



Diabetes and travel

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Summary

Travel exposes an individual in unfamiliar environments. Those planning to travel should schedule an appointment with their treating physician, at least a month in advance of their trip for an updated assessment of glycemic control, and should also procure a prescription describing the patient's medical condition, and medication. A diabetic individual should also carry extra amount of medicines which are distributed properly. Information regarding the climate and environmental conditions of the destination is a must. Extremes of weather can adversely affect the health of the patient and/or degrade medications, supplies, and equipment. Patients with diabetes are more susceptible to environmental stressors than their counterparts, such as increase incidence of heat exhaustion, cold exposure, or foot ulcers. Food options for diabetics may be limited during travel and travel planning should offer greater flexibility in dietary choices. Packing healthy snacks in carry-on luggage can take care of disrupted dietary patterns. Insulin concentration varies in various countries, and hence, the use of the correct syringes is essential. Unit of blood glucose measurement may also be different. Availability of medications may also be an issue. So, it is important to carry a list of all medications with generic name and their dosages. Immunization against common and travel-related vaccine-preventable diseases is recommended. Those on insulin pump therapy should get in touch with the manufacturing company and it is advisable to disconnect the pump during takeoff or landing as change in cabin pressure may lead to excess insulin delivery. Individuals with diabetes should also carry travel health insurance. One must carry physician prescription, health insurance policy, medications and prescriptions for them, rescue medications, snacks, supplies, glucometers, coolants, pumps in double, first aid kit, comfortable shoes, and protective clothing. Airport security requiring patients on pump or continuous glucose monitor (CGM) to go

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through scanners should be warned from doing so as it may cause radiation-induced malfunction. These devices should not be removed also. Air travel requires patients to carry carbohydrate snacks, insulin, insulin pump, and medications in carry-on baggages to maintain temperature stability. Due to pressure differences in the cabin area, there might be some irregularities in insulin administration. Even in insulin pumps, similar issues may arise due to bubbles precipitating out of insulin solution in the microtubules. Blood sugars must be frequently checked. Traveling across less than five time zones does not require insulin dose adjustments, but in greater than five time zones, dose and timings need to be adjusted. Those with diabetes are at an increased risk of developing deep venous thrombosis, so they should be encouraged to stand and walk during long flights every 1–2 h and perform seated dorsiflexion/ plantarflexion exercises to avoid venous stasis; also, one must remain well hydrated. Train travel is much more flexible; though health insurance is not required, one must pack the same essentials in carry-on bags. During travel, there will be an inadvertent increase in walking, for which insulin requirement will decrease, and frequent snacking may also help. Blood sugar must be measured more frequently. One must wear proper footwear to avoid ulcers and infections. One must be properly hydrated and must also avoid diarrhea.

Keywords Diabetes · Insulin concentration · Health insurance

Recommendations

1. A diabetic individual should undergo a proper medical evaluation at least a month in advance of their trip as an individual is exposed to an unfamiliar destination.
2. Information regarding climate and environmental conditions of the destination is a must as extremes of temperature may have a deleterious effect on patients and may degrade medicines.
3. Availability of medicines, unit of blood glucose measurement, and insulin concentrations may also be an issue.
4. Individuals must carry a list of all medications with generic name and their dosages; medicines should be carried in extra in easily accessible bags.
5. Health insurance is a must and patients should also be immunized with vaccine-preventable diseases.
6. Airport security requiring patients going through body scanners should be careful as pumps and CGM may undergo radiation-induced malfunction.
7. In air travel, patients should carry medicines and carbohydrate-rich snacks in their carry-on luggages.
8. In air travel, patients should not inject insulin or use a pump at takeoff or landing due to pressure differences which may lead to irregularities in insulin administration.
9. Traveling across more than five time zones requires insulin dose and frequency adjustment.
10. In air travel, there is an increased risk of developing deep venous thrombosis (DVT), which can be easily prevented by simple exercise and hydration.
11. Train travel is more flexible; health insurance is not required but snacks and medications should be carried in easily accessible bags.
12. During travel, there will be an inadvertent increase in activities, and hence, medications should be adjusted and blood sugar level should be checked regularly.

