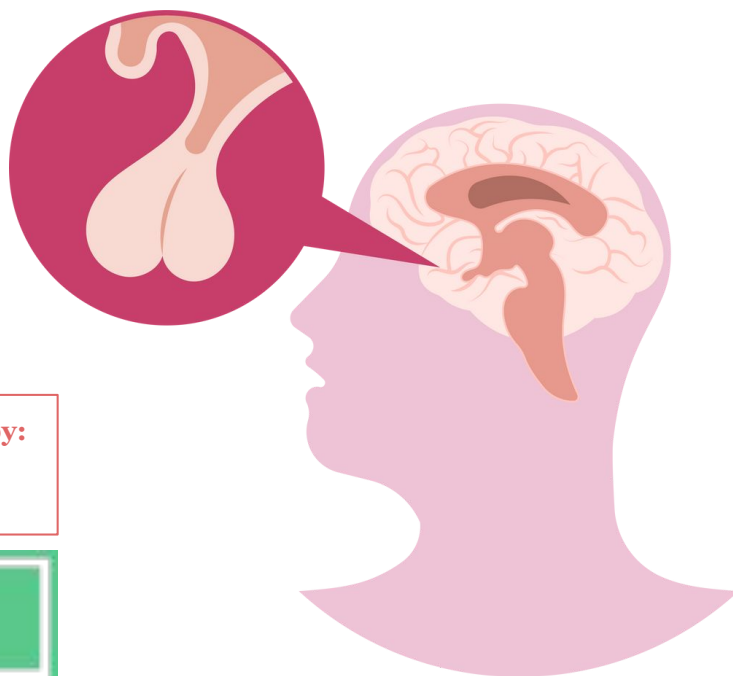




Epidemiology of Diabetes mellitus



This lecture was explained by:
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Editing file

Color index :

Main text (Black)

Female slides (Pink)

Male slides (Blue)

Important things (Red)

Dr's notes (Green)

Extra information (Grey)

OBJECTIVES



To list the types of Diabetes Mellitus.



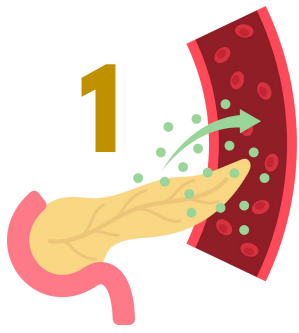
To describe the prevalence of Diabetes Mellitus.



To recognize the importance of diagnostic criteria for estimating the prevalence of Diabetes Mellitus.



To discuss the risk factors and complications of Type II Diabetes Mellitus.



Diabetes mellitus

Definition

A **metabolic disorder** of multiple etiology characterized by chronic **hyperglycemia** with disturbances of carbohydrate, fat and protein metabolism resulting from defects in **insulin secretion**, **insulin action** or both.

Pre-diabetes: Impaired glucose tolerance, A person with pre-diabetes has a blood sugar level higher than normal, but not high enough for a diagnosis of diabetes, & is at higher risk for developing type 2 diabetes. May remain undiagnosed for years, risk of complications same as for T2DM.

Main Types Of DM	Type 1	(5-10%) – due to autoimmune β -cell destruction, usually leading to absolute insulin deficiency, usually affects younger age group (not always).
	Type 2	(90 - 95%) – due to a progressive loss of β -cell insulin secretion frequently on the background of insulin resistance usually older age group (not always).
	Gestational Diabetes	Diabetes diagnosed in the second or third trimester of pregnancy, that was not clearly overt diabetes prior to gestation.
	Secondary Diabetes	The diabetes is not the main illness, a secondary condition that results because of the main illness. If it is possible to treat the main illness successfully the diabetes may/will disappear. e.g. neonatal, maturity-onset diabetes of the young(MODY), diseases of the exocrine pancreas, drug- or chemical-induced diabetes, Cystic fibrosis, chronic pancreatitis & infections.
	Pre-diabetes (IGT)	Impaired glucose tolerance (IGT) and impaired fasting glucose (IFG) - intermediate conditions in the transition between normal blood glucose levels and diabetes (especially type 2).

Symptoms

1 increase frequency of urine (pee)

4 Increase appetite

7 Tingling hand and feet

2 Increase thirst

5 Blurred vision

8 Slow healing wounds

3 Weight loss

6 Dry skin

9 Easy fatigability



2

Key facts and values

Key facts

The number of people with diabetes has risen from 108 million in 1980 to 422 million in 2014.

