

# HEALTHCARE PROFESSIONAL PACK

**TAKING CONTROL OF TYPE 2 DIABETES, PREDIABETES AND OBESITY**

Therapeutic carbohydrate restriction guide for healthcare professionals

All individuals should be empowered to optimise their current and future health and wellbeing. People can be in control of managing, and reversing, their prediabetes and type 2 diabetes. The experience should be enjoyable, sustainable, accessible, and affordable for all.

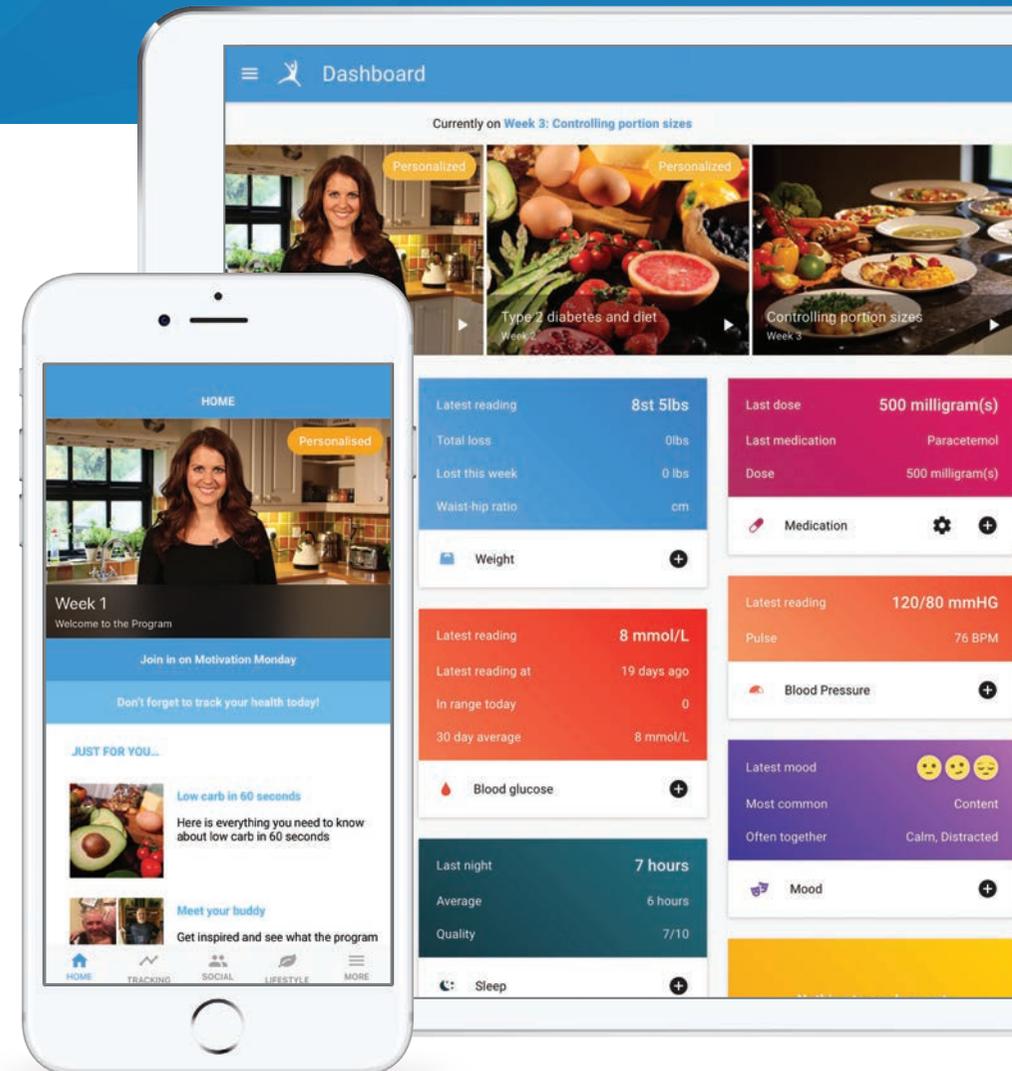


# CONTENTS

This pack is designed to inform healthcare professionals about the Low Carb Program.

The Low Carb Program is an effective and safe evidence-based approach for the management of prediabetes and type 2 diabetes. Achievable and sustainable outcomes include: weight loss, significantly improved blood glucose levels, and better metabolic health.

- 03 INTRODUCTION
- 04 UNDERSTANDING THE PROBLEM
- 05 A NEW APPROACH TO TYPE 2 DIABETES
- 06 WHAT IS THE EVIDENCE?
- 07 WHAT IS LOW CARB?
- 11 DIET AND BLOOD LIPIDS
- 13 THE IMPACT ON PRESCRIBING AND BLOOD GLUCOSE MONITORING
- 14 SIDE EFFECTS
- 16 A SOLUTION FOR TYPE 2 DIABETES AND PREDIABETES
- 18 OUTCOMES AT 1 YEAR
- 21 THE ROLE OF THE HEALTHCARE PROFESSIONAL
- 23 DIABETIC MEDICATIONS ON A LOW CARBOHYDRATE DIET
- 24 REFERENCES
- 25 APPENDIX - WHAT IS THE EVIDENCE?



# INTRODUCTION

For many people, reducing carbohydrate in the diet is the beginning of a journey towards optimising metabolic health, fewer medications, sustainable weight loss, improved blood glucose levels, improved blood lipid profiles and more energy.

Some people will achieve remission of their type 2 diabetes.

The Low Carb Program is an award-winning digital health intervention created to support therapeutic carbohydrate restriction for people with prediabetes and type 2 diabetes.

In just under 3 months, most people who complete the program improve blood glucose control and achieve sustainable weight loss, whilst reducing or eliminating diabetes medications.

## A JOURNEY TO BETTER HEALTH

Over 250,000 people from across the world have taken part in the Low Carb Program. The feedback of the first 100,000 participants has facilitated the personalisation of each step of the patient experience.

The Low Carb Program is intelligent, everything the patient will see is personalised to help them achieve their health goals.

## ACCESSING THE LOW CARB PROGRAM

The Low Carb Program is available as a smartphone and tablet app (iOS and Android), and on the web at [LowCarbProgram.com](https://LowCarbProgram.com).



# UNDERSTANDING THE PROBLEM

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In prediabetes and type 2 diabetes, the body struggles to maintain ideal blood glucose homeostasis. Ingested sugar is a challenge to the maintenance of healthy physiology. A significant reduction in sugar intake needs to occur to achieve better health.

## SUGAR IN FOOD COMES IN THREE FORMS

The three forms:

- ▶ Naturally occurring, such as fruit and honey
- ▶ Added, such as in biscuits, cakes and fizzy drinks
- ▶ A product of digestion of starchy foods, such as bread, pasta, rice and potatoes (starch is a polymer of glucose)

## BLOOD GLUCOSE HOMEOSTASIS, INSULIN, AND BODY FAT

The body attempts to maintain blood glucose homeostasis, responding to ingested sugar and carbohydrate, by producing insulin in the pancreas and releasing it into the blood. An ideal blood glucose level for adults is no more than about 5g, approximately 1 teaspoon, in the entire blood volume.

Insulin acts via numerous mechanisms. These include encouraging the body to store fat, and signalling the liver and abdominal fat to convert excess sugar into fat. If the blood insulin level is high, the body cannot easily access its own fat stores for energy.

Thus, fat 'burning' as fuel/energy source is reduced. This helps explain why people, despite having lots of stored fat, can be hungry a few hours after eating a sugary meal; they cannot access their fat stores.

## INSULIN RESISTANCE

Over time with our modern lifestyle the body becomes less responsive to the insulin it is producing and is said to be 'insulin resistant'. The more insulin resistant the body is the higher the blood insulin needs to be to try to maintain blood glucose homeostasis.

In prediabetes and type 2 diabetes, if insulin resistance is not addressed, it can lead to long-term complications including cardiovascular disease, kidney disease, hypertension and retinopathy. There is developing evidence that insulin resistance also plays a role in some forms of cancer and dementia.

By treating type 2 diabetes with medication, only symptoms such as high blood sugar, are affected. The actual problem, insulin resistance, is not adequately addressed. Unfortunately some medications can exacerbate hyperinsulinaemia and insulin resistance is worsened.

