37 Possible Causes of Hyperglycemia

Causes	Source	Conclusions
1.Simple sugars	DOI: 10.1242/jeb.164202	Continuous exposure to high fructose intake is associated with a low energy turnover and chronic overproduction of intrahepatic trioses-phosphate production, which is responsible for the development of hepatic insulin resistance, intrahepatic fat accumulation, and increased blood triglyceride concentrations. In the long term, these effects may contribute to the development of metabolic and cardiovascular diseases.
2.Carbohydrates	DOI: 10.3390/nu9040322	Carbohydrate intake should be individualized, and low caloric intake remains a crucial factor to improve insulin sensitivity and reduce body weight; however, an HC diet, rich in fiber and with a low GI/GL, may be recommendable in patients with T2DM.
3.Artificial sweeteners	DOI: 10.2174/1573399813666170601093336 DOI: 10.1038/ejcn.2017.37	Artificial sweeteners such as aspartame may act as chemical stressor-increasing cortisol levels, and inducing systemic oxidative stress by producing excess free radicals. It may also alter gut microbial activity and interfere with the (NMDA) receptor, resulting in insulin deficiency or resistance. Twenty-four-hour glucose profiles did not differ between beverages sweetened with non-nutritive (artificial vs natural) and nutritive sweeteners.
4.Alcohol	DOI: 10.3390/biom5042223	It was only in the instances of prolonged heavy alcohol intake (e.g., ~60 g/day for men; 50 g/day for women) where alcohol had a deleterious effect on diabetic patients.

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5.Caffeine	DOI: 10.1186/s12937-016-0220-7	Acute caffeine consumption results in hyperglycemia due to reduced insulin sensitivity.
6.Vitamin A deficiency	DOI: 10.1074/jbc.M114.616763	Vitamin A is needed for pancreatic beta cell function and insulin secretion and poor dietary intake could lead to hyperglycemia.
7.Increased intake of dietary selenium	DOI: 10.1186/s12937-015-0007-2 DOI: 10.1016/j.jtemb.2020.126470	High levels of dietary selenium may lead to hyperglycemia by different pathways including increased release of glucagon. This study reported an OR of 1.52 for participants with the highest intake of selenium among the groups and concluded there was a positive association between dietary intake of selenium and diabetes (p=0.03).
8.Diet induced loss of Hexokinase 2	DOI: 10.1101/2019.12.28.88779	A diet high in fat can cause early loss of HK2 in adipose tissue leading to selective insulin resistance.
9.Stress	DOI: 10.1186/cc12514	Hyperglycemia due to stress is the body's response to increase chances of survival. There is an increased hepatic output of glucose.
10.Physical inactivity	DOI: 10.1249/MSS.0b013e31822ac0c0	Post prandial BG seems to increase even after short periods (3 days) of decreased physical activity in otherwise healthy individuals.
11.Poor dental health	DOI: 10.4103/0975-7406.100251	The progression of periodontal disease is influenced by a variety of factors like microorganisms, host response, systemic background, and genetic makeup of the host. Amongst them, diabetes mellitus tops the list. Diabetes and periodontitis influence the clinical outcome of each other and control of both influences the clinical improvement of each.
12.Poor sleep	DOI: 10.1136/bmjopen-2013-004436	Inadequate sleep quality and duration (<6 hours) may be associated with a

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		higher risk of impaired fasting glucose (OR 6.37, 95% CI 4.66-8.6).
13.Smoking	DOI: 10.3889/oamjms.2018.140	People who smoke may have a higher risk of increased FBG, ppBG, and A1C. However, statistical significance was only seen on the effect of smoking on ppBG. In smokers FBG was higher by 23.64 mg/dL (p=0.325), ppBG increased by 58 mg/dL (p=0.016), and A1C was higher by 0.39% (p=0.412).
14.Steroids	DOI:10.2106/JBJS.RVW.O.00029	Intra-articular steroid injections may cause hyperglycemia in patients with diabetes mellitus. Diabetics should be warned of this and be advised to regularly monitor their blood glucose levels for up to a week after injection.
15.Antidepressants/antipsychotics	DOI: 10.2174/1871530315666150623092031	Weight gain and metabolic disturbances are common side effects during psychopharmacological treatment with specific antipsychotics and antidepressants. The antipsychotics clozapine and olanzapine, and antidepressants tricyclics and mirtazapine have a high risk of inducing weight gain
16.Thiazide diuretics	DOI: 10.1111/jch.12679	The use of thiazide diuretics may be associated with increased fasting plasma glucose.
17.Statins	DOI: 10.1111/dom.12254	In those predisposed to the development of diabetes (the insulin resistant, obese, and older patients) statins may increase the risk of developing diabetes.
18.Beta blockers	DOI: 10.1111/j.1755-5922.2009.00092.x	The risk of new onset diabetes after adjusting for sex and age among users of beta-blockers was (OR = 1.12, 95% CI = 1.04-1.21)
19.Protease inhibitors	DOI: 10.1155/2005/971971	A longer duration of protease inhibitor therapy is associated with an increased risk of developing diabetes.