- The global prevalence of diabetes (1) among adults over 18 years of age has risen from 4.7% in 1980 to 8.5% in 2014.
- Diabetes prevalence has been rising more rapidly in **middle and low-income countries**.
- Diabetes is a **major cause** of blindness, kidney failure, heart attacks, stroke and lower limb amputation.
- In 2015, an estimated 1.6 million deaths were directly caused by diabetes, another 2.2 million deaths were attributable to high blood glucose in 2012 (2).
- Almost half of all deaths attributable to high blood glucose occur before the age of **70 years**, WHO projects that diabetes will be the seventh leading cause of death in 2030.
- Healthy diet, regular physical activity, maintaining a normal body weight and avoiding tobacco use are ways to prevent or delay the onset of **type 2 diabetes**.
- Diabetes can be treated and its consequences avoided or delayed with diet, physical activity, medication and regular screening and treatment for complications.

¹ Defined as FBG ≥ 7 mmol/L, or on medication for raised blood glucose, or with a history of diagnosis of diabetes.

² High blood glucose is defined as a distribution of FBG in a population that is higher than the theoretical distribution that would minimize risks to health (derived from epidemiological studies). High blood glucose is a statistical concept, not a clinical or diagnostic category.

Diabetes occur more in middle & low income countries

Healthy diet, regular physical activity can prevent or delay type 2.

Summary of key facts

Major cause of blindness, kidney failure, heart attack, stroke and lower limb amputations

Values

Diabetes	Fasting plasma glucose 2-h plasma glucose (3) HbA1c	≥ 7.0 mmol/L (126 mg/dl) or ≥ 11.1 mmol/L (200 mg/dl) or $\geq 6.5\%$
Impaired glucose tolerance (IGT)	Fasting plasma glucose 2-h plasma glucose (3)	< 7.0 mmol/L (126 mg/dl) and ≥ 7.8 and < 11.1 mmol/L (140 mg/dl and 200 mg/dl)
Impaired fasting glucose (IFG)	Fasting plasma glucose 2-h plasma glucose (3)	6.1 to 6.9 mmol/L (110 mg/dl to 125 mg/dl) and (if measured) < 7.8 mmol/L (140 mg/dl)
Gestational diabetes (GDM)	One or more of the following: Fasting plasma glucose 1-h plasma glucose (4) 2-h plasma glucose	5.1–6.9 mmol/L (92–125 mg/dl) ≥ 10.0 mmol/L (180 mg/dl) 8.5–11.0 mmol/L (153–199 mg/dl)

³ Venous plasma glucose 2 hours after ingestion of 75g oral glucose load

⁴ Venous plasma glucose 1 hour after ingestion of 75g oral glucose load



Global prevalence

Global Prevalence of Diabetes

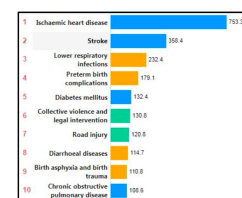
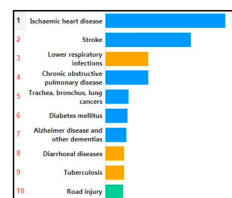
- 1) 2.8% in 2000; 4.4% in 2030 worldwide (171 million in 2000, 463 million in 2030, million 700 by 2025)
- 2) DM worldwide was already 366 million in 2011.
- 3) The prevalence increased to 382 millions (8.2%) by 2013 and current figures are >415 million.
- 4) There is a large percentage of undiagnosed cases and a large percentage at high risk of developing DM.
- 5) A huge percentage of the reported diabetics are in the 40-59 age group, and majority belong to countries with low and middle-income economies.
- 6) In 2013, about half of all diabetes-related deaths in adults were in the age group below 60 years.
- 7) Between 2000 and 2019, there was a 3% increase in diabetes mortality rates by age.
- 8) In 2019, diabetes and kidney disease due to diabetes caused an estimated 2 million deaths.
- 9) Every six seconds there is a diabetes-related death and more so in the poorly-developed region.
- 10) 35 out of 219 countries (16%) show very high prevalence of diabetes, more than 12%, These countries fall mainly in the regions of the Middle-East, North Africa, South Asia and Western Pacific.