To reverse prediabetes and type 2 diabetes it is essential the root causes of the condition are addressed. Addressing nutrition is a key component of this.

# A NEW APPROACH TO TYPE 2 DIABETES

## LESS SUGAR

A growing evidence base of randomised clinical trials (RCTs) suggests lowered insulin levels as a result of reduced sugar and carbohydrate consumption makes the low carb approach the most effective non-invasive treatment of prediabetes, type 2 diabetes and other metabolic health conditions.<sup>1</sup>

## SHOULD THE FOCUS BE ON CARBS OR CALORIES?

When carbohydrate intake is restricted, insulin levels are reduced. Low insulin levels 'unlock' fat from storage. The body can use the fat as an energy source leading to weight loss and freedom from food cravings. People often find they eat less, not because they are consciously choosing to, but because they are no longer hungry.

The body is incredibly adaptive. Over the course of a few weeks, it is possible for the body to adapt from primarily burning glucose as a main fuel source, towards a much greater utilisation of fat for fuel. The weight loss that comes with the dietary change can help many people living with prediabetes or type 2 diabetes to reduce their dependency on medication, lose weight and generally feel healthier and more energetic.

This leads to an improvement of the condition and can place the condition into remission.<sup>2</sup>

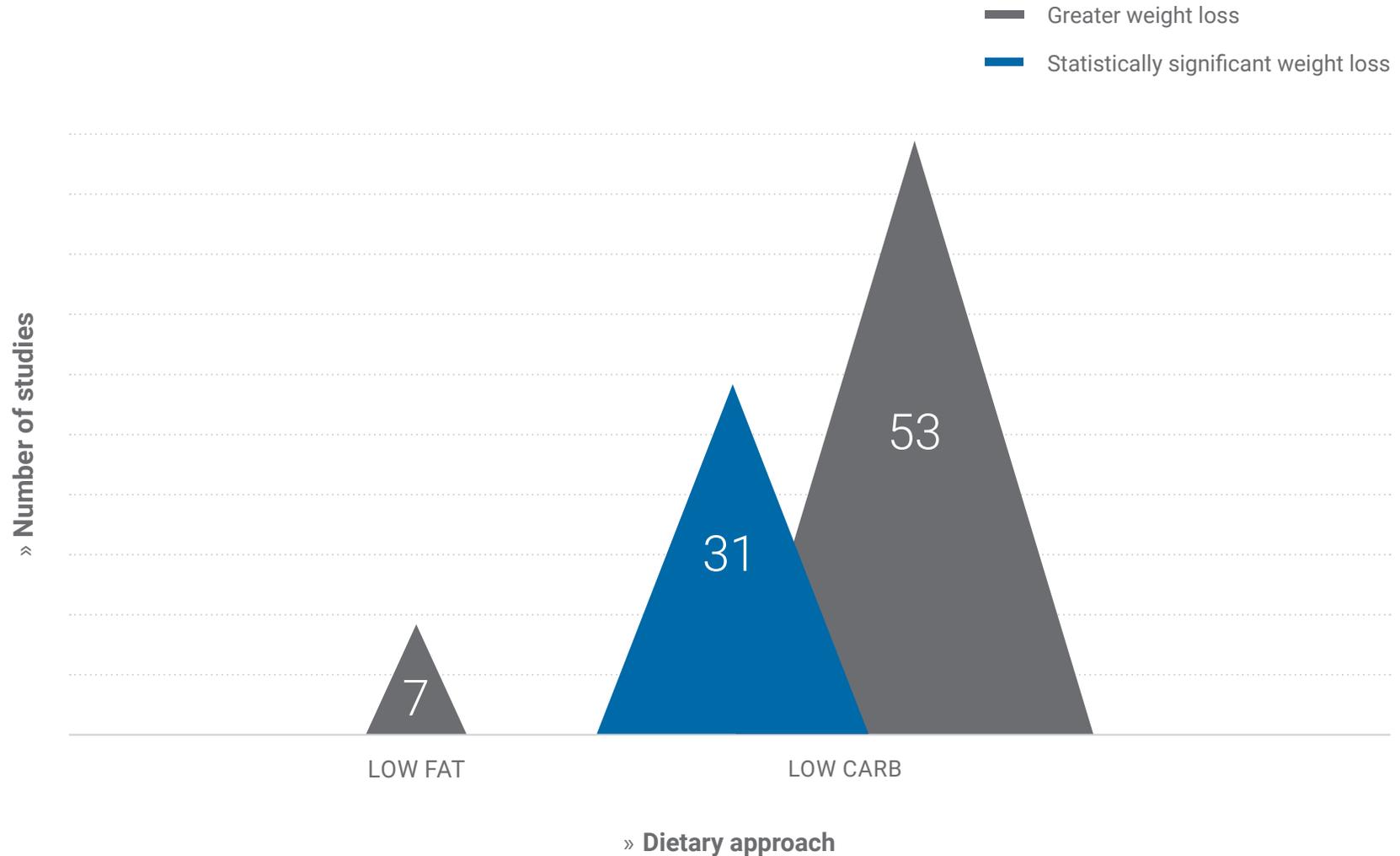
Of 62 RCTs conducted comparing a low calorie to low carbohydrate approach, 31 RCTs supporting the low carbohydrate approach were significant. In comparison, 0 low calorie RCTs had significant results.<sup>1</sup>



For people with prediabetes and type 2 diabetes, it seems sensible to reduce carbohydrate intake. A healthy and sustainable diet can include green vegetables, proteins from sources such as eggs, fish and meat, and healthy fats including nuts, seeds, dairy and olive oil.

# WHAT IS THE EVIDENCE?

There are 62 randomised controlled trials (RCTs) that have compared low carb diets of less than 130g of carbohydrates per day to low fat diets of less than 35% fat of total daily calories. Of these, 53 out of 62 RCTs (85%) found a greater weight loss with a low carb approach compared to a low fat approach. More importantly, 31 of the 62 RCTs (50%) demonstrated statistically significant weight loss.<sup>1</sup>



# WHAT IS LOW CARB?

Low carb refers to a dietary carbohydrate intake that is less than the amount consumed in many people's standard diet. A low carbohydrate diet has been defined as <130g of carbohydrate/day.<sup>3</sup>

## WHAT DOES THE LOW CARB PROGRAM RECOMMEND?

Firstly, table sugar and unhealthy snacks are drastically reduced. Secondly, patients are given information on the benefits of weight loss and reducing higher glycaemic index sources of carbohydrate such as bread, potatoes, pasta, cereals and rice. The starch in these foods is broken down by digestion into large amounts of glucose.

## AN EXAMPLE: COMPARING BREAKFASTS

Breakfasts can vary significantly in glucose intake. The illustration on the right demonstrates how quickly the sugar burden can build up for someone with prediabetes and type 2 diabetes. Option B will provide a significant challenge for glucose homeostasis.

## PERSON-CENTRED

Of course, any diet has to fit with personal tastes, budget and family life. Most importantly, the patient needs information to see if this approach fits with their personal health goals.

## GOLDEN OPPORTUNITY FOR CHANGE

The Low Carb Program is designed for the individual. When given the chance to be empowered and take control of their diabetes, most patients choose lifestyle to improve their diabetes.