Diabetes and travel

Travel, whether for pleasure or business, places an individual in unfamiliar environments. Those with chronic illnesses, like diabetes, may be vulnerable to the emotional and physical stresses associated with traveling. Diabetes is largely self-managed; however, when unfamiliar foods, climate, time zone changes, and living conditions are considered during times of travel, patients may face challenges in managing their diabetes [1]. A study conducted in Aberdeen, UK, showed that 15% of insulin users stated that their use of insulin affected their choice of travel destination, both in terms of health risk in developing countries and avoidance of long-haul travel [2]. However, individuals with diabetes can travel safely with adequate preparation and appropriate self-management skills.

This document aims to present a summary of recommendations and clinical insights that can be provided to patients with diabetes who are preparing to travel.

Travel exposes an individual in unfamiliar environments.

Pretravel recommendations

- Visit treating Health Care Professionals (HCP): Patients with diabetes who are planning to travel should schedule an appointment with their treating physician, at least a month in advance of their trip to allow for planning of diabetes care when traveling. This will also allow an updated assessment of glycemic control, evaluation and review of the risks of travel, and a discussion of the measures the patient can take to minimize these risks. In addition, the physician can remind the patient and reiterate on some important self-management principles, e.g., recognition and treatment of hypoglycemia symptoms, sick day guidelines, and self-monitoring of blood glucose requirements.

It is important to procure a prescription/letter from the physician describing the patient's medical condition, their current diabetes medication regimen, and the patient's medical necessity to carry sharps, e.g., needles and lancets, if the patient is on an insulin regime [3, 4].

It is prudent to advise the patients to plan for travel delays and lost luggage, so taking twice as many diabetes supplies and medications is recommended, preferably distributed in different luggage bags.

Those planning to travel should schedule an appointment with their treating physician, at least a month in advance of their trip for an updated assessment of glycemic control, and should also procure a prescription describing the patient's medical condition, and medication. A diabetic individual should also carry extra amount of medicines which are distributed properly.

- Knowing the destination: It is of utmost importance to research information regarding the climate and environmental conditions of the destination. Extremes of weather can adversely affect the health of the patient and/or degrade medications, supplies, and equipment [5, 6].

Patients with diabetes are more susceptible to environmental stressors than their counterparts.

Patients taking insulin or other injectable medications that are temperature sensitive should investigate the availability of refrigeration, e.g., refrigerators in hotel rooms and travel cold packs, at their destination and plan if such facilities do not exist, i.e., travel cold packs can be packed prior to departure.

Suitable clothing should be carried based on the climate at the destination. Protective gear such as hats/sunglasses/sunscreen, gloves/mittens/boots, and comfortable footwear will enable patients with diabetes to enjoy their trip without putting themselves at higher risk for heat exhaustion, cold exposure, or foot ulcers [7].

Information regarding the climate and environmental conditions of the destination is a must. Extremes of weather can adversely affect the health of the patient and/or degrade medications, supplies, and equipment. Patients with diabetes are more susceptible to environmental stressors than their counterparts, such as increase incidence of heat exhaustion, cold exposure, or foot ulcers.

- Diet: Food options for patients with diabetes may be limited during travel, especially if one is traveling out of the country, so planning in advance is important. This is more relevant during air travel, as travel by road/train and maritime travel offer greater flexibility in dietary choices [8]. For flights during which a meal will be served, there is an option of selecting your choice of meal well in advance. The destination and

flight duration are also important with regard to food options available. Packing healthy snacks in carry-on luggage can take care of disrupted dietary patterns that may occur during the flight. Access to such foods may be limited during travel and it is recommended to be carried to help prevent or treat hypoglycemic events. When traveling to countries where English is not the primary language, food labels and restaurant menus may be difficult to interpret. In such situations, investigating specific dietary options before departure, via the internet, may be helpful. When unsure, it is best to rely on known low-carbohydrate options, e.g., salads, nuts, and eggs [9].

Food options for diabetics may be limited during travel and travel planning should offer greater flexibility in dietary choices; packing healthy snacks in carry-on luggage can take care of disrupted dietary patterns.