Global Prevalence of Diabetes

Top 10 causes of death (Left picture):
World, 2015

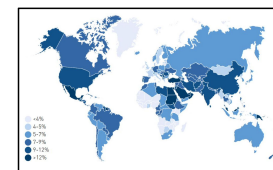
(Right Picture): EMRO, 2015

Crude death rates (per 100,000)



Estimated age-adjusted prevalence of
diabetes in adults

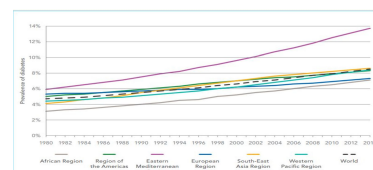
(20-79 years), 2017



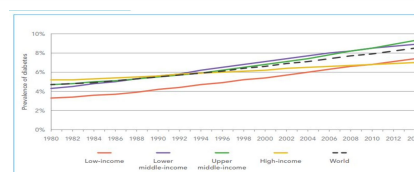
Estimated prevalence and number of
people with Diabetes (18+ years)

WHO Region	Prevalence (%)		Number (millions)	
	1980	2014	1980	2014
African Region	3.1%	7.1%	4	25
Region of the Americas	5%	8.3%	16	62
Eastern Mediterranean Region	5.9%	13.7%	6	43
European Region	5.3%	7.3%	33	64
South-East Asia Region	4.1%	8.6%	17	96
Western Pacific Region	4.4%	8.4%	29	131
Total*	4.7%	8.5%	108	422

Trends in prevalence of diabetes,
1980–2014,
by WHO region



Trends in prevalence of diabetes,
1980–2014,
by country income group





Global prevalence

Regional and Local prevalence

- 1-There are 20 Arab countries in which nearly 20.5 million people are living with diabetes and another 13.7 million are in the pre-diabetes stage, with Impaired Glucose Tolerance (IGT).
- 2-Six of the top ten countries having the highest prevalence rates of diabetes globally are found in the Gulf region, namely: Kuwait (14.6%), Lebanon, Qatar (15.4%), Bahrain (15.4%), UAE (18.7%) and Saudi Arabia.

Diabetes Mellitus and KSA

- 1-WHO ranks SA 2nd in the prevalence of diabetes in the Middle East region & 7th in the world: considered as an Epidemic.
- 2-A more recent study reported that the prevalence of diabetes had risen to 34.1% in males and 27.6% in females.
- 3-The mean reported age for diabetes onset in males and females is 57.5 and 53.4 years
- 4-The number of deaths attributed to diabetes in Saudi Arabia is about 170,000 adults, which is greater than 10% of all deaths in the country.
- 5-Saudi Arabia reported that 40% of diabetic patients are unaware of having the disease.
- 6-The incidence of T1DM is also on the increase over the last 30 years , with prevalence among the Saudi children and adolescents at 109.5 per 100,000.
- 7-Healthcare expenditures incurred by people with diabetes are increasing.
- 8-In 2010 on average, people diagnosed with diabetes spent ten times more towards medical healthcare expenditure.

Glycosylated Hemoglobin A1c

- 1-In July 2009, the International Expert Committee recommended the use of the A1C test in the diagnosis of diabetes, with a threshold of 6.5%.
- 2-Internationally as marker to track the blood sugar control.
- 3-HbA1c may be increased falsely in certain medical conditions: kidney failure, chronic excessive alcohol intake, and hypertriglyceridemia. Medical conditions that may falsely decrease HbA1c include acute or chronic blood loss, sickle cell disease or thalassemia.

Complications

- 1-Nearly 37–41% of diabetic patients in Saudi Arabia suffer from stroke while 61% of them develop peripheral artery disease.
- 2-Amputations are at least 10 times more common in people with diabetes (61% PAD, 31% neuropathy).
- 3-A leading cause of blindness & visual impairment (diabetics are 20 times more likely to develop blindness than non-diabetics).
- 4-Study in one province of SA, found >70% patients having at least ≥one complication.
- 5-It is recommended that every Saudi above 30 years of age should undergo screening for both T2DM and T1DM and pre-diabetes.



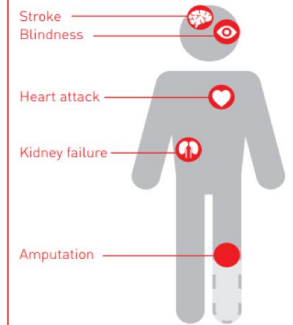
Complications

Why is diabetes so important?

- Complications (physical):**
- Cardiovascular
 - Eyes
 - Hypertension, renal failure
 - Feet & Skin infections
 - sexual, psycho-sexual, depression
 - Quality of life (mobility & psychological)
 - Premature mortality
 - Social Factors: The burden of patients & family & health system

Consequences

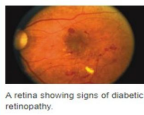
Diabetes can lead to complications in many parts of the body and increase the risk of dying prematurely.