### Option A

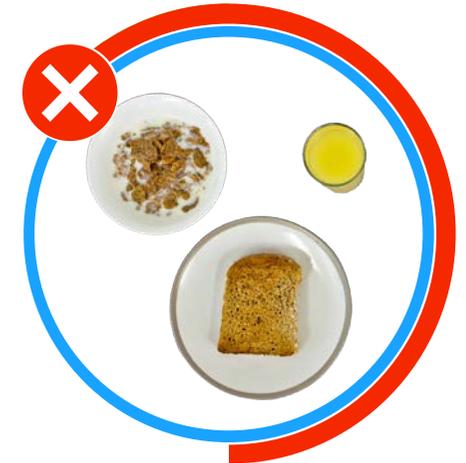
3 egg omelette with cheese, and a coffee with full fat milk



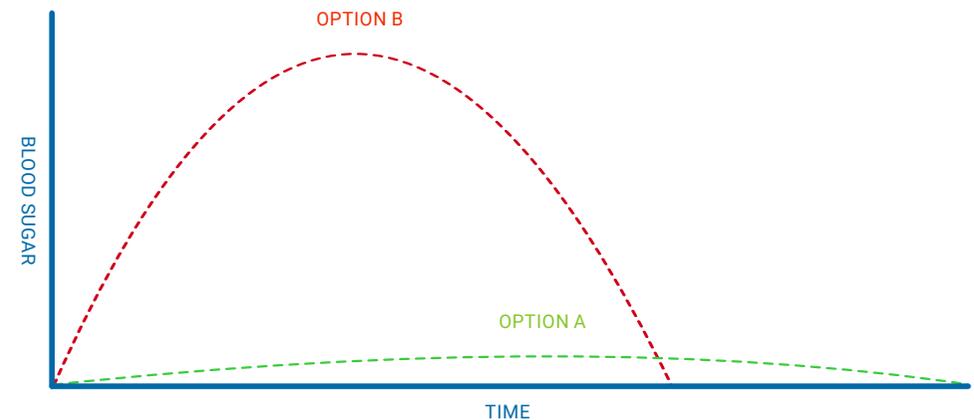
LESS THAN 1 TEASPOON OF SUGAR

### Option B

Typical portion of bran flakes, whole meal toast and orange juice



16.3 TEASPOONS OF SUGAR



# ENJOY AS MUCH AS DESIRED

## HEALTHY FATS

Healthy, naturally occurring and unprocessed fat containing foods should be enjoyed. Fats usually come as part of a food such as cheese, nuts and oily fish. Plain full fat yoghurt with some nuts and berries makes a filling and nutritious real food breakfast.

Olive oil is very useful, butter is tastier than margarine and is better for you. Coconut oil is great for stir fries. (Processed 'vegetable oils' may not be the healthy option that was once believed,<sup>4</sup> and they are probably best avoided.)

Importantly, as a reminder, there are four essential vitamins that are fat soluble, A, D, E and K.

## LEAFY GREEN VEGGIES

All green vegetables and salads are great – eat as much as you can. Try substituting your mash, pasta or rice for vegetables such as broccoli, courgettes, cauliflower or green beans - still covering them with your gravy, Bolognese, or curry. You can even keep pizza in your diet by substituting the carb-dense base for a cauliflower version.

All other above ground veggies and root vegetables (in normal amounts) are great too.

## PROTEIN

Meat, eggs (three eggs a day is not too much), and oily fish such as salmon, mackerel or tuna, are all great sources of protein and can be eaten freely. Protein intake does not need to be high, you can enjoy normal portions.



# IF DESIRED, ENJOY IN MODERATION

## FRUIT

Fruit is trickier; some tropical fruits like bananas, oranges, grapes, mangoes or pineapples have too much sugar and should be avoided. Berries are better and can be eaten in moderation; blueberries, raspberries, strawberries are all good. Apples and pears are fine in moderation too.

## CURED & PROCESSED MEAT

Processed meats such as bacon, ham, sausages or salami contain fewer carbs and more fat so are better at keeping you feeling full. They are not as healthy as unprocessed real food though and should be eaten less often.

## CHEESE

Cheese is a great source of healthy fat but should only be eaten in moderation - it's a very calorific mixture of fat and protein and it is sometimes easy to eat quite a lot of it without realising.

## TREATS

The occasional treat of dark chocolate (70% cocoa or more) in small quantity is fine to have, just don't go overboard! When sugar intake is reduced/stopped many people find their tastes change and higher cocoa chocolate becomes the most enjoyable.



# AIM TO AVOID, OR KEEP TO A MINIMAL AMOUNT

## THE 'WHITE STUFF'

If possible cut out all the 'white stuff'. This means removing bread, pasta and rice from your diet as much as possible, including whole grain versions of these foods because they will still increase blood sugar levels to the same degree, albeit over a slightly longer period.

## SNACKS

Snacking can often occur through force of habit rather than actual hunger and should be avoided, but unsalted nuts such as almonds and walnuts are full of healthy fats and are good options to help stave off hunger.

## SWEETENERS

Sweeteners, in most cases, are artificially produced. They have been shown to increase hunger and may make weight loss more difficult. They also maintain the 'sweet-tooth'.

## ALCOHOL

Many alcoholic drinks contain significant amounts of carbohydrate. Beer contains the same amount of carbohydrate as a slice of bread. Better choices would be an occasional spirit or glass of wine, especially red.

## SUGAR

Sugar needs to be cut out completely. Cakes, biscuits, cereals and high sugar processed snack bars are a mixture of sugar and starch that increases hunger and makes it near impossible to avoid food cravings.

Cut out added sugar in hot drinks and try swapping sugary drinks for water with a slice of lemon.



# WILL A DIET HIGHER IN HEALTHY FATS INCREASE CHOLESTEROL?

Cholesterol is one type of lipid in the body.

It is essential for the body, including having a key role in cell membranes, and in the brain and peripheral nerve myelin sheaths. Cholesterol is also a precursor for bile salts and for steroid hormones; progesteragens, glucocorticoids, mineralocorticoids, androgens, and estrogens.

Humans are able to acquire cholesterol from our food as well as being able to synthesise it in our body. Contrary to popular belief eating more cholesterol does not raise total blood cholesterol level.<sup>5</sup>

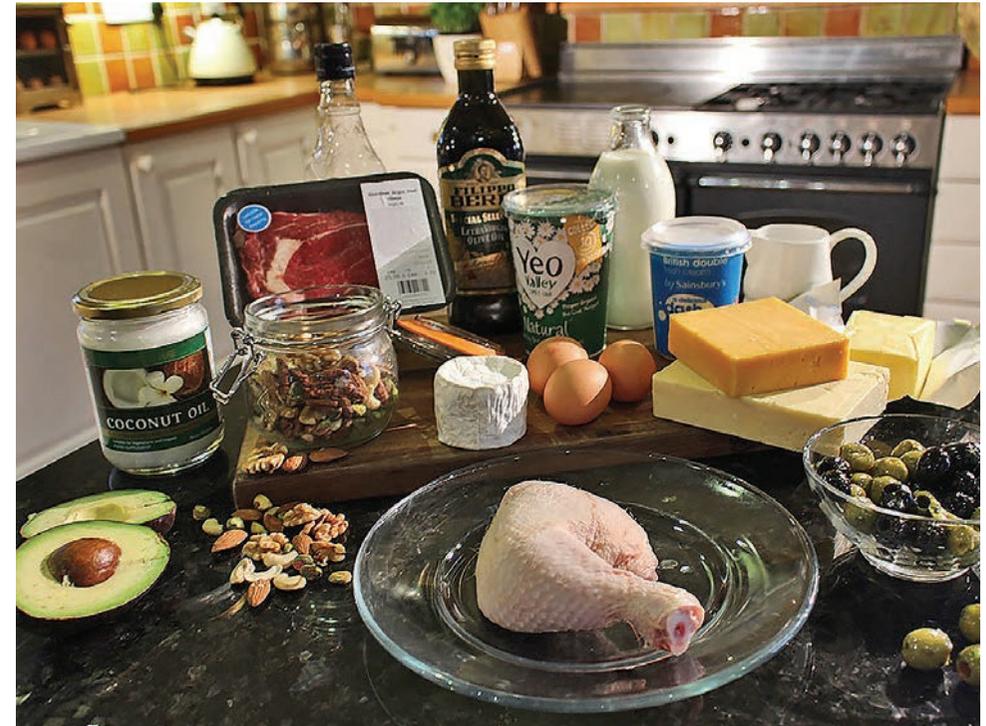
## LDL AND HDL

Because cholesterol is not water soluble it must be transported in the blood with lipoproteins. These include low-density lipoproteins (LDL) and high-density lipoproteins (HDL).

Thus we have LDL-cholesterol and HDL-cholesterol. LDL-cholesterol transports cholesterol from the liver out to the cells of the body, whilst HDL-cholesterol recycles/returns cholesterol back to the liver. Traditionally LDL-cholesterol has been known as 'bad cholesterol' and HDL-cholesterol as 'good cholesterol'.

With the understanding of lipids advancing, the bad press that LDL-cholesterol has received over recent years is no longer appropriate.

Considering the vital role cholesterol plays in the body it is important we take an educated approach to cholesterol.



