Table 4. Noninsulin diabetes medications

Medication	Important side effects	Incidence
Metformin	Diarrhea	10−30%
	Nausea	10−15%
	Lactic acidosis	2−5/100,000
Sulfonylureas	Hypoglycemia	Frequency varies by degree of hypoglycemia
Glinides	Hypoglycemia	Frequency varies by degree of hypoglycemia
Acarbose	Abdominal pain	19%
	Diarrhea	31%
DPP4 inhibitors	Nausea	10−24%
	Diarrhea	10−18%
SGLT2 inhibitors	Diuresis (hypotension, dehydration)	1%
	Increased risk of UTIs	<1% (19 cases of urosepsis reported over 1 year)
	Euglycemic diabetic ketoacidosis	<1% (73 cases reported over 2 years)
GLP-1 receptor agonists	Nausea/Vomiting	10−30%
	Diarrhea	10−15%

AP, artificial pancreas; BG, blood glucose; CGM, continuous glucose monitoring; DPP4, dipeptidyl peptidase-4; GLP-1, glucagon-like peptide 1; HCL, hybrid closed loop; MDI, multiple daily injection; SGLT2, sodium-glucose transport protein 2; UTI, urinary tract infection.

consideration should be given to common noninsulin medications used in the treatment of diabetes and their unique side effects and potential complications (Table 4).

Metformin is a commonly used medication, prescribed to 84% of people with type 2 diabetes in the United Kingdom.[92] Metformin is a biguanide class antihyperglycemic that improves glycemia by reducing hepatic gluconeogenesis and increasing peripheral insulin-mediated glucose utilization. Metformin may cause diarrhea, and 25% experience some form of digestive tract disturbance upon starting the medication. Metformin-induced diarrhea may predispose to dehydration and hypokalemia.[93] There is a known risk of metformin-induced lactic acidosis, found at a rate of 2 to 5 per 100,000,[94] with elevated serum creatinine being the greatest predisposing risk factor. Although concurrent use of metformin and acetazolamide (a diuretic carbonic anhydrase inhibitor commonly used for AMS prophylaxis) has not been directly assessed, there is concern that concurrent use of a diuretic with metformin could precipitate lactic acidosis.[94,95] Exercise alone is known to be safe while using metformin alone,[16] and no dose adjustments are recommended.

Both sulfonylurea and glinide class medications carry a risk of hypoglycemia, and blood glucose should be monitored following initiation or changes in these medications. Acarbose and DPP4 inhibitor medications including sitagliptin and saxagliptin can cause vomiting and diarrhea.[96,97] Hypoglycemia appears to be a minimal risk with the DPP4 medications.[97] SGLT2 inhibitors block glucose reuptake in renal tubules and so have diuretic-like effects that could theoretically worsen dehydration, though there is no supporting clinical evidence.[98] SGLT2 inhibitors pose a known increased risk of urinary tract infections and euglycemic DKA, carrying a specific Food and Drug Administration warning.[98,99] Glucagon-like peptide-1 receptor agonists are a relatively new class of injectable antihyperglycemic medication, with nausea, vomiting, and diarrhea being the most frequently reported gastrointestinal side effects.[100]

Noninsulin diabetes medications should ideally be stored in a dark environment at room temperature, although compared with insulin, they are not as sensitive to environmental perturbations.

Recommendation. Use of noninsulin diabetes medications should not be considered a contraindication to wilderness athletic involvement, though participants should be cautious regarding side effects. Particular attention should be paid to the individual risks of each specific class of medication (**Evidence grade:** 1C).

GLYCEMIC COMPLICATIONS

In addition to proper pre-trip planning and understanding the basics of carbohydrate intake and insulin management, several specific complications and medical issues deserve unique consideration for the wilderness athlete with diabetes.

Hypoglycemia

Hypoglycemia is defined as a plasma glucose level less than 70 $mg \cdot dL^{-1}$, is a well-recognized hindrance to athletic performance, and most importantly poses an acute health risk in diabetes. Typical symptoms of hypoglycemia include drowsiness, confusion, dizziness, nausea, palpitations, tremor, sweating, and anxiety. As a result of hormonal counterregulatory mechanisms, hypoglycemia is also