Common Diabetes Complications:

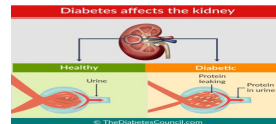
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Loss of vision



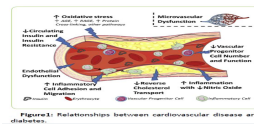
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End-stage renal disease



3

Cardiovascular events



4

Lower extremity amputations



Loss of vision

- Diabetic retinopathy caused 1.9% of moderate or severe visual impairment globally and 2.6% of blindness in 2010
- Studies suggest that prevalence of any retinopathy in persons with diabetes is 35% while proliferative (vision-threatening) is 7%
- However, retinopathy rates are higher among people with type 1 diabetes, people with longer duration of diabetes, caucasian populations and possibly among people of lower socioeconomic status

End-stage renal disease

- Pooled data from 54 countries show that at least 80% of cases of end-stage renal disease (ESRD) are caused by diabetes, hypertension or a combination of the two
- The proportion of ESRD attributable to diabetes alone ranges from 12-55%
- The incidence of ESRD is up to 10 times as high in adults with diabetes as those without



Complications

Cardiovascular events

- Adults with diabetes historically have 2-3 times higher rate of cardiovascular disease (CVD) than adults without diabetes.
- The risk of cardiovascular disease increases continuously with rising fasting plasma glucose levels, even before reaching levels sufficient for a diabetes diagnosis.
- Almost 7 in 10 people with diabetes over the age of 65 will die of some type of heart disease, about 1 in 6 will die of stroke.

Lower extremity amputations

- Diabetes appears to dramatically increase the risk of lower extremity amputation because of infected, non-healing foot ulcers **due to decreased blood circulation.** (439)
- Rates of amputation in populations with diagnosed diabetes are typically 10 to 20 times those of non-diabetic populations.
- Encouragingly several studies show a 40% to 60% reduction in rates of amputations among adults with diabetes during the past 10-15 years in western countries.

Risk factors

Family history

- Compared with individuals without a family history of type 2 diabetes, individuals with a family history in any first degree relative have a two to three-fold increased risk of developing diabetes
- The risk of type 2 diabetes is higher (5 to 6 fold) in those with both a maternal & paternal history of type 2 diabetes
- The risk is likely mediated through genetic, anthropometric (body mass index, waist circumference) and lifestyle (diet, physical activity, smoking) factors



Risk factors

Fat distribution

- The distribution of excess adipose tissue is another important determinant of the risk of insulin resistance and type 2 diabetes
- The incidence of type 2 diabetes are highest in those subjects with central or abdominal obesity, as measured by waist circumference or waist-to-hip circumference ratio
- Intra-abdominal (visceral) fat rather than subcutaneous or retroperitoneal fat appears to be of primary importance

Obesity

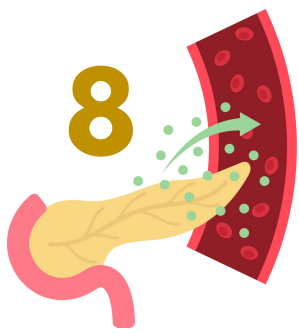
- Contributes to the resistance to endogenous insulin
- The risk of impaired glucose tolerance (IGT) or type 2 diabetes rises with increasing body weight
- The Nurse's Health Study demonstrated an approximately 100-fold increased risk of incident diabetes over 14 years in nurses whose baseline BMI was >35 kg/m² compared with those with BMI less than 22
- The risk of diabetes associated with body weight appears to be modified by age
- Obesity acts by inducing resistance to insulin-mediated peripheral glucose uptake, which is an important component of type 2 diabetes

Smoking

- Several large prospective studies have raised the possibility that cigarette smoking increases the risk of type 2 diabetes. In a meta-analysis of 25 prospective cohort studies, current smokers had an increased risk of developing type 2 diabetes compared with nonsmokers (pooled adjusted RR 1.4, 95% CI 1.3-1.6).
- A definitive causal association has not been established, a relationship between cigarette smoking and diabetes mellitus is biologically possible based upon a number of observations:
 - 1- Smoking increases the blood glucose conc. after an oral glucose challenge.
 - 2- Smoking may impair insulin sensitivity.
 - 3- Cigarette smoking has been linked to increased abdominal fat distribution and greater waist-to-hip ratio that may have an impact upon glucose tolerance.

Physiologic or emotional stress

Causes prolonged elevation of stress hormone levels (cortisol, epinephrine, glucagon and growth hormone), which raises blood glucose levels, placing increased demands on the pancreas.



Risk factors

Diet

- A number of dietary factors have been linked to an increased risk of type 1 diabetes, such as low vitamin D consumption, early exposure to cow's milk or cow's milk formula, or exposure to cereals before 4 months of age, However, none of these factors has been shown to cause type 1 diabetes
- Consumption of red meat, processed meat & sugar sweetened beverages is associated with an increased risk of diabetes
- Fruits, vegetables, nuts, whole grains & olive oil is associated with a reduced risk
- It is important to recognize that most studies have used food frequency questionnaires to capture dietary patterns & that none of the food stuffs examined can be considered in isolation. For example, higher meat intake always means more saturated fat intake, & relatively lower fruit & vegetable intake has frequently higher BMI (body mass index).

