A Smartphone App Lifestyle Programme for Diabetes Prevention in a Multi-ethnic Asian Population: Randomized Controlled Trial

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Weight Loss and Type 2 Diabetes

Trajectory from prediabetes towards type 2 diabetes can be altered by weight loss through lifestyle interventions. Landmark studies have established that interventions focusing on weight loss, diet modification and physical activity can prevent diabetes progression. Widespread implementation of traditional face-to-face diabetes prevention efforts is limited by low uptake, high attrition and withdrawal rates.

Till date, the effectiveness of mobile health application among Asians with prediabetes remains largely unexamined. This study is part of the Diabetes Lifestyle Intervention using Technology Empowerment (D'LITE) randomized controlled trial, aimed to assess whether a smartphone app-based lifestyle intervention programme could lead to weight loss, normoglycemia and improved metabolic indices in a multi-ethnic Asian population with prediabetes.

Smartphone App Lifestyle Programme

Eligible participants from government polyclinics, health screening facilities and hospital outpatient clinics were invited to join the programme. Those who consented with prediabetes diagnosed by impaired fasting glucose of 6.1 - 6.9 mmol/L or impaired glucose tolerance, and body mass index $\geq$ 23 kg/m^2 were randomly assigned to either the intervention group (n=72) empowered by self-monitoring features of the Nutritionist Buddy (nBuddy) Diabetes app with in-app dietitian coaching for 6 months, or the control group (n=76) receiving standard face-to-face diet counselling on healthy food plate at baseline.

D'LITE Intervention
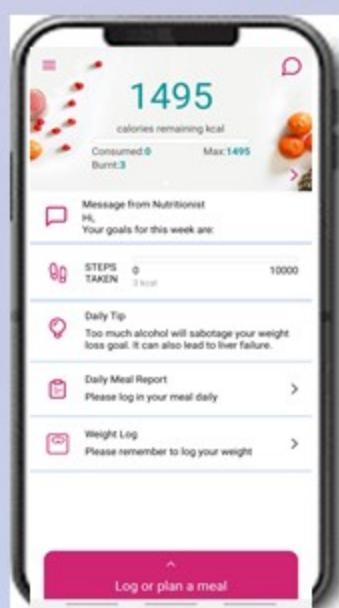
Behavioural Modifications:
- Keep within the pre-set calorie limit through daily meal logging
- Keep within carbohydrates limit per meal
- Choose healthier food alternatives (through automated feedback)
- Weigh minimally twice a week
- Aim to meet daily step count goal of 10K
- Self monitoring of blood glucose twice a week

Education and Support (in-app):
- Dietitian support via chat function
- 3-min educational videos

Primary outcome was defined as change in body weight at 6 months, while secondary outcomes included changes in energy and macronutrient intake, glycemic control and other metabolic indices analyzed using Generalized Linear Mixed Model analysis with intention-to-treat approach.

Weight Loss, Glycemic and Other Changes

Intervention group achieved a significantly greater weight loss, corresponding to weight loss percentage of 5.2% vs 1.5% (P<0.001) with a moderate Cohen d effect size, as compared to the control group at 6-month. Post-intervention, there was a 4.3-fold increased likelihood of achieving $\geq$ 5% weight loss (P<0.001), as compared to standard care, after adjustment for gender, ethnicity and age.
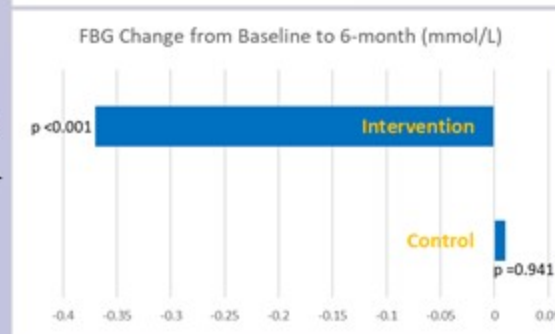
	Weight Change from Baseline to 6-month (kg)
Intervention	-4.2 (SD 4.5)
Control	-1.3 (SD 3.9)

Weight Change from Baseline to 6-month (kg)
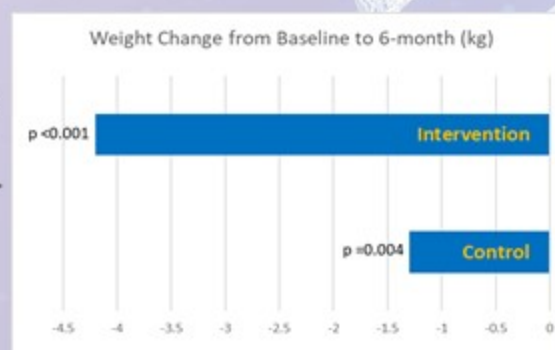
	HbA$_{1c}$ Change from Baseline to 6-month (%)
Intervention	-0.22 (SD 0.33)
Control	-0.06 (SD 0.26)

HbA$_{1c}$ Change from Baseline to 6-month (%)
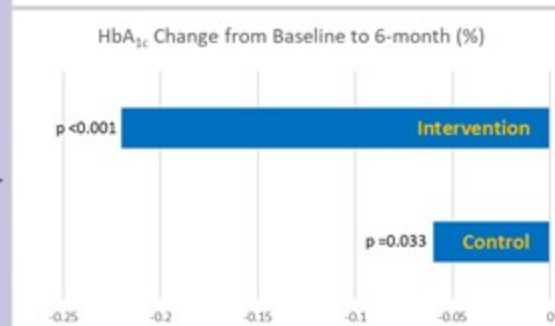
	FBG Change from Baseline to 6-month (mmol/L)
Intervention	-0.37 (SD 0.88)
Control	0.01 (SD 0.74)

FBG Change from Baseline to 6-month (mmol/L)

There was also significant glycemic improvement, with a greater percentage of participants achieving normoglycemia among the intervention group. Changes to blood pressure, total cholesterol and LDL were not statistically significant.

Calorie, carbohydrate, sugar, total fat and saturated fat intake reduced significantly (P<0.001) among the intervention group post-intervention. While there was an increase of 44 vs 11mins in physical activity from baseline for intervention vs control group, the difference did not reach statistical significance.

Implications to Diabetes Prevention

Smartphone app-based lifestyle programme with in-app dietitian health coaching can lead to clinically significant weight loss and improved glycemia among multi-ethnic Asians at risk of type 2 diabetes. By incorporating mobile health in upstream preventive programmes, especially in the face of the Covid-19 pandemic, there is potential to reduce disease burden associated with diabetes.

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