Diabetes prevention studies: The benefits of lifestyle modifications

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Type 2 diabetes prevention: A guide to management

Joseph Henson and colleagues provide guidance on the role of primary care in screening for non-diabetic hyperglycaemia and preventing its progression to type 2 diabetes.

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Early in the 2000s, two landmark studies reported that it was possible to prevent type 2 diabetes through lifestyle modification. Both the Diabetes Prevention Program, based in the US, and the smaller Diabetes Prevention Study, in Finland, achieved significant reductions in diabetes incidence compared with the control groups. In these studies, an intensive lifestyle programme was the more effective intervention, particularly if it was combined with weight loss.

Take-home messages

- It is possible to prevent the development of type 2 diabetes in individuals with IGT by means of lifestyle intervention.
- In both studies, participants were encouraged to be physically active for 150 minutes per week.
- Weight loss was an important predictor of delay in the development of type 2 diabetes.
- Metformin may prevent the development of diabetes in IGT groups but is not as effective as weight loss and lifestyle modification.

The Diabetes Prevention Program (DPP; DPP Research Group, 2002) and Diabetes Prevention Study (DPS; Tuomilehto et al, 2001) differed in their design, but both examined people with impaired glucose regulation, had annual follow-up for the development of diabetes and an active lifestyle arm with weight reduction encouraged. In both of the studies, this proved to be the most effective intervention compared with either placebo or drug interventions. When they were followed up some time after the initial publications, both showed that the cumulative incidence of diabetes remained lowest in the lifestyle group.

US Diabetes Prevention Program goals

- Achieve and maintain a weight reduction of ≥7% of initial body weight.
- Have a healthy, low-calorie, low-fat diet.
- Engage in physical activity of moderate intensity for at least 150 minutes a week.
- Support offered: 16-lesson curriculum covering diet, exercise and behaviour modification.

Finnish Diabetes Prevention Study goals

- A reduction in body weight of ≥5%.
- Reduce fat intake to <30% of energy consumed.
- Increase fibre intake.
- Engage in moderate exercise for at least 30 minutes per day.
- Support offered: guidance on nutrition and exercise; supervised, progressive, individually tailored, circuit-type resistance training sessions.

Study designs

Diabetes Prevention Program (US)

In this study, 3234 individuals with fasting hyperglycaemia and impaired glucose tolerance (IGT) from racially diverse groups were randomised into a four-arm trial. They received either an intensive lifestyle intervention or a standard lifestyle intervention, and the standard group were additionally randomised to receive one of the following: placebo, metformin (850 mg twice daily) or troglitazone (400 mg daily). Troglitazone treatment was discontinued after a fatal episode of liver failure in a DPP participant. The average follow-up was 2.8 years.

Diabetes Prevention Study (Finland)

The DPS included 522 middle-aged, overweight subjects with IGT who were randomised to either usual care or intensive lifestyle intervention. The control group received general dietary and exercise advice at baseline and had an annual physician's examination. The individuals in the intervention group were also offered circuit-type resistance training sessions and were advised to increase their overall physical activity. The intervention was the most intensive during the first year and was then followed by a maintenance period. Mean follow-up was 3.2 years.

Main outcomes

DPP

In the DPP, the incidence of diabetes was reduced by 58% with the intensive lifestyle intervention and by 31% with metformin, as compared with placebo (DPP Research Group, 2002).

An important observation was that physical activity only had a small effect on type 2 diabetes prevention and was dwarfed by the much stronger effect of weight loss (Hamman et al, 2006). For every kg of weight lost during the DPP, there was a 16% reduction in the risk of developing type 2 diabetes when adjusted for changes in diet and activity. This has an important bearing on the wider applicability of this study.

DPS

The DPS results also provided evidence that type 2 diabetes can be prevented by changes in the lifestyles of both women and men at high risk of the disease. After a mean follow-up of 3.2 years, the overall incidence of diabetes was reduced by 58%. As with the DPP, the outcomes showed the importance of even a relatively small reduction in weight in the prevention of diabetes.

Long-term follow-up

DPP Outcomes Study

After the DPP intervention phase ended, 2766 participants (88% of the surviving cohort) were enrolled in the DPP Outcomes Study (DPPOS) following a 1.1-year bridging period. All participants were offered a group lifestyle intervention, and those in the former intensive group were offered two additional lifestyle support sessions per year.

During the DPPOS, the diabetes incidence rates were similar between the groups (DPP Research Group, 2009). However, compared with placebo, the cumulative diabetes incidence over the entire follow-up was reduced by 34% in the lifestyle group and by 18% in the metformin group. These effects were similar in men and women and in all racial and ethnic groups.

DPS follow-up

After the DPS, participants were followed up for a further median of 3 years (median total follow-up, 7 years). The study focus was on whether the lifestyle changes were maintained after cessation of the active intervention. This was found to be the case, and a 36% relative risk reduction was observed during the follow-up period (Lindström et al, 2006). Over the entire 7-year follow-up, type 2 diabetes risk was reduced by 43% overall. ■

Clinical perspective – the diabetes prevention studies

Colin Kenny, GP, Dromore, and Editor, *Diabetes Distilled*

The striking feature of these two studies was the dramatic decrease, by 58%, in diabetes incidence by a lifestyle intervention. Very few other diabetes studies have led to this degree of reduction in the primary outcome, and the effect was also sustained over time.

Critics of the studies have pointed to the intensive nature of the lifestyle intervention, particularly the part played by the physical activity lifestyle coaches, and the need for significant weight loss. Yet now, almost 15 years later, these remain the standout studies in diabetes prevention, and have helped to inform the recently updated NICE PH38 guideline on type 2 diabetes prevention in people at high risk (Nice, 2012; updated September 2017), and in turn the NHS Diabetes Prevention Programme.

As the diabetes epidemic gathers pace worldwide, governments and health authorities are seeking to come to terms with the costs of management of diabetes itself. Prevention is an obvious way forward, yet in spite of the clear evidence base from these studies, it remains a challenge. With so many people living with impaired glucose handling, the task is to find those who are motivated to engage with this type of intensive intervention and sustain it.

In the recent NICE guidance, the unlicensed role for metformin in prevention is acknowledged, but were this lifestyle intervention a pharmaceutical agent, it would certainly be deemed unethical not to prescribe it for people at risk of developing diabetes.

NICE (2012) *Type 2 diabetes: prevention in people at high risk* [PH38]. NICE, London. Available at: www.nice.org.uk/guidance/ph38 (accessed 02.10.17)

Results of other national diabetes prevention studies

Da Qing study (China)
Relative diabetes risk reduced by 31%, 46% and 42%, with diet, exercise and diet+exercise, respectively, compared with control group (Pan et al, 1997).

Indian Diabetes Prevention Programme
Relative risk reduced by 28.5% , 26.4% and 28.2% with lifestyle modification, metformin and lifestyle+metformin, respectively, compared with control group (Ramachandran et al, 2006).

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