💡 Cholesterol is largely misunderstood. Although it becomes problematic when coupled with inflammation, it is required for many bodily functions. Research into low carbohydrate diets often show a reduction in cholesterol levels in the blood.

# WILL A DIET HIGHER IN HEALTHY FATS INCREASE CHOLESTEROL?

LDL particles vary in size, from 'small-dense' through to 'large-fluffy'. The number of small-dense particles appears to directly correlate with cardiovascular risk,<sup>6</sup> and this may be a far more important measure than total LDL-cholesterol level.

Typically, we do not measure LDL particle number or size. However small-dense LDL particle number seems to directly correlate with fasting blood triglyceride level, which could therefore be used as a proxy measure.<sup>6</sup>

A diet high in sugar and refined carbohydrate is thought to be a driving factor for raised fasting triglyceride levels and increased small-dense LDL particle number.

## METABOLIC SYNDROME

Metabolic syndrome, also known as insulin resistance syndrome, is associated with a range of poor health outcomes including heart disease and stroke.

The 5 diagnostic criteria for metabolic syndrome are:

- ▶ Waist circumference: Men  $\geq$  90cm (Europids  $\geq$  94cm); Women  $\geq$  80cm
- ▶ Raised triglycerides:  $\geq$  150 mg/dL (1.7 mmol/L)
- ▶ Reduced HDL: Men  $<$  40 mg/dL (1.03 mmol/L); Women  $<$  50 mg/dL (1.29 mmol/L)
- ▶ Raised blood pressure: Systolic  $\geq$  130 mmHg; Diastolic  $\geq$  85 mmHg
- ▶ Raised fasting blood glucose:  $\geq$  100 mg/dL (5.6 mmol/L)

Note, metabolic syndrome diagnostic criteria include high triglycerides and low HDL-cholesterol. It does not include a measure of LDL-cholesterol. A low carbohydrate diet typically reduces fasting triglyceride level and raises HDL-cholesterol level.

It also improves blood glucose, reduces waist circumference and for many reduces blood pressure.<sup>8</sup>

These are all measures that can help determine if a patient is gaining positive benefits from any dietary or lifestyle change.

## PURE COHORT STUDY

The PURE prospective cohort study of 135,000 people from 18 countries urged the global reconsideration of dietary guidelines,<sup>9</sup> concluding:

- ▶ Refined sugar and starchy carbohydrates are associated with a higher risk of total mortality
- ▶ Total fat and individual types of fat are related to lower total mortality
- ▶ Total fat and types of fat are not associated with cardiovascular disease, myocardial infarction, or cardiovascular disease mortality

# THE IMPACT ON PRESCRIBING AND BLOOD GLUCOSE MONITORING

Once patients have lowered their carbohydrate intake for a number of days or weeks, they may begin to notice improvements in both their blood pressure and blood glucose readings.

When carbohydrate intake is reduced, people with diabetes who either inject insulin, or take oral blood glucose lowering medications such as sulphonylureas (e.g. gliclazide), will need to pay closer attention to their blood sugar levels. As glucose intake from food is reduced then blood glucose homeostasis will require less insulin. A reduction in prescribed insulin or insulin-raising medication is often required.

A lower requirement for medication and normalising blood glucose levels is a reassuring sign that a dietary change is providing a healthy benefit. Also by reducing or stopping insulin, and drugs such as sulphonylureas, the risk of hypoglycemia will also be reduced or eliminated - a wonderful outcome for a patient.

## MEDICATION DEPRESCRIPTION

A reduced need for medication is of course a dream of many patients who were reliant on taking medication to manage their condition. There are also significant budget savings for the healthcare system.

Out of 250,000 members of the Low Carb Program, 47% had chosen reduction of medication as their primary goal.



It was a nurse that actually told me about the program. I was having really bad lipoatrophy on all of my injection sites. Since joining the Low Carb Program, I have lost 3 stone (just under 20kg) in 10 weeks and am now only having to take 25% of the insulin I was previously on.

**Sarah Boud, 43**

# SIDE EFFECTS

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Most patients experience a significant improvement in HbA1c at 10 weeks. An HbA1c test 6 weeks after commencing can provide useful feedback to a patient and doctor.

People who significantly reduce their carbohydrate intake may experience side effects that have been described as low carb flu; fatigue, brain fog and a headache. These are, in part, thought to be due to the transition and time lag that occurs with the body switching from being 'glucose burning/dependent' to becoming 'fat burning'.

Also, in the first week, the kidneys may excrete more sodium which can lead to lower blood pressure. As the body's metabolism adapts to the dietary change the side effects disappear and many people describe feeling better than they have for a long time.

Fortunately there are steps that can be taken to reduce these side effects. Restricting carbohydrate intake more gradually may be a choice that works well for some people.

## LOW BLOOD SUGAR (HYPOGLYCEMIA)

Patients using insulin or taking blood glucose lowering medications (such as sulphonylureas) should take precautions to prevent hypos. If carbohydrate intake is significantly reduced it is likely that medication dosages need to be reduced. Testing blood glucose levels can provide useful information. It is usually wise to play it safe when reducing medication, a short period of hyperglycaemia would be preferable to hypoglycaemic episodes.

## IMPACT ON BLOOD PRESSURE

Surprising improvements in blood pressure are common. This can provide opportunity for reducing medication. Reductions in blood pressure of approximately 7.5 mmHg in systolic and 5.5 mmHg in diastolic can be expected.

Early blood pressure drops on a low carbohydrate diet may be due to the diuresis that can occur. The longer-term blood pressure drop is due to improving metabolic health, likely associated with the reduction in visceral fat that occurs.

## LOW SODIUM

Insulin doesn't just affect blood glucose, it also causes a degree of sodium retention by the kidneys. A lower carbohydrate intake causes less insulin production. Until the kidneys adjust to the reduction in insulin there can be a significant loss of sodium which can cause a surprising diuresis.

This may explain some of the early weight loss and improvements in blood pressure seen with a low carbohydrate diet.

The diuresis may also explain some of the 'low carb flu' symptoms that people may experience. Fortunately ensuring a bit of extra salt intake with food in the first couple of weeks on a low carbohydrate diet will often help.

# SIDE EFFECTS

## MUSCLE CRAMPS

Muscle cramps soon after starting a low carbohydrate diet may be a result of the early physiological changes and could be related to magnesium or sodium.

