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The efficiency of sodium-glucose cotransporter-2 (SGLT2) inhibitors on fatty liver mass in patients with type 2 diabetes and associated fatty liver disease diagnosed by magnetic resonance imaging

Submission date
11/09/2024

Recruitment status
No longer recruiting

Registration date
12/09/2024

Overall study status
Completed

Last Edited
18/03/2025

Condition category
Nutritional, Metabolic, Endocrine

[_] Prospectively registered
[_] Protocol
[_] Statistical analysis plan
[X] Results
[_] Individual participant data

Plain English summary of protocol

Background and study aims
Metabolic-associated steatotic liver disease (MASLD) is a liver condition that can develop as a complication of type 2 diabetes (T2DM). It often comes with other health issues, like heart disease and kidney problems, which can seriously affect the lifespan of people with diabetes. Because of this, early treatment for MASLD in diabetic patients is important. A relatively new class of oral diabetes drugs called SGLT2 inhibitors has been approved by the FDA to help manage type 2 diabetes, especially in people with heart or kidney problems. Recent research suggests that these drugs may also help protect the liver in people with T2DM and MASLD. This study aims to assess the impact of adding an SGLT2 inhibitor, empagliflozin, to the standard treatment for diabetic patients with MASLD to see if it reduces liver fat content, which will be measured using a special type of MRI scan.

Who can participate?
Adults between the ages of 30 and 65 years who have type 2 diabetes and MASLD can participate in the study. The condition must be diagnosed using an abdominal ultrasound and MRI. Participants should currently be on standard oral medications for diabetes, such as metformin and sulfonylurea.

What does the study involve?
Participants in this study will receive a daily dose of the SGLT2 inhibitor empagliflozin (10 mg) in addition to their usual diabetes medications for six months. During this time, they will have their liver fat content assessed by MRI at the start of the study and again after six months. Participants will also undergo a thorough health check, including a review of their medical history, physical examination, and measurements of weight, height, waist circumference, and body mass index (BMI). Blood tests will be taken to check blood sugar levels, liver enzymes, kidney function, and cholesterol. All these tests will be repeated at the end of the six months.

What are the possible benefits and risks of participating?
At the end of the study, participants showed significant improvements, including reduced BMI, lower blood sugar levels, and less liver fat. However, there is a small risk of developing urinary tract infections from taking the SGLT2 inhibitor.

Where is the study run from?
The study is being conducted at the outpatient Endocrinology and Diabetes Clinic of the Internal Medicine Department at Kasr Alainy Hospitals, Cairo University, Egypt.

When is the study starting and how long is it expected to run for?
The study began in January 2022 and is expected to run until December 2023.

Who is funding the study?
Investigator initiated and funded

Who is the main contact?
Professor Mona Amin, monasleman@kasralainy.edu.eg.

Contact information

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Public, Scientific, Principal investigator

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Additional identifiers

Clinical Trials Information System (CTIS)
Nil known

Protocol serial number
Nil known

Study information

Scientific Title
The effect of SGLT2 inhibitors on hepatic steatosis detected by MRI-PDFF in Patients with type 2 Diabetes Mellitus and metabolic associated steatotic liver disease

Study objectives
SGLT2 inhibitors drugs can improve steatosis in metabolic associated steatotic liver disease (MASLD) patients

Ethics approval required
Ethics approval required

Ethics approval(s)
approved 27/02/2022, Cairo University, Faculty of medicine Research Ethics Committee (Faculty of medicine, Cairo University, Kasr Al-Aini street, Cairo, 11562, Egypt; +20 223682030; ethics@kasralainy.edu.eg), ref: MS-663-2021

Study design
Single arm clinical trial

Primary study design
Interventional

Study type(s)
Efficacy

Health condition(s) or problem(s) studied
Type 2 diabetes with MASLD

Interventions
Our patients received SGLT2 inhibitor in the form of empagliflozin 10 mg daily added to their standard of care treatment and followed up for 6 months with full assessment of hepatic steatosis and fibrosis done by MRI-PDFF at the beginning of the study and after 6 months. All patients were subjected to thorough history taking, clinical examination, measurement of weight, height, and waist circumference. Body mass index (BMI) was calculated. Laboratory investigations in the form of serum fasting blood glucose (FBG), 2 hours postprandial blood glucose (2 hrs pp glucose), glycated hemoglobin (HbA1C), serum alanine transaminase (ALT), aspartate transaminase (AST), creatinine, total cholesterol (TC), low density lipoprotein (LDL-C), high density lipoprotein (HDL-C), and triglycerides (TG) were measured. Estimated glomerular

filtration rate (eGFR),Fib-4 and NAFLD fibrosis scores were calculated. Abdominal ultrasound and MRI-PDFF were performed in all patients. All the laboratory and imaging studies were performed at baseline of the study and 6 months after adding SGLT2 inhibitors.