- Medication: For insulin users, it is important to note that insulin concentration varies in various countries. Available options include U-40, U-100, or U-200. Use of the correct syringes with specific insulin concentrations is essential, since using wrong syringes may deliver incorrect dose of insulin. This concern is diminished in those who use insulin pens rather than vial and syringes.

It is also important to note that the unit of blood glucose measurement in India is mg/dL, but many other countries use mmol/L. This will be important if someone's glucose meter malfunctions while abroad and another one needs to be bought locally.

Travelers should be also aware that not all insulins, other injectables, or oral diabetes medications available in India will be available in every country throughout the world and that medications may be referred to by different names [10]. Therefore, it is important to carry a list of all medications with generic name and their dosages.

Those who are on insulin pump therapy should get in touch with the manufacturing company for contact details at the destination, should there be a need. They must discuss with their treating physician about an alternative basal-bolus insulin regimen in the event of pump failure.

Immunization against common and travel-related vaccine-preventable diseases is recommended, as per individual country recommendations, prior to departure. *It is advisable to disconnect the pump during take-off or landing as change in cabin pressure may lead to excess insulin delivery.*

Insulin concentration varies in various countries, and hence, the use of the correct syringes is essential. Unit of

blood glucose measurement may also be different. Availability of medications may also be an issue. So, it is important to carry a list of all medications with generic name and their dosages. Immunization against common and travel-related vaccine-preventable diseases is recommended. Those on insulin pump therapy should get in touch with the manufacturing company and it is advisable to disconnect the pump during takeoff or landing as change in cabin pressure may lead to excess insulin delivery.

- Travel health insurance: Where feasible, travelers need to get in touch with their medical insurance companies and review their medical coverage policies during travel should unforeseen emergencies arise. One should have easy access to their health insurance identification card. It is also important to locate the nearest hospital and pharmacy at the destination, before arrival, in case medical assistance is required. It would be wise to ensure that the health insurance is accepted at these facilities beforehand to avoid expensive medical bills or unforeseen costs.

Individuals with diabetes should also carry travel health insurance.

What to pack [1]

- Physician prescription/letter with the following information:
 - Letter should be in English.
 - Whether the patient has type 1 or 2 diabetes.
 - Medications (generic name) and dosages—if on insulin pump, settings and basal-bolus backup regimen, in case of pump malfunction, should be included.
 - Rescue medications, viz glucose gel, tablets, and a glucagon pen.
 - Supplies with quantities mentioned (glucometer, testing strips, lancets, syringes/pens, and batteries).
 - Necessity to carry sharps (needles and lancets).
 - Physician name and contact details.
- Health insurance policy/card or details
- Diabetes medications and prescriptions for them
 - Always keep double medicines and supplies than needed for travel. Do not pack them all in one place. Keep half the supplies in a bag that will be with the concerned individual in person, irrespective of mode of travel.
- Rescue medications (glucose gel, tablets, and glucagon pen)
- Supplies (syringes, lancets, test strips, sharps container)

- Two glucose meters (in case one fails) with extra batteries
- If on insulin pump, twice as many pump supplies as may be needed
- Coolant/cold packs/insulin wallets for insulin users
- First aid kit
- Comfortable shoes
- Protective clothing, depending on destination climate
- Some snacks to avoid hypoglycemia

One must carry physician prescription, health insurance policy, medications and prescriptions for them, rescue medications, snacks, supplies, glucometers, coolants, pumps in double, first aid kit, comfortable shoes, and protective clothing

Air travel

- Airport security [1]: Travel security, both national and international, has become strict in recent years. When traveling by air, outside the country, passengers should contact the airline to find out if the destination country has any specific airport security restrictions or requirements regarding diabetes medications or equipment. If a traveler is on an insulin pump or a continuous glucose monitor (CGM), it is important to ensure that the device not be removed since it is attached via a catheter underneath the skin. It is also prudent to check with the pump CGM manufacturing companies regarding recommendations for radiation exposure. Several companies allow the passage of their equipment through metal detectors but do not recommend that their products should be run through the x-ray machines or body scanners that implement x-ray technology, due to the potential risk of radiation-induced malfunction. This information may be available online and can be printed and shown to security personnel.