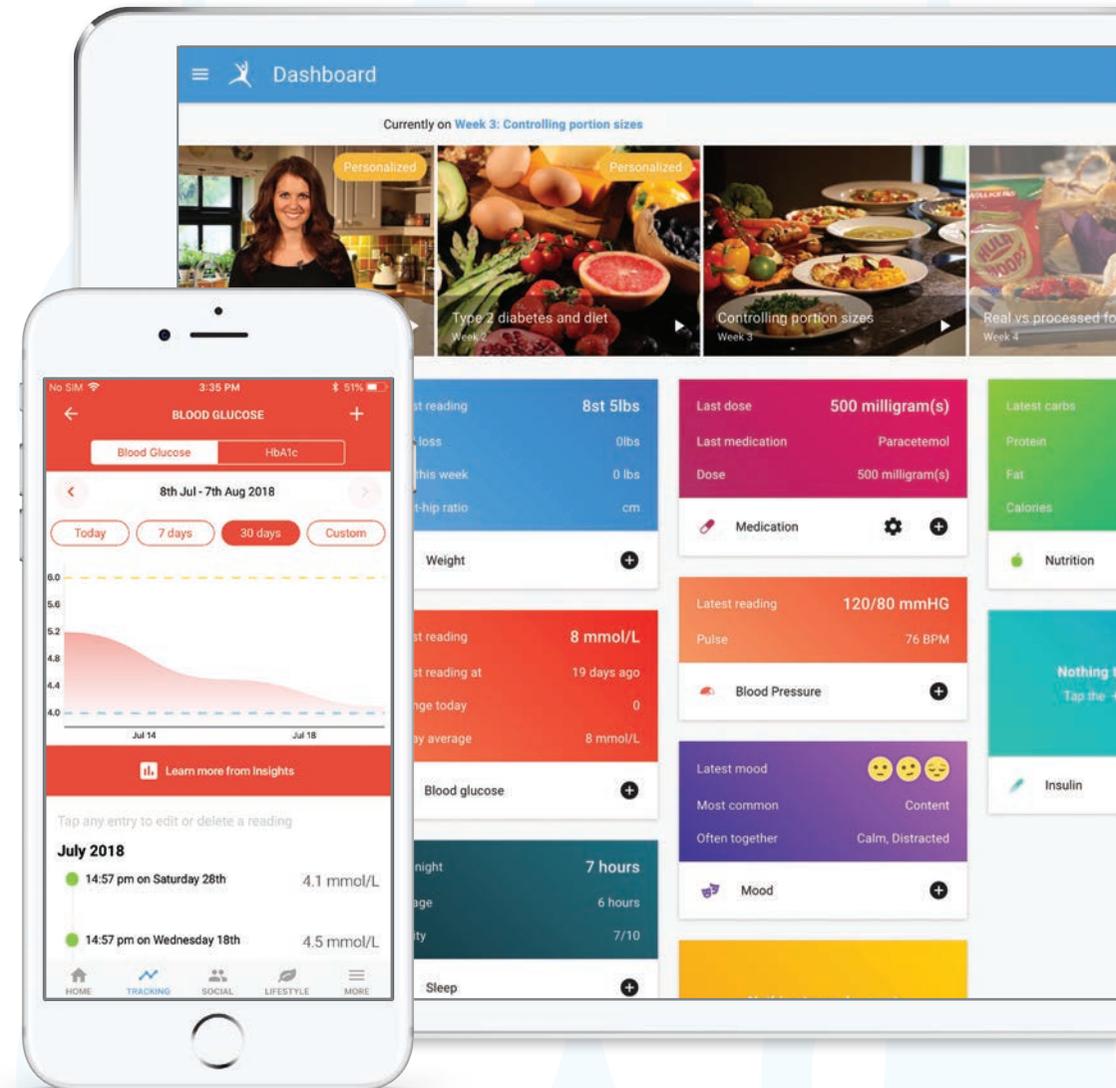
Some people find a soak in a bath with Epsom salts (magnesium sulphate) helpful, or perhaps even better a daily magnesium supplement.

## CONSTIPATION

Some people experience constipation when transitioning to a low carbohydrate diet. This is thought in part to be due to the change in food being supplied to the microbiome (gut bacteria). As time continues the gut bacteria will adapt to the new food and constipation can resolve.

The large amount of green vegetables that many on a low carbohydrate diet eat often means fibre intake is adequate.

People often describe that a low carbohydrate diet resolves long standing IBS symptoms. Coming off metformin can be very beneficial for some people's gastrointestinal symptoms.



# A SOLUTION FOR TYPE 2 DIABETES AND PREDIABETES

## THE LOW CARB PROGRAM

The Low Carb Program provides the education, resources, and, most-importantly, support required when reducing the amount of sugar (or carbohydrates) in the diet.

The Low Carb Program was developed with Dr David Unwin, RCGP National Champion for Collaborative Care and Support Planning in Obesity and Diabetes, and the feedback of 100,000 members of Diabetes.co.uk.

In as little as 10 weeks, most patients who complete the program improve blood glucose control, reduce or eliminate diabetes medications and lose weight.

## WHAT COULD I ACHIEVE?

MEMBERS WHO COMPLETE THE PROGRAM AT 1 YEAR\*



**1.2%**

HbA1c reduction (13 mmol/mol)



**7.4kg**

average weight loss (7% of body weight)



**39%**

reduce their HbA1c below type 2 diabetes threshold



**40%**

eliminate one or more medications



# THE LOW CARB PROGRAM: AT A GLANCE

## PERSONALISED EDUCATION

The Low Carb Program is a digital evidence-based education program customised for people with type 2 diabetes, prediabetes and obesity.

## COMMUNITY SUPPORT

Support, motivation and encouragement from over 250,000 members in real-time - available anywhere, at any time.

## TRACKING PATIENT SUCCESS

Track a variety of biomarkers such as mood, medication, nutrition, blood glucose, sleep, ketones, selfies and more.

## PATIENT-CENTERED

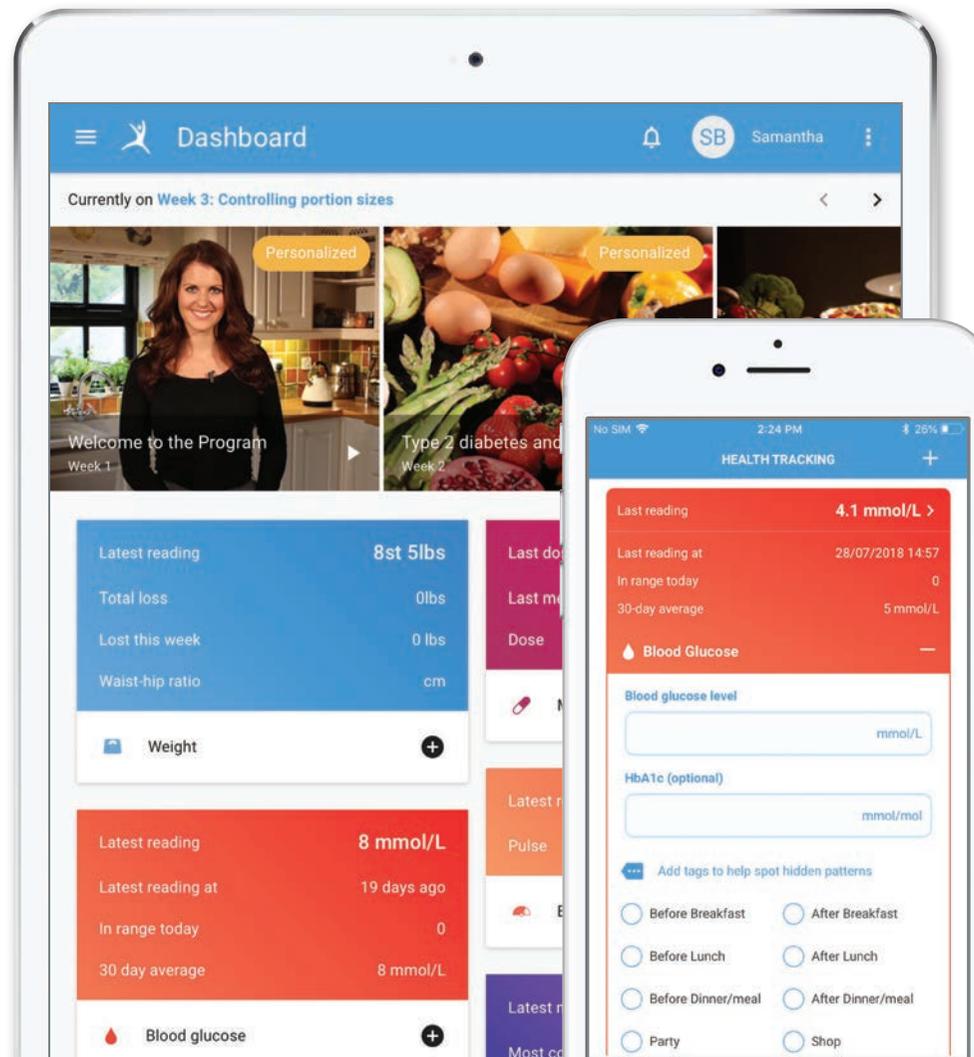
Benefits of a low carb lifestyle include lower blood glucose levels, less dependence on medication and improved blood pressure levels.

## STRUCTURED LEARNING

Each week, Louise addresses a different aspect of nutrition - with action points, downloads and support.

## GOAL FOCUSED

Grounded in solution-focused health psychology, the Low Carb Program tailors patient learning and resources to help achieve personal health goals.



## TAILORED MEAL PLANS

Cookbooks, meal plans and food swaps tailored to your dietary preference.

