



INSTITUTO DE INVESTIGACIONES FÍSICAS

LABORATORIO DE RAYOS CÓSMICOS Y ESTACIÓN GAW DE CHACALTAYA

ALTITUDE ADAPTATION GUIDELINES

v.2022

CHACALTAYA AND ALPACA OBSERVATORIES

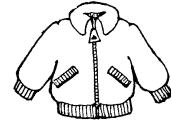
This guide has been prepared for your well-being during your visit the altitude observatories Chacaltaya and Alpaca. In spite of the extreme conditions, diverse research projects have been carried out since the 1940s in Chacaltaya and a new instrumental setup will be operating soon in Alpaca. The research topics include meteorology, cosmic rays, atmosphere, high altitude medicine, etc.

The facilities are accessible by car and are located between 4900 and 5320 masl. The average pressure at the highest point is 540 mbar and therefore the partial pressure of oxygen in the air is 85 mmHg (almost half of that at sea level!).

The average temperature at Chacaltaya is 0°C (maximum at 13h can reach 15°C and minimum at 5 am can be -15°C). Relative humidity can be as low as 10%. The ultraviolet index (UVI) is extreme and very dangerous, ranging from 18 to 23, 15% higher than in La Paz and out of the international scale!

Although the observatories have suitable infrastructure, the conditions of low pressure, hypoxia and low temperature at high-altitude sites might have different effects on each person. In extreme cases these conditions might become a real threat to health. For this reason, in order to help you have a pleasant visit and to minimize incidents as much as possible, we will offer you some basic information that you should consider when visiting our high altitude observatories. Hopefully it will help you identify the problems in your body and thus minimize the risks.

You will need...



STEPS TO VISIT THE HIGH ALTITUDE OBSERVATORIES CHACALTAYA - ALPACA

1. Please contact the director of our institute with your request: diriif@fiumsa.edu.bo
2. Once a date is scheduled, please contact the person assigned as your guide to coordinate the details.
3. If you cannot go to the observatory, please let us know to cancel the visit.
4. Please read this guide beforehand

Can altitude sickness affect me?

Even professional athletes are affected by altitude. Even Rambo would be.

The body's response to altitude is a subject of constant study. Not all the factors for an excellent or poor adaptation to altitude have been identified yet. Genetic factors have an influence, but also risk factors such as heart problems, overweight, hypercholesterolemia, diabetes, recurrent respiratory infections, arterial hypertension (systemic or pulmonary), etc. Birth history also plays a role: premature, low birth weight children who did not cry at birth are more likely to poorly adapt to altitude (even if they were born at high altitude). Factors that help towards a good adaptation are: a healthy diet and the constant practice of sports (running, swimming, dancing, etc.); both at least several months before the ascent to Chacaltaya or Alpaca. If you have a health issue before your visit, it would be a good idea to inform the person in charge, so that necessary precautions can be taken.



GENERAL RECOMMENDATIONS

THE DAY BEFORE

- Get enough sleep (more than 7 hours) and avoid alcohol consumption.
- If possible, have carbohydrates for dinner (pasta, potatoes) to have energy reserve for the next day.
- Eat your dinner early and focus on food that is easily digestible (avoid pizza, cheese etc.)
- Prepare a light lunch for when you are in Chacaltaya: a big bottle of water, a hot beverage, energy bars, dehydrated and fresh fruits, chocolate and/or a light sandwich.

THE VISIT DAY

- Do not neglect breakfast as digestion is slower at high altitude
- It is forbidden to arrive in a state of drunkenness.

ONCE AT THE SITE

PLEASE DO NOT

- make unnecessary physical efforts, such as running or lifting heavy weights without help
- panic, even in emergency situations
- do things that you don't know how to do, whether exploring, reacting to emergencies, or in any other situation, it is better to ask for help of the personnel in charge of the observatories
- climb to the Chacaltaya summit if there is a risk of storm (because at the top we act as the lightning rod)
- ascend alone to the summit
- touch the cables because you can get an electric shock

PLEASE DO

- remain with the visiting group
- stay hydrated, drink isotonic beverages frequently
- carry a piece of candy or chocolate in your pocket to help you if you feel light-headed
- mind solar radiation, so apply sunscreen every 2 hours and wear certified factor 4 lenses
- wear clothes that are easy to put on and take off
- start walking uphill slowly, even without feeling tired, because this will help you keep up the pace later on
- take care of your partner(s), because many times we are not self-aware of the effects of altitude in our bodies, therefore an external eye will be able to identify if we are not doing well

Are you feeling unwell?



Please communicate your symptoms!

Maybe you feel a little bit embarrassed about how your body is reacting towards altitude.

Please don't, we understand you.

If you feel dizzy, weak, sleepy or simply unwell we could help you if you let us.

- You can:
- Take some rest or sleep on one of the available sofas or beds
 - Drink a *mate* with sugar and a pinch of salt, or eat a candy
 - If you feel very bad, you can ask for oxygen

If your condition does not improve, it is not recommendable to stay any longer at high altitude. Therefore, we advise you to immediately go back to the city and take some rest.

