

## Visit to the China Qinghai Duoba National Highland Sports Training Base

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### Abstract

The Human High Performance doctoral degree program at the University of Tsukuba was established in 2015, and I (Cao Yinhang) am one of the first students in this program. For my doctoral thesis, I have been working on a project aimed at elucidating the factors that determine individual variation in the hypoxia-induced reduction in peak oxygen uptake among endurance athletes during high-altitude exposure. To gain important insight into actual high-altitude training in China, as part of my doctoral research, I visited the Qinghai Duoba National Highland Sports Training Base (Duoba Base) on July 4-7, 2016. Duoba Base is the largest and highest high-altitude training center in China. The director of the Qinghai Institute of Sports Science, Ma Fuhai, extended to me an invitation to come to Duoba Base. During my visit, I met Chinese national race walkers engaged in high-altitude training in preparation for the 2016 Summer Olympic Games. With great support from Liu Haiming, a coach of the Qinghai province race walking team, I learned how Chinese national race walkers train at high altitude, and I assessed the pulmonary function of the race walkers from Qinghai province.

### Introduction

I (Cao Yinhang) am a third-year student in the Human High Performance doctoral degree program at the University of Tsukuba. To better understand high-altitude training, as a part of my thesis research, I visited the China Qinghai Duoba National Highland Sports Training Base (Duoba Base). Duoba Base is the largest and highest high-altitude training base in China, and has played an important role in improving the performance of endurance athletes since the 1980s. Every year, national endurance athletes from around the world, including middle and long-distance runners, race walkers and long-distance swimmers, engage in high-altitude training at Duoba Base. As a result of these teams winning large numbers of medals in the Olympic Games and World Championships, Duoba Base is known as “a cradle of world championships.”

A second aim of my visit was to better understand how Duoba Base manages athletes' training, and to establish a relationship between the University of Tsukuba and Duoba Base.

#### 1.1 Basic information about Duoba and Kunming Haigeng Bases

There are two major high-altitude training bases in

China: Duoba Base and Kunming Haigeng Base. Duoba Base was founded in February 1982, is located at an altitude of 2,388 m (barometric pressure: ~580 mmHg), and covers an area of 2,645 mu (1 mu equal to 666.7 m<sup>2</sup>)<sup>3,4</sup>. Kunming Haigeng Base was founded in 1973, is located at an altitude of 1,888 m (~770 mmHg), and covers an area of 615 mu<sup>6</sup>. Duoba Base is thus larger and at higher altitude than Kunming Haigeng Base. In addition, Duoba has more facilities than Kunming Haigeng Base, including a 200-m indoor track and field ground, and wrestling and boxing stadiums<sup>3</sup>. Based on this information, Duoba Base appears to be superior to Kunming Haigeng Base as the high-altitude training center.

Duoba Base is 22 km from Xining City in Qinghai province, and is just a 1-h drive from Xining Caojiapu airport. Kunming Haigeng Base is 10 km away from Kunming City in Yunnan province and is a 1-h drive from Kunming Changshui International airport (Figure. 1). Thus access to both bases is very convenient. At Duoba Base, the average temperatures during summer and winter are ~14°C and -9.5°C, respectively, and the annual precipitation is ~330 mm<sup>3</sup>. At Kunming Haigeng Base, the average temperatures during summer and winter are ~24°C and 8°C, respectively, and the annual precipitation is ~1,000 mm<sup>6</sup>.

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Figure. 1 Locations of Duoba and Kunming Haigeng Bases

### 1.2 Facilities at Duoba Base

Duoba Base possesses several stadiums, including football fields; halls for basketball, judo, wrestling, boxing and taekwondo; 400-m track and field grounds; and a 50-m swimming pool (Figure. 2). In addition, a curling stadium is currently under construction. Duoba Base also has facilities for high-altitude training research and sports medicine research, as well as a medical center. These facilities are equipped with advanced experimental instruments, such as a gas analyzer (CareFusion Jaeger, MaterScreen, TM CPX) and an automated chemiluminescence immunoassay analyzer (SWELab, Auto Counter 900+) <sup>3-5)</sup>.