## MOBILE APP

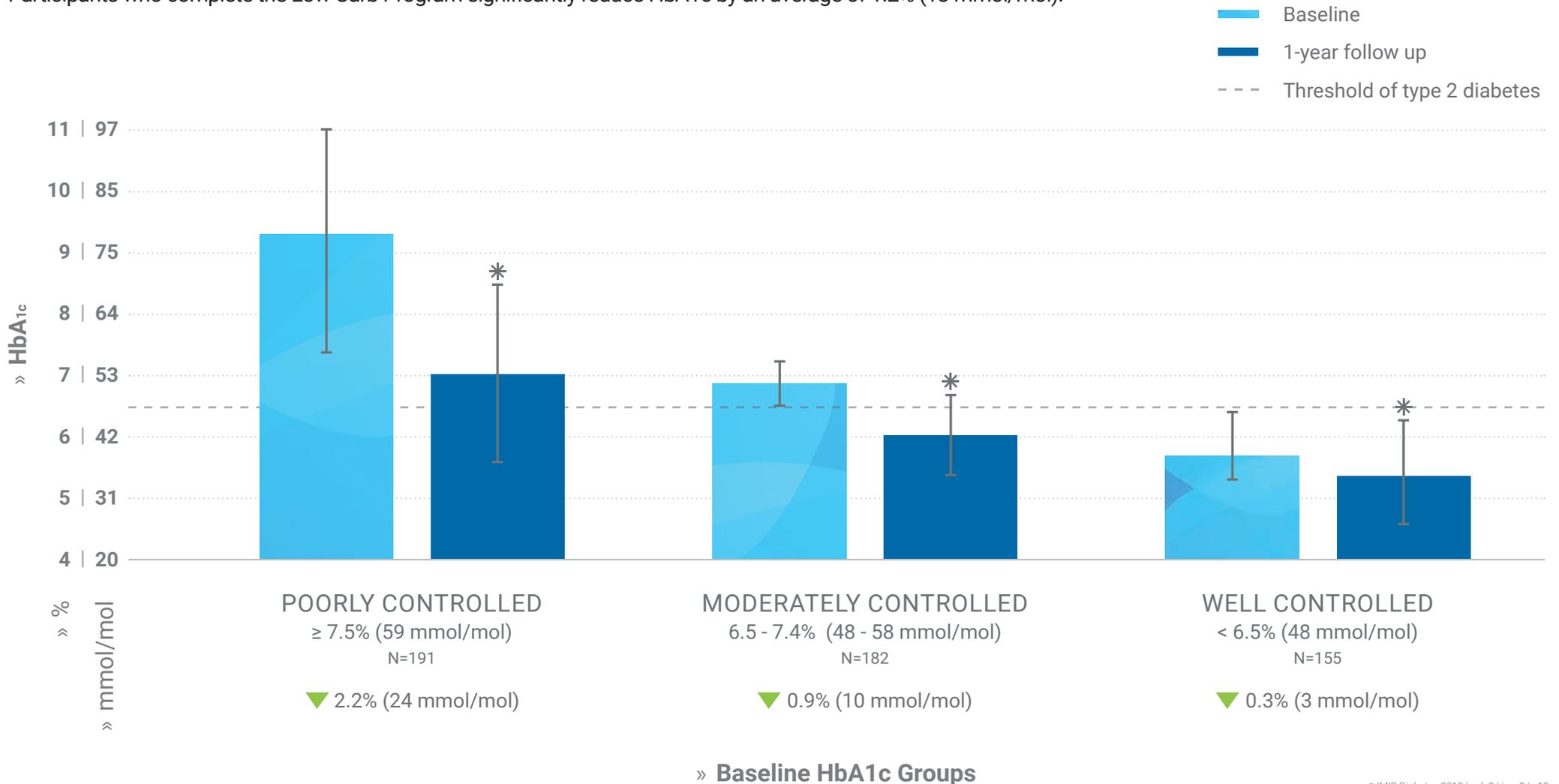
Available to download as a mobile app on iOS and Android devices as well as on the web at [LowCarbProgram.com](http://LowCarbProgram.com)



# PEER REVIEWED OUTCOMES AT 1 YEAR: HbA1C

Our study randomly followed 1,000 people with type 2 diabetes over the course of a year. The study concluded that patients with type 2 diabetes can be taught to sustain adequate carbohydrate restriction in order to improve glycemic control, decrease medication use, and allow clinically relevant weight loss. This can be achieved using a highly personalised treatment that is delivered and supported online. Our peer-reviewed, clinically validated outcomes are published in JMIR Diabetes\*.

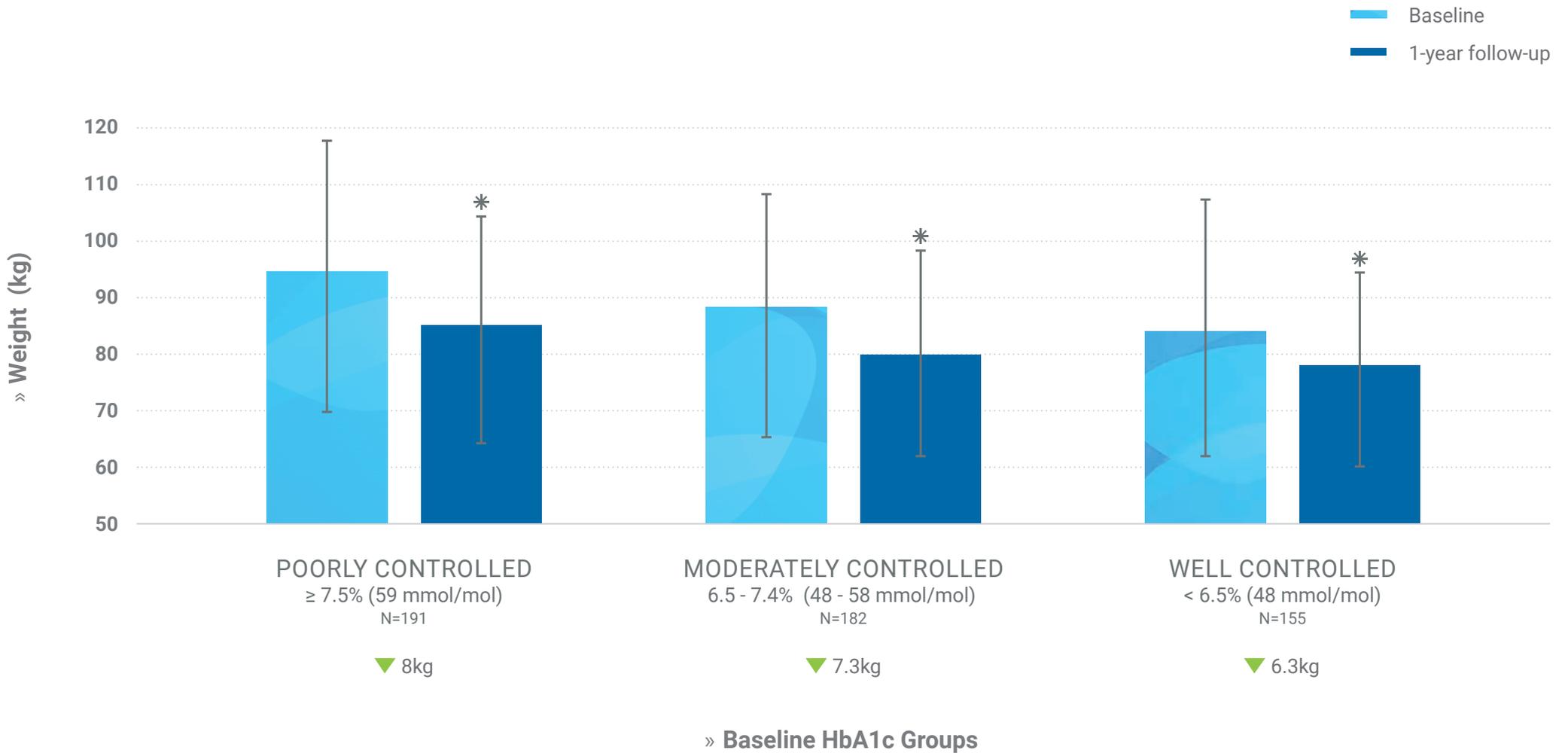
Participants who complete the Low Carb Program significantly reduce HbA1c by an average of 1.2% (13 mmol/mol).