Airport security requiring patients on pump or CGM to go through scanners should be warned from doing so as it may cause radiation-induced malfunction. These devices should not be removed also.

- Storing diabetes medications and supplies: Carrying snacks that contain carbohydrates is a good backup in addition to glucose tabs, gels, or glucagon kits, in case blood sugars fall low. Carrying diabetes supplies in carry-on luggage is also a beneficial for several reasons:
 - Easier accessibility while traveling.
 - Avoids medications and supplies getting lost in case of luggage loss.
 - Temperature extremes occur more frequently in the luggage compartments rather than in the cabin areas on

airplanes, which is important to consider when carrying insulin vials or pens.

Injectable diabetes medications have optimal storage temperatures between 2 and 8 °C while oral medications can be stored between 20 and 30 °C [11].

Insulin pumps have temperature tolerances of 5–40 °C and CGM devices from 10 to 40 °C; but specific temperature ranges vary by manufacturer.

Blood glucose testing strips should be kept in their tightly sealed containers to avoid exposure to moisture. Do not expose them to extreme temperatures.

Travelers should read the package inserts of their medications, devices, and equipment to ensure proper functioning.

In India, very recent Clinicare (India) Pvt. Ltd., a Mumbai-based company, has launched the FRIO ® Insulin Wallet. This is meant for keeping insulin cool while traveling and is a good option when one has no access to refrigeration or during power shortages while traveling.

Unlike traditional insulin carrying cases, FRIO®'s cooling properties are not derived from an ice pack or anything that needs refrigeration. It is easily activated by water. It is an environment-friendly green reusable product and is convenient to be carried around on oneself or in one's hand baggage [12].

Air travel requires patients to carry carbohydrate snacks, insulin, insulin pump, and medications in carry-on baggages to maintain temperature stability.

- Insulin on board: Depending on the duration of the flight, insulin may need to be administered on board an airplane. Due to pressure differences in the cabin area, resistance may arise when utilizing syringe plungers to draw up insulin [13]. Similarly, with insulin pen devices, there may be a leak in insulin when applying the pen tip needle for use.

For those using insulin pump therapy on board an aircraft, recent data suggests the possibility of unintended insulin delivery during ascent from bubbles precipitating out of insulin solution in the microtubules according to pressure gradients [14]. In addition, there have been reports of significant unintended insulin administration due to plunger movements during rapid cabin depressurization, during emergency. Overall, more data is needed before recommendations regarding insulin pump management during flight can be made [15]. Travelers must check their blood sugars frequently due to the effects that stress, altered eating habits, and altered medication administration times may have on overall blood glucose control.

Due to pressure differences in the cabin area, there might be some irregularities in insulin administration. Even in insulin pumps, similar issues may arise due to bubbles precipitating out of insulin solution in the microtubules. Blood sugars must be frequently checked.

- Traveling across time zones: Diabetes management is based on a 24-h cycle. When traveling from west to east, one should remember that the day shortens compared with when traveling from east to west, when the days become longer [16]. Usually, if fewer than five time zones are crossed during travel, adjustments to insulin dosing are generally not necessary [17]. If more than five time zones are crossed, specific recommendations should be made by the treating physician to discuss how insulin dosing or timing of administration should change based on time zone differences.

For those on oral medications, timing is less important. Patients should be educated not to take their sulfonylurea if they will be missing meals during travel to avoid hypoglycemia. However, other oral agents may be continued.

Generally, it is helpful if travelers keep their wrist watch set to their departure time zone at least for the first day of travel.

Traveling across less than five time zones does not require insulin dose adjustments, but in greater than five time zones, dose and timings need to be adjusted.

- Prevention of venous thromboembolism in air travelers: Those with diabetes may be at an increased risk of developing deep venous thrombosis (DVT) [18, 19]. Therefore, they should be encouraged to stand and walk during long flights every 1–2 h while awake and perform seated dorsiflexion/plantarflexion exercises to avoid venous stasis that could potentiate clot formation. Staying well hydrated throughout the flight may also decrease the risk of DVT formation.

