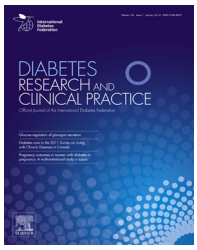
Contents available at ScienceDirect

Diabetes Research and Clinical Practice

journal homepage: www.elsevier.com/locate/diabres

International Diabetes Federation



Review

Preventing the progression to Type 2 diabetes mellitus in adults at high risk: A systematic review and network meta-analysis of lifestyle, pharmacological and surgical interventions

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ARTICLE INFO

Article history:
Received 15 July 2014
Received in revised form
31 October 2014
Accepted 2 January 2015
Available online 21 January 2015

Keywords:
Type 2 diabetes mellitus
Systematic review
Network meta-analysis
Mixed treatment comparison

ABSTRACT

Aims: Individuals with impaired fasting glucose (IFG) or impaired glucose tolerance (IGT) have an increased risk of progression to Type 2 diabetes mellitus. The objective of this review was to quantify the effectiveness of lifestyle, pharmacological and surgical interventions in reducing the progression to Type 2 diabetes mellitus in people with IFG or IGT.
Methods: A systematic review was carried out. A network meta-analysis (NMA) of log-hazard ratios was performed. Results are presented as hazard ratios and the probabilities of treatment rankings.
Results: 30 studies were included in the NMA. There was a reduced hazard of progression to Type 2 diabetes mellitus associated with all interventions versus standard lifestyle advice; glipizide, diet plus pioglitazone, diet plus exercise plus metformin plus rosiglitazone, diet plus exercise plus orlistat, diet plus exercise plus pedometer, rosiglitazone, orlistat and diet plus exercise plus voglibose produced the greatest effects.
Conclusions: Lifestyle and some pharmacological interventions are beneficial in reducing the risk of progression to Type 2 diabetes mellitus. Lifestyle interventions require significant behaviour changes that may be achieved through incentives such as the use of pedometers. Adverse events and cost of pharmacological interventions should be taken into account when considering potential risks and benefits.

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http://dx.doi.org/10.1016/j.diabres.2015.01.027
0168-8227/

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1. Introduction

Type 2 diabetes mellitus is associated with significant clinical and social consequences, including a reduced quality of life and a reduction in life expectancy of up to 10 years. It has a long preclinical phase and 30–50% of all individuals with diabetes can remain undiagnosed for many years [1]. Diabetes accounts for approximately 10% of UK health expenditure but is projected to rise to 17% by 2035/2036 [2]. Conditions defined by blood glucose levels between normal and that associated with Type 2 diabetes mellitus are typically known as impaired fasting glucose (IFG) or impaired glucose tolerance (IGT). Individuals with IFG or IGT have an increased risk of progression to Type 2 diabetes mellitus but this is not inevitable and progression rates vary in different populations.

Risk factors for individuals at high risk of developing Type 2 diabetes mellitus include obesity, a high waist circumference, a sedentary lifestyle, a close family history of Type 2 diabetes mellitus, a history of gestational diabetes in women, being older than 40 years of age, and being of South Asian, African-Caribbean and black African descent. Lifestyle changes, including improved diet and increased physical activity levels, pharmacological interventions [3] and bariatric surgery have all been demonstrated to have utility in preventing the progression to Type 2 diabetes mellitus in those people at high risk. A recent systematic review confirms the growing evidence base from individual studies that diet and exercise interventions can be effective if significant behaviour change is achieved [4] but it is still necessary to understand the relative value of lifestyle intervention and/or drug treatment.

The objective of this systematic review was to quantify the effectiveness of lifestyle, pharmacological and surgical interventions in reducing the progression to Type 2 diabetes mellitus in people with IFG or IGT using a network meta-analysis [5].

2. Materials and methods

2.1. Search strategy

The search strategy for this systematic review was based on an earlier search strategy used by Gillies et al. [3] but with some modification to ensure a balance between sensitivity and specificity as outlined in the NICE Public Health Reviews Methods Manual [6]. The search strategy combined terms for the presentation of Type 2 diabetes mellitus and terms relating to pre-diabetes with a randomised control trials filter. This approach was adopted to ensure that no intervention intended for the prevention of progression to Type 2 diabetes mellitus was excluded. Medline In Process and Other Non-Indexed Citations and Medline 1950-Current via OVID, SP, EMBASE via OVID SP, Cochrane Library (DARE, CRENTRA, HTA) via Wiley, CINAHL via EBSCO, BNI via OVID, Science and Social Science Citation Indices via Web of Knowledge, PsycINFO via OVID SP and EPPI Centre were searched. In addition to searching these databases, reference lists were scrutinised, cited reference searches of included papers were undertaken and liaisons with topic experts took place. All databases and additional searches were restricted by date to 1966–2013.

2.2. Data extraction and quality evaluation

The retrieved literature was screened by one of the two reviewers and double-checked by one other reviewer at title and abstract level for relevance, and those that were relevant were taken to full paper appraisal.

The patient population was defined as those aged 18 years and older with IFG (i.e. a fasting plasma glucose $\geq$6.1 mmol/L (110 mg/dL) and $\leq$6.9 mmol/L (125 mg/dL) and a 2-h plasma glucose (Venus plasma glucose 2-h after ingestion of 75 g oral glucose load) $<$7.8 mmol/L (140 mg/dL) or IGT (i.e. fasting plasma glucose $<$7.0 mmol/L (126 mg/dL) and a 2-h plasma glucose $\geq$7.8 mmol/L (140 mg/dL) and $<$11.1 mmol/L (200 mg/dL). Interventions of interest were changes in lifestyle, pharmacological agents and surgical interventions for weight loss. Progression to Type 2 diabetes mellitus was a required outcome measure. Study selection was restricted to randomised controlled trials (RCTs).

Data were extracted with no blinding to authors or journal. Data were extracted by one of the two reviewers using a standardised form. Extracted data were checked by a second reviewer. If data were missing from studies, attempts were made to contact the study authors to obtain the required information.

The quality of each RCT was assessed and presented in Table 1 using the Jadad score [7] and the categories outlined by