\*JMIR Diabetes 2018 | vol. 3 | iss. 3 | e12

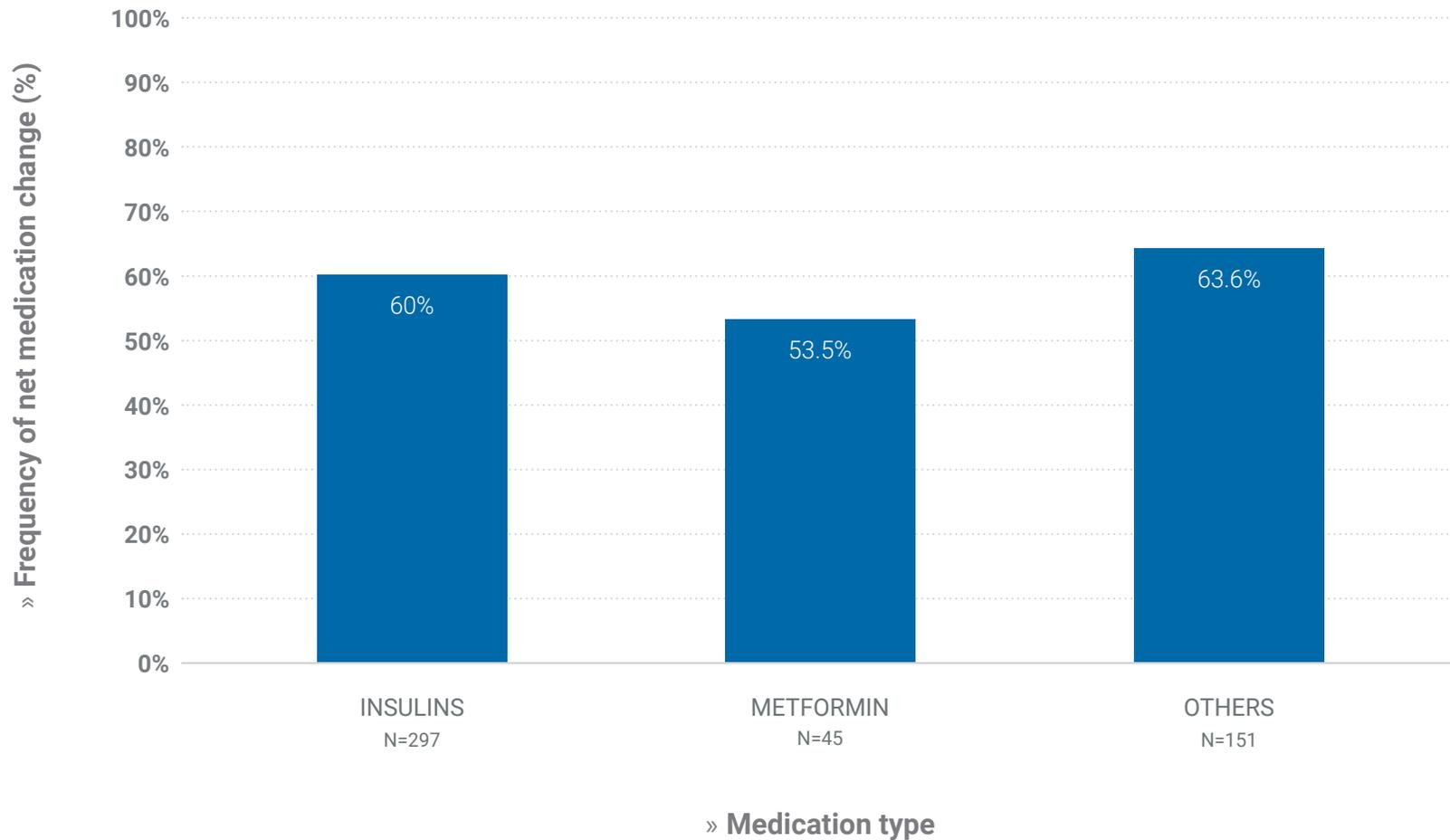
# PEER REVIEWED OUTCOMES AT 1 YEAR: WEIGHT

At the one-year follow-up, all participants who had completed the Low Carb Program produced a significant difference in weight between baseline and one year with an average weight loss of 7.5kg, or 7% of body weight.



# PEER REVIEWED OUTCOMES AT 1 YEAR: MEDICATION

Patients experienced significant reduction and elimination of medications from baseline to follow-up. Bars represent percentage of users who have reduced or eliminated at least one diabetes medication. At one year, the cost saving as a result of reduced medication dependency is £835 or \$1,115 USD per patient, per year.



# THE ROLE OF THE HEALTHCARE PROFESSIONAL

## EARLY SUPPORT

Working with the patient to offer blood pressure checks and blood tests (in particular glucose/HbA1c) is extremely helpful. Where possible, patients should be encouraged to be self-sufficient.

Perhaps purchasing their own blood pressure monitor, and where needed blood glucose monitor.

Blood glucose measurement can be a significant benefit to some patients, and by enhancing their success it may provide drug budget savings in the medium to longer term.

Patients at risk of hypoglycemia due to medication will require support in adjusting dosages, and they may need to test their blood glucose level more frequently in the early stages.

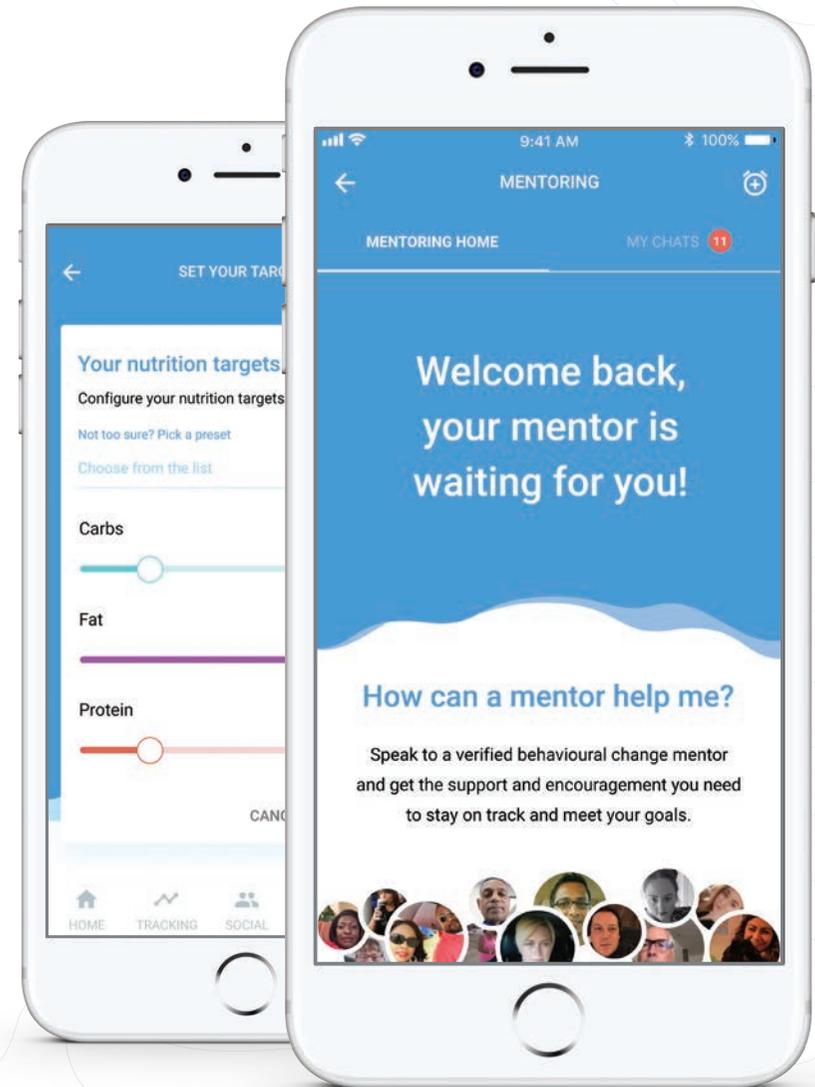
## SUPPORTING SUCCESS

After just 10 weeks, most patients experience a significant improvement in HbA1c. Having an extra blood test for the patient to see their improvement first-hand can be enormously encouraging for patients.

Also, some practices are finding group sessions with patients very useful for peer-support. These are being facilitated by doctors, nurses, or health coaches.