Hydration is essential

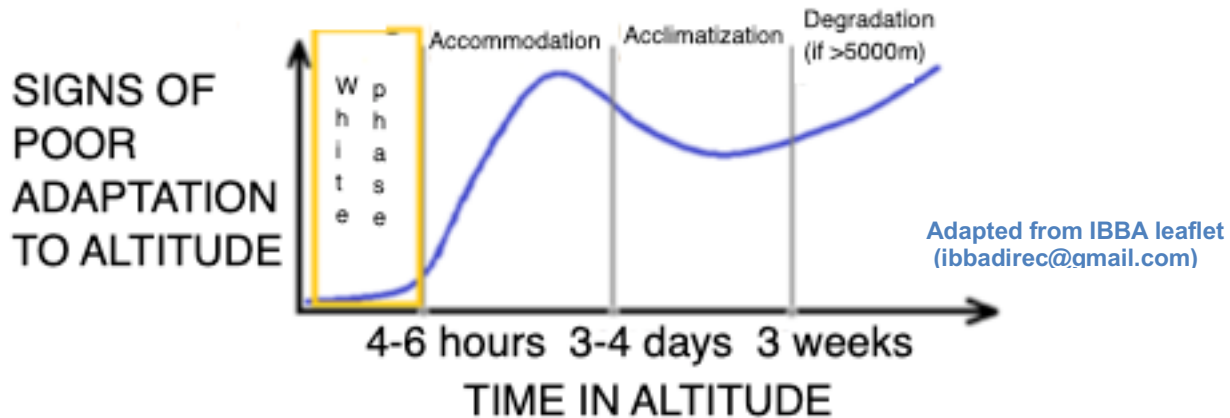


Even if you are not thirsty, drink

The low relative humidity at high altitude dehydrates you just by merely being there, even without exerting yourself physically. That is why it is very important to drink frequently and abundantly (even up to 3 liters of water per day in the mountains), with a little sugar and a pinch of salt (sodium is very important in rehydration). Avoid tea and coffee because they dehydrate the body and are diuretics. At the observatory, an electric boiler is available at all times to supply hot water for infusions. Eating fresh fruits also help your hydration. Coca leaf tea is great to help ease the effects of altitude, but avoid drinking it after 4 pm as it might keep you awake late in the evening.

ADAPTATION TO HIGH-ALTITUDE

In the following graphic there is a qualitative chronology to high-altitude.



The arrival to Chacaltaya and Alpaca is fast (ca. 2 hours from the city). With such a fast arrival, the body has not yet realized that it is in different conditions than usual, so at first the altitude sickness is not necessarily felt. This phase is called "white" and can last from a few minutes to 4-6 hours, depending on the person. Subsequently, the body adapts to the altitude, and this is called "accommodation" phase and can last 3 to 4 days. This is when the greatest symptoms of poor adaptation occur. Then comes the "acclimatization" phase, which is when the body responds as well as it can to the altitude. This phase lasts up to 3 weeks, after which the body may begin to show complications ("degradation" phase).

For these reasons, and also due to experience with work at high altitude, we recommend our visitors to stay **no more than 4 hours** at the observatory.

SLEEPING AT HIGH-ALTITUDE

Visitors can request an overnight stay at the observatory, especially if it is related to research.

In case you stay overnight:

- You will likely have difficult night and will not be very fit or mentally performant the next day
- It is suggested to rent a good sleeping bag (-10 C) and plan in advance your meals
- Leave a bowl of water in the room where you will sleep to hydrate the air
- Notify the person in charge of the observatory of an emergency telephone number just in case of complications



If you wish to overnight in Chacaltaya or Alpaca for other reasons: Contact a tourism agency (at Sagarnaga street) or the Club Andino Boliviano.



SYMPTOMS OF POOR ADAPTATION TO HIGH ALTITUDE

In the following table we present the most frequent problems related to high altitude, their symptoms and how to deal with them.