Those with diabetes are at an increased risk of developing deep venous thrombosis, so they should be encouraged to stand and walk during long flights every 1–2 h and perform seated dorsiflexion/plantarflexion exercises to avoid venous stasis; also, one must remain well hydrated.

Train travel/road travel

In general, traveling by train and/or road is a much more flexible option for a person with diabetes, especially with respect to diet and medications. However, it is mandatory to have a visit with the HCP pretravel and it is most definitely beneficial to know details about the destination beforehand, as listed above.

Since train/road travel is feasible only within the country, specific travel health insurance is not a pre-requisite; but it would be helpful to review one's medical coverage policies and get a list of hospitals/clinics wherein their current insurance will be accepted, at the destination, should unforeseen emergencies arise.

The list of what to pack remains the same, as above.

For carrying and storage of insulin, as mentioned above, FRIO® Insulin Wallet may be a good option [12].

Train travel is much more flexible; though health insurance is not required, one must pack the same essentials in carry-on bags.

Recommendations after arriving at travel destination

- Physical activity

Depending on travel itineraries, there may be an inadvertent increase in walking more than one is accustomed to (whether at their destinations or in airports between security and boarding gates). This increase in physical exercise may increase glucose utilization and lower blood sugars in addition to more rapid insulin absorption. In such situation, it may be useful to slightly decrease the insulin dosages or eat more carbohydrates and snack between meals to keep blood glucose levels appropriately controlled [20]. It is also advisable to check blood sugar levels more frequently, to be able to keep a track on overall glycemic control. This is considering exposure to a new cuisine, a new environment, and a potentially different physical activity levels [13].

With increased walking comes the need for comfortable footwear since blisters and abrasions can develop from improperly fitted shoes. Wearing sandals on beaches to reduce the introduction of bacteria and other stray objects is advisable [21].

During travel, there will be an inadvertent increase in walking, for which insulin requirement will decrease; frequent snacking may also help. Blood sugar must be measured more frequently. One must wear proper footwear to avoid ulcers and infections.

- Keeping hydrated

It is important to remain hydrated, especially when traveling to hotter climates. It is also important to know the quality of the potable water available at one's destination to avoid traveler's diarrhea and the ensuing dehydration [22, 23].

One must be properly hydrated and must also avoid diarrhea.

Conclusion and future perspective

Travelers with diabetes can face challenges during their trips, particularly international travelers. In general, traveling within the country in the same time zone, be it by air or train, poses less of a challenge than traveling outside the country, to a destination with a different time zone.

Being prepared by planning, in advance, will be helpful to achieve management of diabetes and boost self-confidence. This is of utmost importance to achieve appropriate patient glucose control amidst changing diet, time zone difference, and a new environment. Patients should meet their treating physician at least 1 month prior to travel, to allow time for the physician to generate a travel letter and/or prescriptions for needed medications, equipment, and supplies.

Diabetes is manageable when patients and their providers work together to formulate a treatment plan for travel. No destinations should seem "off-limits" to individuals with diabetes, given the available resources that can be utilized in preparation for travel. It is always advisable to take extra precaution while traveling to high altitude (above 8000 ft.) as low oxygen level there may offset glycemic control.

While the above guidelines outlined here seem reasonable, there is no information on how many patients actually have any knowledge of the basics or seek pretravel counseling, and the area remains largely understudied. More data on the diabetic traveling population is needed so that better evidence-based guidelines can be developed.

Tips for safe trips

1. Plan your tour well in advance. Consult your physician and discuss it in details about tour schedule.
2. Carry the prescription, important documents, and a list of all the supplies at hand.
3. Always carry insulin/medicines/accessories double the required amount for you.
4. Use comfortable shoes; always carry some snacks/ glucose tabs or gel while on move.
5. Remain hydrated, avoid unaccustomed food and physical activities, and avoid alcohol in excess.
6. Always take help from co-traveler or travel agents in case of emergency.

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