

# The second Summer Youth Olympic Games in Nanjing, People's Republic of China: preparing youth athletes to compete in the heat

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**Abstract:** The second Summer Youth Olympic Games will take place August 16–28, 2014 in Nanjing, People's Republic of China during the peak of the summer. Nanjing has been reported as one of the hottest cities in the People's Republic of China, with temperatures reaching as high as 40°C. There is limited clinical evidence of the real risks that youth athletes face when training and competing in the heat, but some recommendations can be made. The estimated average wet bulb globe temperature for Nanjing in August is 32°C, which has been classified as a very high risk/stop play condition for heat illness and injury. Training and competing under extreme heat conditions could stress the thermoregulatory system and adversely affect health and performance. However, current guidelines appear to be inadequate or too conservative, and mostly focus on adult elite athletes. Therefore, proper preventive measures are warranted to reduce the risks of heat illness and injury. With proper heat acclimatization and monitoring, youth athletes can exercise reasonably well and safely in the heat. During the second Summer Youth Olympic Games in Nanjing, People's Republic of China, special attention should be devoted to athletes exposed to long and extensive sunny and hot conditions.

**Keywords:** youth sports, heat acclimatization, thermoregulation

## Introduction

The second Summer Youth Olympic Games will take place August 16–28, 2014 in Nanjing, People's Republic of China. Approximately 3,600 youth athletes from 204 nations are expected to compete in 28 different sports under the motto “Share the Games, Share our Dreams”. The Games will run during the peak of the summer, and Nanjing has been reported as one of the hottest cities in the People's Republic of China. Nanjing is located in eastern China, at the lower valley of Yangtze River, and has a humid subtropical climate. According to anecdotal reports, the nearby mountains hold the hot air in, and temperatures can reach extreme highs of 40°C during summer months. The average temperature is 28°C, and average high and low temperatures are 32°C and 24°C, respectively. The average relative humidity for the month of August is 81%, with rain occurring occasionally and lasting on average 12 days.<sup>1</sup>

In 2012, the International Olympic Committee (IOC) Medical Commission published a consensus statement on the thermoregulatory challenges for Olympic and other high-level athletes.<sup>2</sup> IOC Medical Commission, in collaboration with the International Sports Federations, has also issued a series of guidelines and preventive measures aimed to reduce the risks associated with training and competing under thermal stress conditions.<sup>2–5</sup> However, no guidelines have been developed for youth athletes.

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Despite limited clinical evidence of the real risks that youth athletes face when training and competing in the heat, some recommendations can be made, eg, increase the time for recovery and reduce the number of contests per day in same-day contests; monitor the athletes closely, and encourage hydration and cooling strategies; schedule competition events for cooler times of the day; and cancel the events in case of extreme environmental conditions.<sup>6</sup>

Ambient air temperature, relative humidity, air motion, and the amount of radiant heat from the sun or other sources are the environmental factors that influence the risk of heat illness and injury. Recently, wet-bulb globe temperature (WBGT) – an index calculated from wet-bulb, dry-bulb, and black-globe temperatures – has been recognized as the gold-standard indicator of environmental heat stress. WBGT is now largely used in sports, as it possibly represents the best current measure available, particularly during hot and humid conditions.<sup>6</sup> However, not all facilities have the proper equipment to calculate WBGT. To overcome this limitation, approximate WBGT values calculated based on shaded dry-bulb temperature and relative humidity may be used.<sup>7</sup>

Cut-off values for decision making are still an important topic of discussion. In most cases, the organizers of a sports event will follow the recommendations of the American College of Sports Medicine<sup>7</sup> regarding the risk of heat illness and injury: “unrestricted” (<22°C), “low risk” (22°C–28°C), “high risk” (28°C–30°C), “very high risk” (30°C–32°C), and “stop play” (>32°C). However, these recommendations address the potential risks for a broad range of athletes independently of their fitness level and acclimatization. It is not known whether the same recommendations apply to youth athletes exercising in the heat.

In the end, many sports events still happen regardless of WBGT guidelines or the recommendations for exercising in the heat.<sup>2–5</sup> It is possible that current guidelines are too conservative, or that they fail to consider the specific risks of heat illness in sports.