Medications

Drugs that are known to antagonize the effects of insulin:

- 1- Thiazide diuretics
- 2- Adrenal corticosteroids
- 3- Oral contraceptives

Genetic factors

- May play a part in development of all types; Autoimmune disease and viral infections may be risk factors in Type I diabetes
- Twin studies

Physical inactivity

- Prolonged TV watching is associated with a significantly increased risk of type 2 diabetes
- Men who watched TV more than 40-h per week had a nearly three-fold increase in the risk of type 2 diabetes compared with those who spent less than 1-h per week watching TV

Infections

A range of relatively rare infections & illnesses can damage the pancreas & cause type 1 diabetes

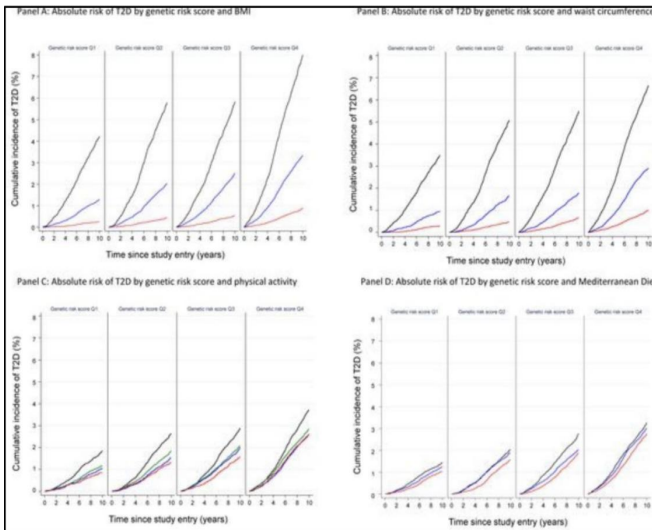
Pregnancy

Pregnancy causes weight gain & increases levels of estrogen & placental hormones which antagonize insulin.



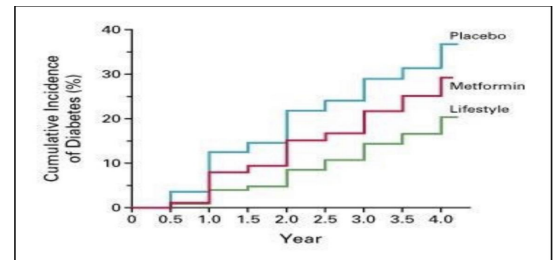
Charts and graphs

Family history



Cumulative incidence of type 2 diabetes (percent) by quartiles of the imputed, unweighted genetic risk score & strata of body mass index, waist circumference, physical activity, & Mediterranean diet score: the InterAct study.

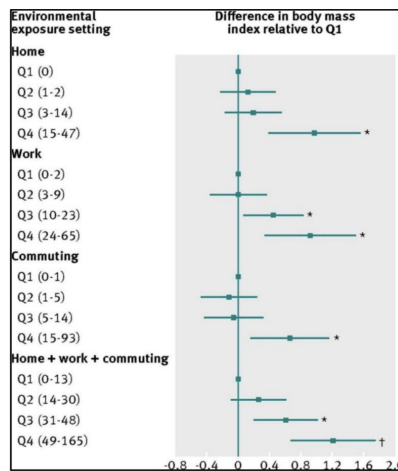
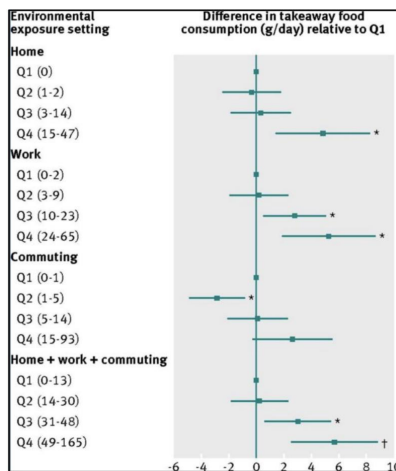
Physical inactivity