Intervention Type
Drug

Phase
Not Applicable

Drug/device/biological/vaccine name(s)
Empagliflozin 10 mg

Primary outcome(s)
Measured at baseline and after 24 weeks of adding Empagliflozin 10 mg to the standard of care treatment:
1. The hepatic fat content was measured by Magnetic resonance imaging Proton Density Fat Fraction (MRI-PDFF) in every patient
2. Staging of hepatic fibrosis using Fib-4 and NAFLD fibrosis scores was calculated using the formula below:
FIB-4 =Age ([yr] x AST [U/L]) / ((PLT [10(9)/L]) x (ALT [U/L])(1/2)).
NAFLD fibrosis score = -1.675 + 0.037 × age (year) + 0.094 × BMI (kg/m2) + 1.13 × IFG/diabetes (yes = 1, no = 0) + 0.99 × AST/ALT ratio - 0.013 × platelet count (×109/L) - 0.66 × albumin (g/dL).

Key secondary outcome(s))
Measured at baseline and after 24 weeks of adding Empagliflozin 10 mg to the standard of care treatment:
1. Serum fasting blood glucose (FBG) measured using glucose oxidase methods
2. Serum 2 hours postprandial blood glucose (2 hrs pp glucose) measured using standard techniques
3. Glycated hemoglobin (HbA1C) measured using high frequency liquid tomography
4. Serum alanine transaminase (ALT) measured using standard biochemical assays
5. Serum aspartate transaminase (AST) measured using standard biochemical assays
6. Serum creatinine measured using standard biochemical assays
7. Total cholesterol (TC) measured using standard biochemical assays
8. Low-density lipoprotein (LDL-C) measured using by Friedwald formula
9. High-density lipoprotein (HDL-C) measured using standard biochemical assays
10. Fasting Triglycerides (TG) measured using standard biochemical assays
11. Estimated glomerular filtration rate (eGFR) calculated using age, sex, and serum creatinine

Completion date
01/12/2023

Eligibility

Key inclusion criteria
1. Adult patients with type 2 diabetes with sonographic evidence of hepatic steatosis with or without elevated liver enzymes diagnosed as MASLD
2. Patients on oral hypoglycemics not including SGLT2 inhibitors in their standard of care treatment

Participant type(s)
Patient

Healthy volunteers allowed
No

Age group
Adult

Lower age limit
30 years

Upper age limit
65 years

Sex
All

Total final enrolment
30

Key exclusion criteria
1. T2DM patients already on SGLT2 inhibitors
2. Type 1 diabetes
3. Patients with estimated GFR<30ml/min
4. Pregnant and lactating females
5. Patients with liver cirrhosis
6. Patients who could not tolerate SGLT2 inhibitors

Date of first enrolment
01/05/2022

Date of final enrolment
01/10/2023

Locations

Countries of recruitment
Egypt

Study participating centre
Faculty of medicine, Cairo University, Kasr El Aini medical school
Kasr El Aini medical school, out patient clinic of the Internal medicine department
Cairo
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Sponsor information

Organisation
Cairo University

ROR
https://ror.org/03q21mh05

Funder(s)

Funder type
Other

Funder Name
Investigator initiated and funded

Results and Publications

Individual participant data (IPD) sharing plan
The datasets analyzed during the current study will be available upon request from Dr Hend Elsheimy, hendaelshemy@kasralainy.edu.eg. Data related to statistical analysis, ethical consideration, and raw data will be shared only after publication on reasonable request. No personal details as names and phone numbers will be shared. Participants were informed that no personal data would be published

IPD sharing plan summary
Available on request

Study outputs

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?
Results article		14/03/2025	18/03/2025	Yes	No