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Effects of coffee drinking on glucose metabolism, cytokines and gastrointestinal hormone secretion

Submission date	Recruitment status
28/04/2009	No longer recruiting
Registration date	**Overall study status**
03/07/2009	Completed
Last Edited	**Condition category**
04/06/2019	Nutritional, Metabolic, Endocrine

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

Plain English summary of protocol
Not provided at time of registration

Contact information

Type(s)
Scientific

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Additional identifiers

Protocol serial number
N/A

Study information

Scientific Title
Effects of coffee drinking on glucose metabolism, cytokines and gastrointestinal hormone secretion: a single-blind randomised controlled trial

Acronym
COGMI

Study objectives
All biomarkers determined in this study have been associated with type 2 diabetes and glucose metabolism in some way. First, glucose and insulin levels are the principal and very well known markers of diabetes. We hypothesise that coffee compounds may affect oral glucose tolerance test (OGTT) curve profile of glucose or insulin or both. Second, many inflammation markers are associated with development of type 2 diabetes. For example, interleukin-6 (IL-6) concentration is strongly related to fat mass in subjects with type 2 diabetes. Low-grade inflammation and increased C-reactive protein (CRP) have also been implicated in the development of type 2 diabetes. We hypothesise that some coffee compounds may act as protective factors of inflammation and furthermore prevent the progression of type 2 diabetes. The inflammation state is defined with measuring different plasma inflammation markers such as RANTES/CCL5, inter-cellular adhesion molecule 1 (ICAM-1), macrophage migration inhibiting factor (MIF), macrophage inflammatory protein-1 alpha (MIP-1a), IL-6 and CRP. The antioxidant properties of coffee may result in a reduction in inflammation markers.

We will also determine the plasma levels of the gastric hormones gastric inhibitory polypeptide (GIP) and glucagon-like peptide-1 (GLP-1), which are critical in the regulation of glucose and insulin metabolism. In a previous acute-dose study they were found to be modified by coffee drinking. Obesity is an important factor in the aetiology of type 2 diabetes. Circulating leptin concentrations, on the other hand, increase when energy stores are high. We will clarify the possible connection between leptin concentration and components of coffee since this has not been studied before. We hypothesise that coffee may decrease appetite through leptin and furthermore decrease obesity and type 2 diabetes. Ghrelin is a neurotransmitter, which increases food intake. We assume that some compounds of coffee could affect ghrelin concentrations and keep the food intake in balance. Adiponectin participates in the long-term control of energy balance and has been suggested to affect on progression of insulin resistance, which is a very important factor in the etiology of type 2 diabetes. We hypothesise that coffee may reduce insulin resistance by affecting adiponectin levels.

We are not trying to prevent the development of manifest type 2 diabetes with coffee in this trial since the trial period is too short. Instead, we focus on the possible mechanisms of coffee-derived compounds which may be responsible for the favourable effects on glucose and insulin levels.

The main hypothesis is that coffee consumption has favorable effects on glucose metabolism, and chlorogenic acid and caffeic acid, or their metabolites, are responsible for these effects, and that there is a dose-response. By correlating the serum concentrations of biomarkers reflecting effects with serum concentrations of bioavailability and metabolism, we will investigate whether specific coffee-derived compounds or their metabolites, are responsible for them. In addition, we will be able to determine the mode of action of these compounds in this trial design.

Aims:
1. To evaluate the effects of coffee drinking on glucose metabolism, glucose tolerance and the secretion of gastrointestinal hormones

2. To examine the effects of coffee drinking on the biomarkers of oxidative stress, protein expression, and cellular activation
3. To investigate the bioavailability, metabolism and pharmacokinetics of coffee derived compounds. Emphasis will be on chlorogenic acid and caffeic acid.

Ethics approval required
Old ethics approval format

Ethics approval(s)
Joint Authority for the Hospital District of Helsinki and Uusimaa Ethics Committee, Department of Medicine, approved on the 14th December 2005 (ref: 302/E5/05)

Study design
Randomised single-blind three-stage three-arm trial

Primary study design
Interventional

Study type(s)
Other

Health condition(s) or problem(s) studied
Glucose metabolism; type 2 diabetes

Interventions
This is a randomised, single blind, national, three stage and three group (men, women, and women with gestational diabetes history) clinical trial, which lasts for three months.

Trial plan:
The trial plan indicates the number and timing of the planned visits. Eight clinic visits are planned. Subjects are asked to fast overnight before each visit.

Visit 1 will occur before the trial to explain the points of the trial for the subjects and for fasting glucose, insulin level, GIP, GLP-1, leptin, ghrelin, adiponectin, RANTES, ICAM-1, MIF, MIP-1a, IL-6, CRP and SAA assessment at baseline. At visit 1 the subjects will get advice for exercise and nutrition to find out other sources of chlorogenic acid and caffeine.