Cumulative Incidence of Diabetes According to Study Group

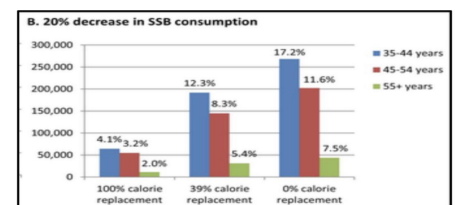
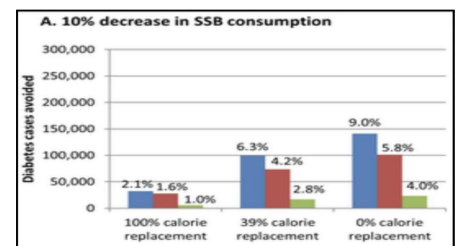
Randomly assigned 3234 nondiabetic persons with elevated fasting & post-load plasma glucose conc. to placebo, metformin (850 mg twice daily), or a lifestyle-modification program with the goals of at least 7 % weight loss & at least 150 minutes of physical activity per week

Diet



Difference in consumption of takeaway food per quarter of exposure to takeaway food outlets, in the Fenland Study sample (n=5594)

Difference in body mass index per quarter of exposure to takeaway food outlets, in the Fenland Study sample (n=5442).



Incident cases of diabetes prevented during 2013–2022 under different intervention scenarios, with results for each scenario stratified by age group

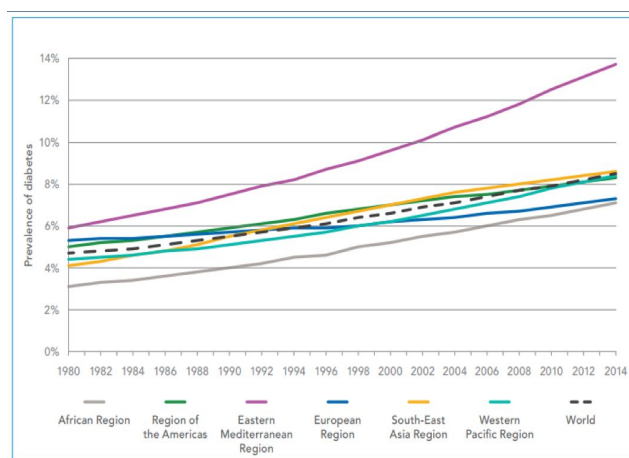


Charts and graphs

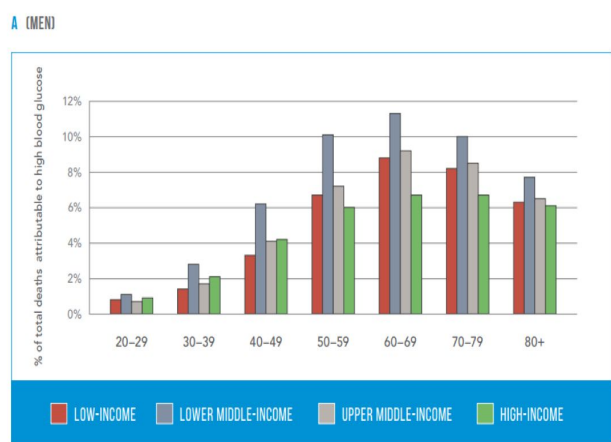
High blood glucose age-standardized mortality rates per 100000 by WHO region, age 20+, 2012

	Both sexes	Female	Male
African Region	111.3	110.9	111.1
Region of the Americas	72.6	63.9	82.8
Eastern Mediterranean Region	139.6	140.2	138.3
European Region	55.7	46.5	64.5
South-East Asia Region	115.3	101.8	129.1
Western Pacific Region	67	65.8	67.8

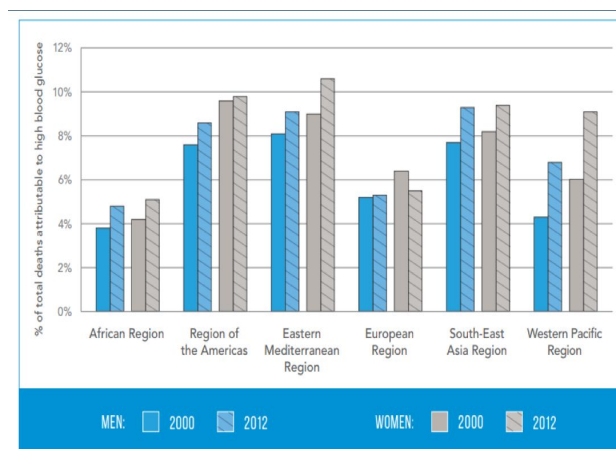
Trends in prevalence of diabetes, 1980–2014, by WHO region



Percentage of all-cause deaths globally attributed to high blood glucose in men, 2012



Percentage of all deaths attributable to high blood glucose for adults aged 20–69 years, by WHO region and sex, 2000 and 2012



Diabetes prevalence (% of population ages 20 to 79)