## Discussion

The estimated average WBGT for Nanjing in August is 32°C,<sup>1</sup> which has been classified as a very high risk/stop play condition for heat illness and injury.<sup>7</sup> The WBGT was calculated based on historical average temperature and relative humidity; it is only valid for full sunshine and light wind conditions, and it does not take into consideration the intensity of solar radiation and wind speed. An overestimation of thermal stress is likely, particularly in cloudy and windy conditions, and at night time and early morning when the sun is low or

below the horizon.<sup>4</sup> On the other hand, the temperatures in Nanjing can reach as high as 40°C,<sup>1</sup> which means that WBGT is likely to go above 32°C. It is possible that during the second Summer Youth Olympic Games, athletes train and compete under extreme thermal stress conditions that could adversely affect their health and performance.

The responsibility for preparing the athletes to compete in the heat should be shared between event organizers, referees, medical staff, coaches, and the athletes themselves. According to the IOC, infrastructures should provide the solutions (ie, air-conditioned rooms, shaded areas, and cooling stations) to reduce heat stress and support the staff during training and competition. A comprehensive emergency action plan should be tested and prepared for any casualty. The scheduling of training and competitions should consider the time of the day when less heat stress and exposure is expected.<sup>2</sup> Recently and for the first time in World Cup history, the organizers of the 2014 FIFA World Cup Brazil™ ordered water breaks if the temperature reached 32°C or higher. In Nanjing, referees and medical staff should also have the possibility of introducing official stoppages for hydration.

Special attention should be devoted to youth athletes competing outdoors multiple times on the same day with short resting times between rounds of play during hot-weather conditions (as in athletics or 3×3 basketball).<sup>6</sup> Long and intense exposure to heat might challenge body fluid balance.<sup>6</sup> Thus, young athletes competing in sports such as cycling, soccer, rugby, tennis, and triathlon might also be at increased risk.

With proper heat acclimatization, hydration, and monitoring during heat exposure, youth athletes can exercise reasonably well and safely in the heat.<sup>8,9</sup> Most of the long-held beliefs concerning the higher vulnerability of the youth to heat stress might be overstated, and are not fully supported by scientific literature. However, during the Beijing 2008 Olympic Games, there were 27 cases of heat-related illness among workforce, public, and athletes.<sup>10</sup> Interestingly, the average temperature during the Beijing 2008 Olympic Games was 25°C, with high and low temperatures of 33°C and 20°C, respectively; the relative humidity averaged 81%.<sup>11</sup> This means that the environmental conditions in Nanjing might prove even more challenging than in Beijing. Besides heat and humidity, several issues related to air pollution have been raised during the Beijing 2008 Olympic Games.<sup>12</sup> Air pollution may negatively affect respiratory function and exercise performance,<sup>13</sup> and more so if combined with high ambient temperatures.<sup>14,15</sup> Special attention should be given to asthmatic participants or ozone-sensitive individuals who are at increased risk of lung inflammation when exposed to both heat

and high ozone levels.<sup>13</sup> In Beijing, the Chinese government has made unprecedented strides toward improving air quality during the Games. These measures resulted in a decrease in air pollutants around the Beijing area that were associated with an acute reduction in biomarkers of inflammation in young adults.<sup>16,17</sup> Nanjing has typically low levels of pollution compared to Beijing, but recent episodes of severe air pollution have forced cancellation of classes at kindergartens and elementary and middle schools.<sup>18</sup> Restrictions in traffic and industrial production are suggested around the time of the second Summer Youth Olympic Games in Nanjing. In an attempt to further minimize the adverse effects of air pollution and heat in health and performance, organizers, coaches, and athletes should follow local air quality forecasts<sup>13</sup> and plan training sessions and competitions accordingly.

## Conclusion

Youth athletes can exercise reasonably well and safely in the heat, but given the high temperatures that are expected to occur during the second Summer Youth Olympic Games in Nanjing, People's Republic of China, proper heat acclimatization, monitoring, and recovery is recommended. During training and competition, special attention should be devoted to athletes exposed to long and extensive sunny and hot conditions. If proper preventive measures are taken, the risk of heat illness and injury can be greatly reduced.

## Disclosure

The authors report no conflicts of interest in this work.

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