, known as herpes gladiatorum when identified in wrestlers, has been extensively reviewed.[1 2 4 6–8] Herpes simplex may also be endemic in rugby players.[5] Clinically the infection can appear as an erythematous plaque upon which are vesicles. These vesicles may rupture resulting in erosions. In a study of one wrestling camp, 34% of participants were infected with herpes simplex.[7] It is primarily transmitted through skin to skin contact, and transmission through fomites is felt to be less important.[7 8] Identifying infected athletes promptly and excluding them from direct contact with other wrestlers will help to halt epidemic occurrences.[7 8] Rapid administration of antiviral treatment may accelerate an athlete's return to wrestling.

Fungal organisms can also significantly impact on athletes. Tinea pedis can be characterised by scaling plaques in a moccasin-like distribution on the plantar surfaces on the feet, by interdigital maceration, or by discrete vesicles on the foot. Tinea pedis can affect many athletes because the causative organism thrives in warm and moist environments. Runners, skaters, and long distance walkers may be particularly at risk.[4] Affected athletes should be treated with antifungal agents and also wear protective footwear while using shared facilities to decrease transmission to other athletes. Athletes can also be infected with tinea corporis which is clinically characterised by well defined, scaling, erythematous, occasionally annular plaques. This infection has been extensively reported in wrestlers and has been termed tinea gladiatorum, trichophytosis gladiatorum, and tinea corporis gladiatorum.[9–11] The term tinea corporis gladiatorum seems to be the most descriptive but is not comprehensive as it excludes tinea capitis which is transmitted between wrestlers. Several studies have examined the epidemiology of tinea corporis gladiatorum[6 9–11] in wrestlers. The frequency with which tinea corporis affects wrestling teams was found to range from 24% to 77% and varied with the methodology of each study. Two of these studies attempted to determine the incidence of tinea corporis in specific wrestling teams, both at the high school level.[10 11] One study, prompted by an alert from a local health department, noted an epidemic affecting 75% of a high school team's wrestlers[10], and the other, investigating a team without a known epidemic, found 24% of the wrestlers infected with tinea corporis.[11] Wrestling teams, often aware of the potential difficulties associated with tinea corporis infection, fastidiously clean equipment and mats. Transmission of the fungal organism, however, is most likely primarily through skin to skin exposure and not through fomites.[10 11] This suggestion is supported by two findings. First, most lesions of tinea corporis gladiatorum are located on the head, neck, and arms, which are the areas of most contact between two competing wrestlers.[10 11] If wrestling mats played a larger role in transmission, one would expect more lesions on the lower extremities. Furthermore, attempts to culture organisms from mats have been unsuccessful.[9] Athletes, particularly wrestlers and others subjected to extensive skin to skin contact, should be carefully examined before each practice and competition.[10 11] Athletes with signs of tinea infection should be treated promptly with antifungal agents and should be removed from direct contact with other wrestlers if the infected area cannot be appropriately covered using bandaging techniques.

Skin infections, to varying degrees, are transmitted among athletes. In general, data support the fact that most cutaneous infections are caused by close skin to skin contact. Prevention of skin infection epidemics in sports' teams is of paramount importance to avoid unnecessary morbidity and to minimise any disruption in team practices and competitions.

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