After two weeks of each stage a fasting sample will be taken and glucose, insulin level, GIP, GLP-1, leptin, ghrelin, adiponectin, RANTES, ICAM-1, MIF, MIP-1a, IL-6, CRP and SAA will be obtained. This includes visits 1, 2, 4, 6 and 8.

At the end of each stage (after four weeks coffee consumption) subjects pass the OGTT and blood samples for glucose, insulin level, GIP, GLP-1, leptin, ghrelin, adiponectin, RANTES, ICAM-1, MIF, MIP-1a, IL-6, CRP and SAA will be obtained. On arrival at the clinic, an intravenous cannula is inserted into a forearm (antecubital) vein, and a baseline blood sample is taken. Then subjects will consume 75 g glucose dissolved in water. Blood samples are taken at intervals for the following 2 hours. 0-, 10-, 30-, 60-, 90- and 120-samples are taken. This includes visits 3, 5 and 7.

Biomarkers of bioavailability of coffee-derived compounds will be analysed from serum samples obtained at the beginning of the study and at the end of each stage. The primary interest lies in serum concentrations of chlorogenic acid, caffeic acid and its metabolites. Caffeine and some of its metabolites will also be analysed in serum.

Trial coffee consumption:
1. Type of the coffee and presentation: the trial coffee will be supplied by the Paulig Group. All trial coffee will be in form of roasted, brewed Juhla Mokka coffee. During the fixed period of trial 1, the subjects will be given 0, 3 or 5 packages of trial coffee. One package is 500 g.
2. Storage: all trial coffee packages will be stored at or below 10°C and protected from light and moisture.
3. Dosage: coffee will be prepared with coffee maker and will be drunk daily. Subjects will cook their daily amount of coffee in the morning and they maintain it in a thermos if it's impossible to prepare the coffee before drinking.
4. Subject restriction: subjects should refrain from coffee consumption on the morning of clinic visits. Also, the subjects are advised to maintain their normal physical activities and diet during the trial.

Details of Joint Sponsors:
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Intervention Type
Other

Phase
Not Applicable

Primary outcome(s)
The following will be assessed as described in the Interventions field:
1. Incretins
2. Serum cytokines and other inflammatory markers
3. Serum concentrations of polyphenols (caffeic acid and six metabolites of chlorogenic acid and caffeic acid, including their methylated and hydrated forms), caffeine, and the caffeine metabolite paraxanthine

Key secondary outcome(s))
1. Dietary assessment: at the end of each stage subjects fill three-day food diary to assess the normal intake of chlorogenic acid
2. Physical examination: a detailed medical history, including family history of diabetes, alcohol intake, use of any medications, as well as coronary heart disease (CHD) will be recorded

Completion date
31/08/2006

Eligibility

Key inclusion criteria
For inclusion in this trial subjects must fulfill all of the following criteria:
1. Written informed consent to participate in this trial
2. All drugs which may interfere with glucose metabolism must be discontinued. These include all medication for diabetes, asthma, heart diseases and stomach. Regular non-steroidal anti-inflammatory drug (NSAID) use must also be discontinued.
3. Men and women aged less than 65 years (no lower age limit)
4. Normal fasting insulin level
5. 13 points as a result in the diabetes risk score
6. 7.0 - 12.0 mmol/l as 2-hour blood glucose value in the OGTT

Participant type(s)
Patient

Healthy volunteers allowed
No

Age group
Adult

Sex
All

Total final enrolment
49

Key exclusion criteria
Any of the following is regarded as a criterion for exclusion from the trial:
1. Deterioration any of base examination which reveal diabetic state
2. Persons with previous diagnosis of diabetes mellitus
3. Use of drugs, which interfere with glucose metabolism or receiving treatment to lower blood glucose
4. Pregnant women and women who are breast feeding
5. History of malignancy, which needs any therapeutic intervention
6. History of any chronic diseases or other medical characteristics likely to interfere with participation in the study
7. Subjects with imbalanced clinical conditions, such as thyroid and liver diseases, which could interfere with glucose metabolism
8. History of alcohol or drug abuse, or both

Date of first enrolment
01/06/2006

Date of final enrolment
31/08/2006

Locations

Countries of recruitment
Finland

Study participating centre
Department of Public Health
Helsinki
Finland
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Sponsor information

Organisation
Physiologic Effects of Coffee Committee (PEC) (Netherlands)

Funder(s)

Funder type
Research organisation

Funder Name
Institute for Scientific Information on Coffee (ISIC) (Switzerland)

Funder Name
Physiologic Effects of Coffee Committee (PEC) (Netherlands)

Funder Name
Paulig Oy (Finland) (ref: 21/05/BD/EL)

Results and Publications

Individual participant data (IPD) sharing plan

IPD sharing plan summary
Not provided at time of registration

Study outputs

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?
Results article	results	01/06/2019	04/06/2019	Yes	No