Rank	Country	%	Year
1	Tuvalu	27.25	2017
2	Nauru	24.07	2017
3	New Caledonia	23.36	2017
4	Kiribati	22.66	2017
5	Mauritius	22.02	2017
6	Solomon Islands	18.68	2017
7	Saudi Arabia	17.72	2017
8	Papua New Guinea	17.65	2017
9	Egypt	17.31	2017
10	United Arab Emirates	17.26	2017

Percentage of all-cause deaths globally attributed to high blood glucose in women, 2012



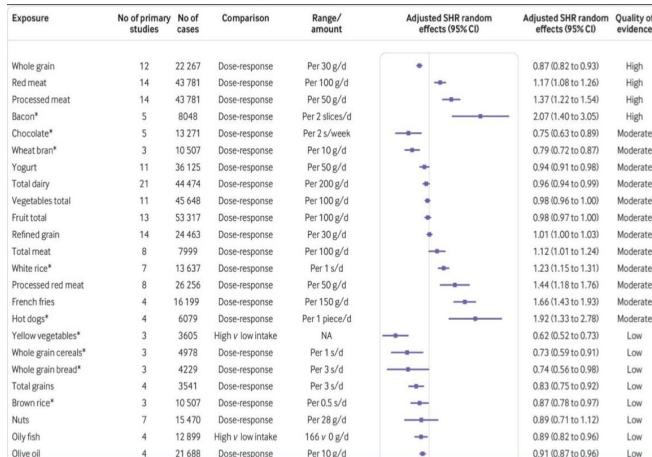
a. As categorized by the World Bank for 2012.



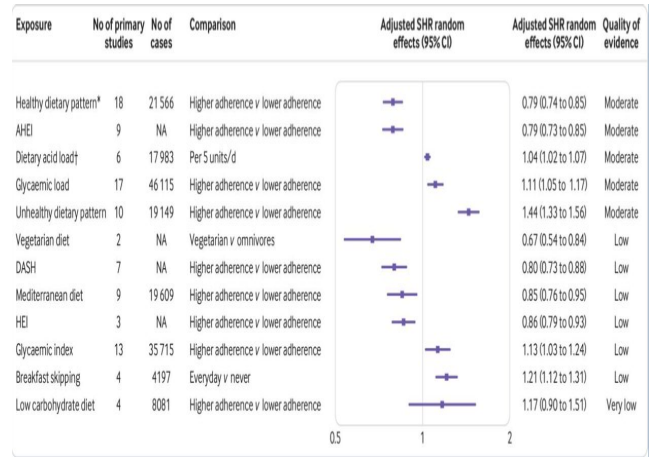
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Charts and graphs

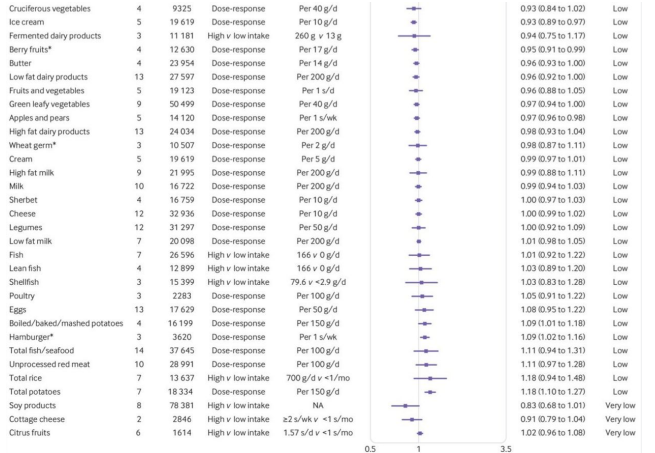
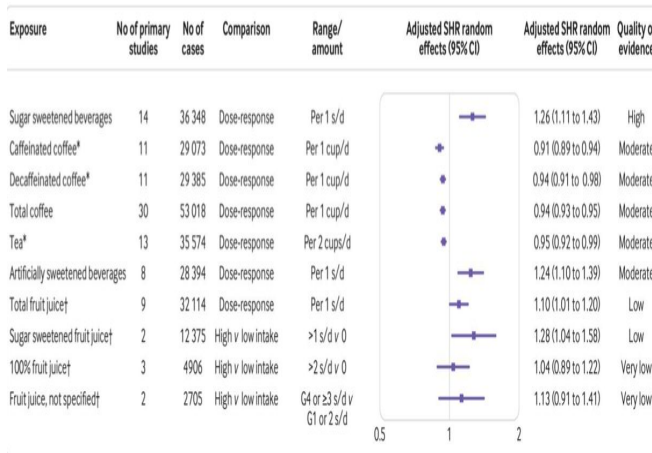
Adjusted summary hazard ratios (SHR) with 95% confidence intervals and quality of evidence for association between food groups and foods and incidence of type 2 diabetes.