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20.Calcineurin inhibitors	DOI: 10.1046/j.1600-6143.2003.00372.x	New onset diabetes mellitus was reported in 13.4% of patients after solid organ transplantation, with a higher incidence in patients receiving tacrolimus than cyclosporine (16.6% vs. 9.8%).
21.Obesity	DOI: 10.2147/DMSO.S67400	Obesity is associated with reduced insulin sensitivity.
22.Gastroparesis	DOI: 10.1210/er.2018-00161	Hyperglycemia, autonomic neuropathy, and enteric neuromuscular inflammation and injury are implicated in the pathogenesis of delayed gastric emptying.
23.Infection	DOI: 10.1016/j.cmi.2016.12.033	Hyperglycaemia, as part of the endocrine-metabolic responses to stress, is present in virtually all critically ill patients and is associated with poor outcome.
24.Menstruation	DOI: 10.1097/MAJ.0b013e31815adec8	To date there have been 7 reported cases in the literature demonstrating an association between menstruation and DKA. The 2 new cases highlight the potentially significant changes in glucose metabolism that may occasionally be observed during the late luteal and decidual phases of the menstrual cycle;
25.Pregnancy	DOI: 10.15537/smj.2015.4.10307	Gestational diabetes mellitus (GDM) is the most common medical complication of pregnancy. It is associated with maternal and neonatal adverse outcomes. Maintaining adequate blood glucose levels in GDM reduces morbidity for both mother and baby.
26.PCOS	DOI: 10.1210/jc.2017-01354	Women with PCOS have a higher risk for diabetes and are diagnosed at a younger age. Patients with PCOS had a total event rate of T2DM of 8 per 1000 person-years compared to 2 per 1000

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		person-years in the control group ($p<0.001$).
27.Cushing Syndrome	DOI: 10.1007/s11102-013-0483-3	Cushing's disease is a severe clinical condition caused by a pituitary adenoma hypersecreting adrenocorticotropic hormone (ACTH). The persistently high levels of ACTH lead to chronic hypersecretion of cortisol by the adrenal glands, which negatively affects many tissues and organs in the body. Cushing's contributes to the risk of hyperglycemia secondary to hypercortisolism.
28.Insulin resistance	DOI: 10.1155/2017/1478294	While type 1 diabetes is characterized by the presence of beta cell autoantibodies, a combination of peripheral insulin resistance and dysfunctional insulin secretion by pancreatic beta cells is implicated in the pathogenesis of type 2 diabetes
29.Pancreatitis	DOI: 10.1111/jsap.12295	The underlying pathology of diabetes mellitus in dogs and cats is heterogeneous, with exocrine pancreatic inflammation accompanying diabetes mellitus in a number of cases.
30.Pancreatic cancer	DOI: 10.1016/S1470-2045(08)70337-1	The most commonly identified causes of type 3c diabetes are chronic pancreatitis, pancreatic ductal adenocarcinoma, haemochromatosis, cystic fibrosis, and previous pancreatic surgery. Diabetes can also develop as a direct consequence of other diseases, including diseases of the exocrine pancreas- referred to as type 3c diabetes. The most commonly identified causes of type 3c diabetes are chronic pancreatitis, pancreatic ductal adenocarcinoma, haemochromatosis, cystic fibrosis, and previous pancreatic surgery.

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31.The Somogyi phenomenon/ Dawn Phenomenon	DOI: 10.1016/j.diabet.2014.10.002	The dawn effect, is an abnormal early-morning increase in blood sugar (glucose) — usually between 2 a.m. and 8 a.m. — in people with diabetes.
32.Cystic Fibrosis-Related Diabetes	DOI: 10.3389/fendo.2018.00020	Cystic fibrosis (CF) is the most common autosomal recessive disorder in Caucasian populations. The most common complication of CF is cystic fibrosis-related diabetes (CFRD), which affects 40–50% of CF adults.
33.Hyperthyroidism / Graves' Disease	DOI: 10.1155/2013/390534	The most probable mechanism leading to T2DM in thyroid dysfunction could be attributed to perturbed genetic expression of a constellation of genes along with physiological aberrations leading to impaired glucose utilization and disposal in muscles, overproduction of hepatic glucose output, and enhanced absorption of splanchnic glucose.
34.Pheochromocytoma	DOI: 10.7759/cureus.4551	The catecholamines such as epinephrine and norepinephrine play an important part in countering hypoglycemia especially if glucagon release is impaired [3]. However, excess catecholamines can have deleterious effects on glucose and insulin homeostasis.
35.Autoimmunity (DM Type I)	DOI: 10.1297/cpe.23.99	Type 1 DM is an autoimmune disease that results in the destruction of pancreatic beta cells. Therefore, insulin cannot be produced and hyperglycemia results.
36.Family history	DOI: 10.1097/GRF.0b013e31815a61d6	Offspring of mothers with GDM are at risk for development of obesity and abnormal glucose metabolism during childhood, adolescence, and adulthood
37.Race/ethnicity (e.g. Native American)	DOI: 10.1007/s11892-013-0421-9	The prevalence of diabetes is highest among Native Americans (33%) and lowest among Alaska natives (5.5%)

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