There are three major buildings containing business

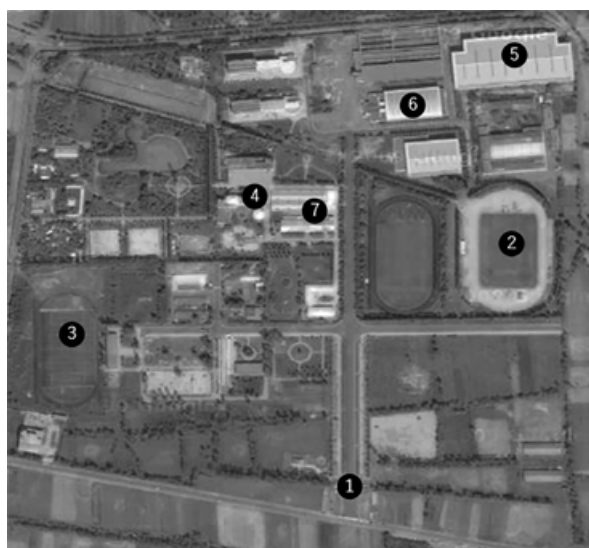


Figure. 2 Full view of Duoba Base

- ① Main gate, ② 400-m track and field grounds, ③ Football field, ④ Office, ⑤ 200-m indoor track and field grounds, ⑥ 50-m swimming pool, ⑦ Restaurant

centers, multifunctional halls, conference rooms, sauna bathrooms, entertainment bars, 160 guestrooms, and 298 beds (Figure. 3). In addition, there is a grand dining hall capable of hosting 600 people, and a halal garden restaurant that can host 500 people (Figure. 4) <sup>3-4)</sup>.

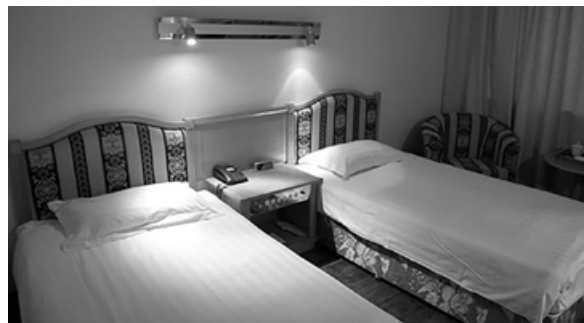


Figure. 3 Guest room



Figure. 4 Dining hall

### 1.3 Athletic achievements of Duoba Base

Every year, athletes from different countries visit Duoba Base for high-altitude training. These include national teams of endurance athletes such as middle and long distance runners, race walkers, and long distance swimmers. For example, the Omani national swimming team and Russian national bicycle team regularly visit Duoba Base for high-altitude training. Many of the athletes who train at Duoba Base won medals at the 2008 Beijing Olympic Games, including Liu Zige and Jiao Liuyang, who respectively won the gold and silver medals in the Women's 200-m butterfly stroke swimming race <sup>3-4)</sup>. In addition, Lv Xiuzi trained at Duoba Base and won the bronze medal in the Women's 20-km Race Walk at the Rio Olympic Games in 2016.

### 1.4 International Altitude Training and Health Forum at Duoba Base

The Duoba International Altitude Training and Health Forum has been held every two years since 2009. The

forum is sponsored by the China Sport Science and Qinghai Sports Bureau and is organized by the Qinghai Institute of Sport Science. More than 400 experts from China, the United States, France, Germany, Australia, Korea, Japan and Austria attend this forum (Figure. 5), where they discuss whether and how high-altitude training improves exercise performance as well as human health generally<sup>3-5</sup>.