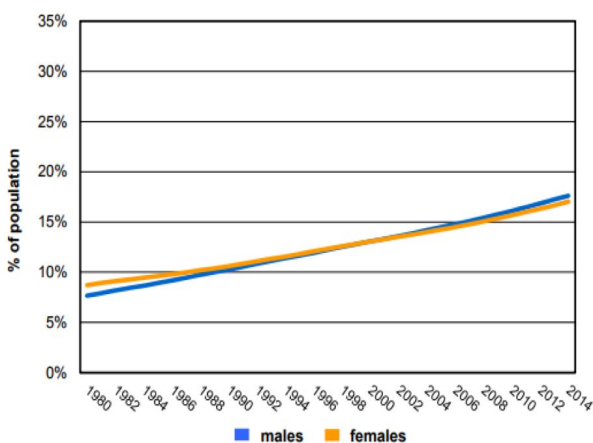
Adjusted summary hazard ratios (SHR) with 95% confidence intervals and quality of evidence for association between dietary behaviours or diet quality indices and incidence of type 2 diabetes.



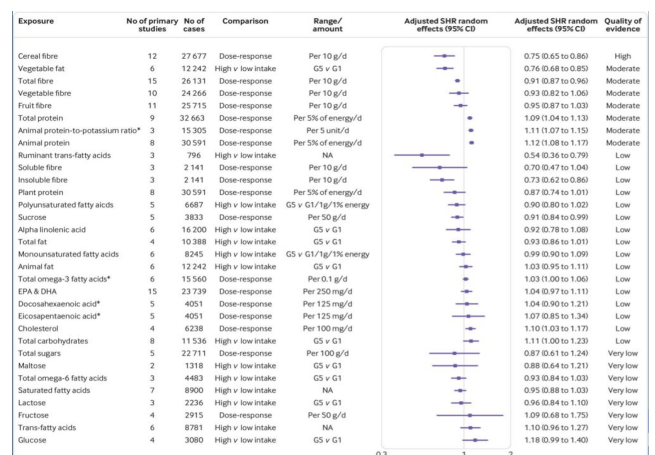
Adjusted summary hazard ratios (SHR) with 95% confidence intervals and quality of evidence for association between beverages and incidence of type 2 diabetes.



Trends in age-standardized prevalence of diabetes in Saudi Arabia



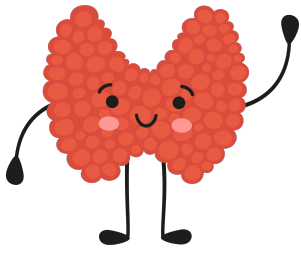
Adjusted summary hazard ratios (SHR) with 95% confidence intervals and quality of evidence for association between macronutrients and incidence of type 2 diabetes.





Future directions

- Tackling environmental factors and lifestyle.
- Appropriate use of screening tools to control diabetes mellitus.
- Early interventions in high risk populations.
- Therapeutic and management choices and updated criteria for treatment.
- Rehabilitation services for complications.
- The Saudi National Diabetes Registry (SNDR) was recently established with the primary goal of developing a database including all the diagnosed national diabetic patients.
- The objective of the SNDR is to act as an electronic medical file to provide the medical teams correct clinical, investigational, and management data.
- It is a surveillance-monitoring tool for clinical and epidemiology practitioners by identifying the significant performance indicators linked to this disease in either acute or chronic cases.
- The SNDR also provides data relating to the association of diabetes with hypertension, hyperlipidemia, and obesity.



MCQs

Q1

Damage in the pancreas due to infections or illness is an increased risk of developing the?

A. Type 2 diabetes.

B. Type 1 diabetes.

C. Neither.

D. Both.

Q2

Which of the following is the leading complication of diabetes in Saudi Arabia?

A. Retinopathy.

B. Nephropathy.

C. Neuropathy.

D. Stroke.

Q3

Which one of the following most common cause blindness in adults?

A. Hypertension.

B. Diabetes.

C. Obesity.

D. Injuries.



1-B 2-A 3-B

MEDICINE TEAM

Leader



يزن الأحمري

Leader



رغد المصلح

Member

عبدالله الضويحي



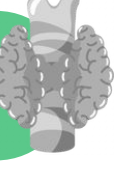
Member

رند أبا الخيل



Member

ريما المطيري



Member

فيصل الشويعر



Member

ريوف الأحمري



Member

ريما الزغبي



Member

عبدالعزيز الحميدي



Member

محمد السلامة



Member

يزيد السليم



Member

عبدالله الزامل



Member

مشعل الدخيل