PROBLEM	ORIGIN	SYMPTOMS	WHAT TO DO
Hypoxia	Insufficient oxygen supply to the body/brain	Low mental (cognitive) performance with inability to think clearly or solve simple problems (multiplications and divisions), personality changes and disorders of consciousness may occur.	Provide oxygen from the tank available at the observatory and bring the person immediately to a lower altitude. The body can respond rapidly to this by building up more red cells. Depending on the individual, this can start as early as 2 hours. However, it usually takes several days.
Acute mountain sickness (AMS, <i>sorojchi</i>)	Natural adaptation of the body to the change in altitude.	The heart beats rapidly, plugged ears, dizziness, nausea, headache, lack of appetite, poor digestion, gas and physical exhaustion.	Rest and hydrate: drink hot infusions, such as coca or chamomile tea. If it persists, the affected person should be taken to a lower altitude immediately. Sodas (preferably still) and electrolyte drinks (<i>gatorade, powerade, etc.</i>) also help.
Hypoglycemia	Low concentration of glucose in the blood. Sometimes it can happen after a physical effort.	Restlessness, headache, sweating, tremors, confusion, memory loss, blurred vision, and even fainting	Have a candy or chocolate, a sweetened mate, sit her down while she recovers and talk to the person in charge.
Frostnip (the first stage of frostbite or frozen fingers)	Low temperature causes irrigation problems	The fingers feel very cold, they turn pink or a little darker (a sensation similar to what we feel when we hang a plastic bag on our fingers for a long time). The skin loses the ability to feel, it seems that it was made of leather.	<ol style="list-style-type: none"> 1. Take them out of the glove and put them behind your own or your partner's neck (they can also be placed under the armpit) 2. Raise your arm and drop it with relaxed muscles, like giving a whip; this forces irrigation. It is normal to feel a throbbing or tingling pain when blood returns to the affected finger
Hypothermia	Extreme drop in body temperature	Extreme tremors and chills, loss of coordination, slurred speech, heart rhythm disorder, and numbness	Cover the person with blankets, warm them with warm compresses on the neck, chest wall and groin, even with your own body heat. Never bring someone with hypothermia near a direct source of heat, nor rub the body, nor immerse in hot water.
Brain edema	AMS complication due to lack of oxygenation, the brain lacks of oxygen	Very strong headaches, loss of coordination, weakness, decreased levels of consciousness that lead to disorientation, memory loss, hallucinations, incoherent speech, psychotic behavior and even coma.	Usually the affected person is not aware of this problem. If edema is suspected, the person should immediately be taken to a lower altitude. A doctor should be called.
Pulmonary edema	AMS complication due to lack of oxygenation, the pulmonary alveoli fill with liquid.	Shortness of breath, cough which may be accompanied by pink (bloody) phlegm, crackly (bubbly) breath, blue lips, and chest pains	If edema is suspected, the person should immediately be taken to a lower altitude. A doctor should be called.

<p>Snow blindness (photokeratitis) *</p>	<p>Exposure of the eyes to ultra-violet (UV) radiation. **</p> <p>It can be prevented by using certified glasses when going out, especially if there is snow.</p>	<p>Marked decrease in vision, sensation of having a foreign body under the eyelid, increased blinking, light bothers and/or hurts, tearing, in severe cases ulcerations (wounds and flesh) in the eye and temporary blindness.</p>	<p>The outer cells of the eyeball die a few hours after exposure. The body will naturally (and painfully) eliminate them to make new ones. The process is reversible, it simply requires rest in a dark room with the eyes closed (minimum 24 hours) and ophthalmological evaluation to assess the degree of damage.</p>
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* Snow blindness is not a sign of poor adaptation to altitude, it is a consequence of inadequate eye protection. It is listed here for simplicity ** The exposure to UV radiation produces also skin burns.

<p>CHILDREN AND TEENAGERS IN THE MOUNTAIN</p>	
<p>Children under 12 years of age at high-altitude</p>  <p>Think it twice!</p>	<p>Although many children climb to great heights without complications, there is an international consensus on the importance of adequate care for them, especially if they are going to be exposed to the effects of height (case Chacaltaya). Please consider the following:</p> <ul style="list-style-type: none"> - Children will hardly describe the symptoms they present, so in case of basic or serious complications it is difficult to diagnose them. - Parents/tutors should ask themselves why they are taking their children to the mountains. Is it because they themselves like it? What activities are suitable for children in the place of visit? - The possibility of a quick evacuation should be kept in mind in case of complications with the minor. - Children's bodies do not respond in the same way as those of adults. Something can happen when there are risk factors, such as: overweight, low birth weight, preeclampsia, birth by assisted fertilization, premature child, high blood pressure, etc. Since the person in charge does not necessarily know the child's medical history in detail, the minor may be exposed to a greater health risk than supposed. <p style="text-align: center;">Chacaltaya and Alpaca observatories are open to all types of visitors, but the care and diagnosis of the minors are the full responsibility of the parent/tutor.</p> <p><i>For more information, see the statement of the medical board of the Intl. mountaineering and climbing federation</i></p> <p><i>https://theuiaa.org/documents/mountainmedicine/UIAA_MedCom_Rec_No_9_Children_at_Altitude_2008_V1-1.pdf</i></p>
<p>TEENAGERS 13-18 years old</p> <p>Even they can better communicate their problems, their adaptation to altitude should still be constantly evaluated.</p> 	

EXPERT MEDICAL ADVICE REGARDING ALTITUDE ADAPTATION

Please contact the Instituto Boliviano de Biología de Altura (IBBA), Calle Claudio Sanjinés s/n (Miraflores) - Hospital del Tórax, frente al INO, La Paz, Bolivia.

Tel.: (591-2) 2242064 / (591- 2) 2242059. Fax :(591-2) 2221418

e-mail: Ifisibba@fdm.umsalud.edu.bo

Working hours: Mo-Fri 9h - 16h.

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Translation and update (v. 2022). C. Isabel Moreno R.