Figure. 5 Attendees at the International Altitude Training and Health Forum in 2011

### 1.5 International collaboration at Duoba Base

From August 13 to September 9, 1993, the Sino-Japanese collaborative high-altitude training camp for race walkers was conducted at Duoba Base. Japan sent 5 male and 5 female race walkers as well as 6 coaches, 3 doctors and 5 nutritionists, including Junichiro Aoki from Juntendo University as the leader and Kando Kobayashi from Tokyo University as the assistant leader. China sent 5 male and 5 female race walkers, 3 coaches, 2 doctors and 6 researchers. At this high-altitude training camp, the 20 race walkers undertook 27 days of high-altitude training while researchers measured their plasma, blood and erythrocyte volumes. This was the first collaborative high-altitude training study between China and Japan and provided valuable data pertaining to high-altitude training. Duoba Base is currently collaborating with Sendai University in Japan on a research project focusing on locomotivity and lipid metabolism in older people living in highlands and at sea level<sup>5</sup>.

## 2. High-altitude training by the Chinese national race walking team at Duoba Base

The Chinese national race walking team engaged in high-altitude training from July to August 2016 at Duoba Base in preparation for the 2016 Summer Olympic

Games held at Rio, Brazil. On July 6-7, I visited the team to better understand the high-altitude training program for race walkers. The team included 9 race walkers (7 males and 2 females), 5 coaches and 1 medical doctor. The daily training was conducted for 2 h in the morning and 2 h in the afternoon. During the training, coaches rode bicycles and gave instructions about the walkers' pace when needed (Figure. 6). At Duoba Base, the race walkers were provided with comfortable single-rooms and nutritious diets. Researchers at the training camp monitored the athletes' condition through biomarker assessment (Figure. 7) functional evaluation so as to assist with fatigue recovery, injury prevention and therapy.



Figure. 6 Chinese national race walkers during high-altitude training



Figure. 7 Researchers of Duoba Base collecting fingertip blood samples from athletes

## 3. Assessment the pulmonary function in highlander race walkers at Duoba Base

For my doctoral thesis, I have been working on a project aimed at elucidating the factors that determine individual variations in the hypoxia-induced reduction in peak oxygen uptake seen in endurance athletes during exposure to high altitude. For one of my projects, I assessed the pulmonary function (forced vital capacity and peak expiratory flow rate, etc.) of endurance athletes at the University of Tsukuba, and I thought it would be

interesting to do a similar assessment with highlander endurance athletes in China. The Qinghai province race walkers are highlanders who live and train at Duoba Base throughout the year. Therefore, before visiting Duoba Base, I contacted Liu Haiming, a coach with the Qinghai province race walking team, and he allowed me to assess the pulmonary function, resting heart rate (HR) and arterial O<sub>2</sub> saturation (SaO<sub>2</sub>) of 8 (4 males and 4 females) national level race walkers on the Qinghai province team (Figure. 8).



Figure. 8 Race walkers of highlanders who participated in the assessment of pulmonary function in the Duoba Base

#### 4. Perspectives

For Asian athletes, Duoba Base is more convenient and suitable for high-altitude training than other high-altitude training bases, such as Colorado in the United States, as traveling to Duoba Base does not cause jet lag and is less expensive than visiting Colorado. Moreover, at an altitude of 2,388 m, Duoba Base is higher than Kunming Haigeng Base (1,888 m) and at an altitude that is reportedly best for promoting erythropoietin expression (2,100-2,500 m)<sup>1-2)</sup>. Hence it is recommended that middle and long distance runners and/or long distance swimmers at University of Tsukuba choose Duoba Base as the place

to engage in high-altitude training.

Director Ma Fuhai is willing to collaborate with University of Tsukuba and invite professors and researchers from University of Tsukuba to Duoba Base. In addition, Duoba Base has many athletes willing to serve as experimental subjects as well as the advanced experimental equipment necessary to conduct various types of experiments. We (director Ma and myself) believe that this trip is an important first step toward collaboration between the University of Tsukuba and Duoba Base.

#### 5. Acknowledgements

I would like to sincerely thank everyone who supported my trip, especially Ma Fuhai, a director of the Qinghai Institute of Sports Science and Liu Haiming, a coach of Chinese Qinghai province race walker team. I also thank the Human High Performance doctoral degree program at the University of Tsukuba for providing me with the opportunity to travel to Duoba Base.

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