## HEALTHCARE PROFESSIONAL PLATFORM

Access the Low Carb Program Healthcare Professional Platform at [lowcarbprogram.com/HCP](http://lowcarbprogram.com/HCP).



# HEALTHCARE PROFESSIONAL SUPPORT

Healthcare Professionals are supported in a number of ways.

## DIGITAL EDUCATION AND SUPPORT

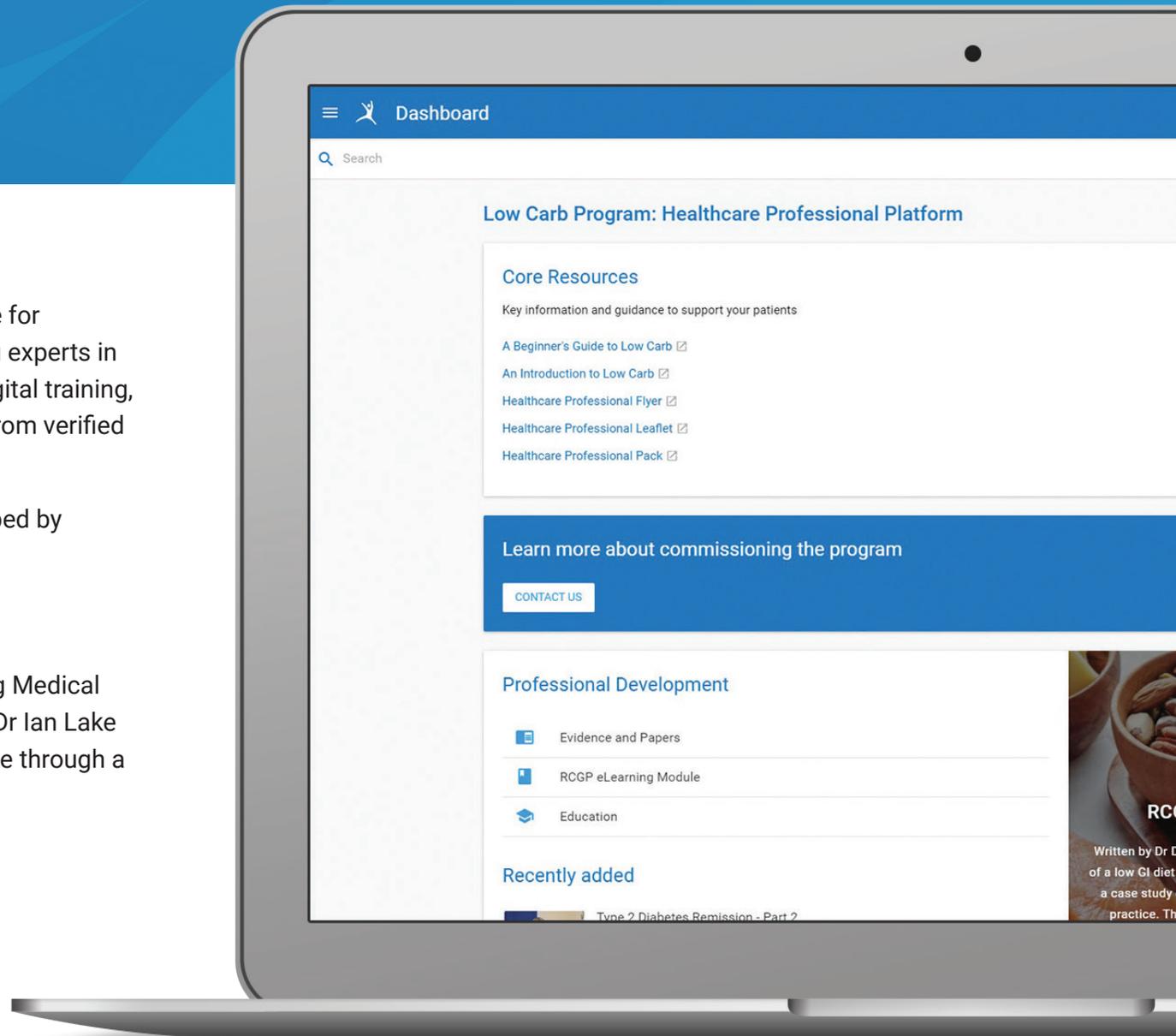
The Healthcare Education Platform is a free online resource for healthcare professionals developed with the world's leading experts in lifestyle medicine. Engage in disease-specific education, digital training, resources to support your patients, evidence, and support from verified Healthcare Professionals from around the world.

The platform also hosts the RCGP e-learning course developed by Dr David Unwin, *Type 2 Diabetes – a Low GI Approach*.

## TRAINING

Bespoke face-to-face training is delivered by a world-leading Medical Team including Dr David Unwin, Dr Campbell Murdoch and Dr Ian Lake at your clinic, surgery, or workplace. Training is also available through a digital pathway.

Learn more at [LowCarbProgram.com/hcp](https://LowCarbProgram.com/hcp)



# DIABETIC MEDICATIONS ON A LOW CARBOHYDRATE DIET

## SUMMARY AND SUGGESTIONS

There are three considerations with the use of diabetic medications in type 2 diabetes and a low carbohydrate diet:

- ▶ Is there a risk of hypoglycemia?
- ▶ What is the degree of carbohydrate restriction?
- ▶ Does the medication provide any benefit, or do any potential benefits outweigh any side effects and potential risks?

| Drug Group                          | Action   | Hypo Risk? | Suggested Action   |
|-------------------------------------|--|------------|--|
| <b>Biguanides (Metformin)</b>       | Reduce hepatic gluconeogenesis, and reduce peripheral insulin resistance | No         | Optional, consider clinical pros/cons.   |
| <b>GLP-1 agonists</b>               | Slow gastric emptying. Glucose dependent pancreatic insulin secretion    | No         | Optional, consider clinical pros/cons.   |
| <b>Insulins</b>                     | Exogenous insulin  | Yes        | Reduce/Stop*   |
| <b>Sulfonylureas</b>                | Increase pancreatic insulin secretion                                    | Yes        | Stop (or if gradual carbohydrate restriction then wean by e.g. halving dose successively).   |
| <b>Meglitinides</b>                 | Increase pancreatic insulin secretion                                    | Yes        | Stop (or if gradual carbohydrate restriction then wean by e.g. halving dose successively).   |
| <b>SGLT-2 inhibitors</b>            | Increase renal glucose secretion   | No         | Stop (Concern over risk of causing ketoacidosis, including with euglycaemia).  |
| <b>Thiazolidinediones</b>           | Reduce peripheral insulin resistance                                     | No         | Usually stop. Concern over risks usually outweighs benefits.   |
| <b>DPP-4 inhibitors</b>             | Inhibit DPP-4 enzyme   | No         | Stop. No significant risk, but no benefit in most cases.   |
| <b>Alpha-glucosidase inhibitors</b> | Delay digestion of starch and sucrose                                    | No         | Stop. No benefit on a low carbohydrate diet.   |
| <b>Blood glucose testing strips</b> | Provide feedback on the blood glucose response to food                   | N/A        | Some people may find a period of measuring blood glucose helpful for informing them about the effect of various foods on blood glucose. This can support behaviour change. A period of measurement may also be useful if HbA1c is not improving as expected. |

**\*Insulin reduction suggestion:** Important to tailor to individual. Usually requires close supervision with healthcare professional, and if in doubt seek expert input.

**T2DM without 'beta cell failure':** If using basal-bolus regime convert to long-acting insulin only, BD in equal doses (OD may suit some people), and on commencing low carbohydrate diet reduce total insulin by 30-50%. Monitor QDS initially for hypoglycemia (rescue glucose if required). Continue down-titration of insulin as insulin resistance improves (can take months). Goal for most can be to eliminate insulin.

**Caution:** Some people with T2DM may have significant 'beta cell failure'. Also people with other forms of pancreatic insufficiency (e.g. LADA or T3c) may have been misdiagnosed as T2DM. Consider this if rapidly increasing HbA1c, thirst, polydipsia, weight loss, low C-peptide. Insulin should not be eliminated in this cohort, although basal and bolus dose adjustment needed for carbohydrate restriction.

# REFERENCES

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“ I lost 50kg and my wife lost 20kg too. Not only that, I reversed my type 2 diabetes.

**Mark Chadbourne, 65**

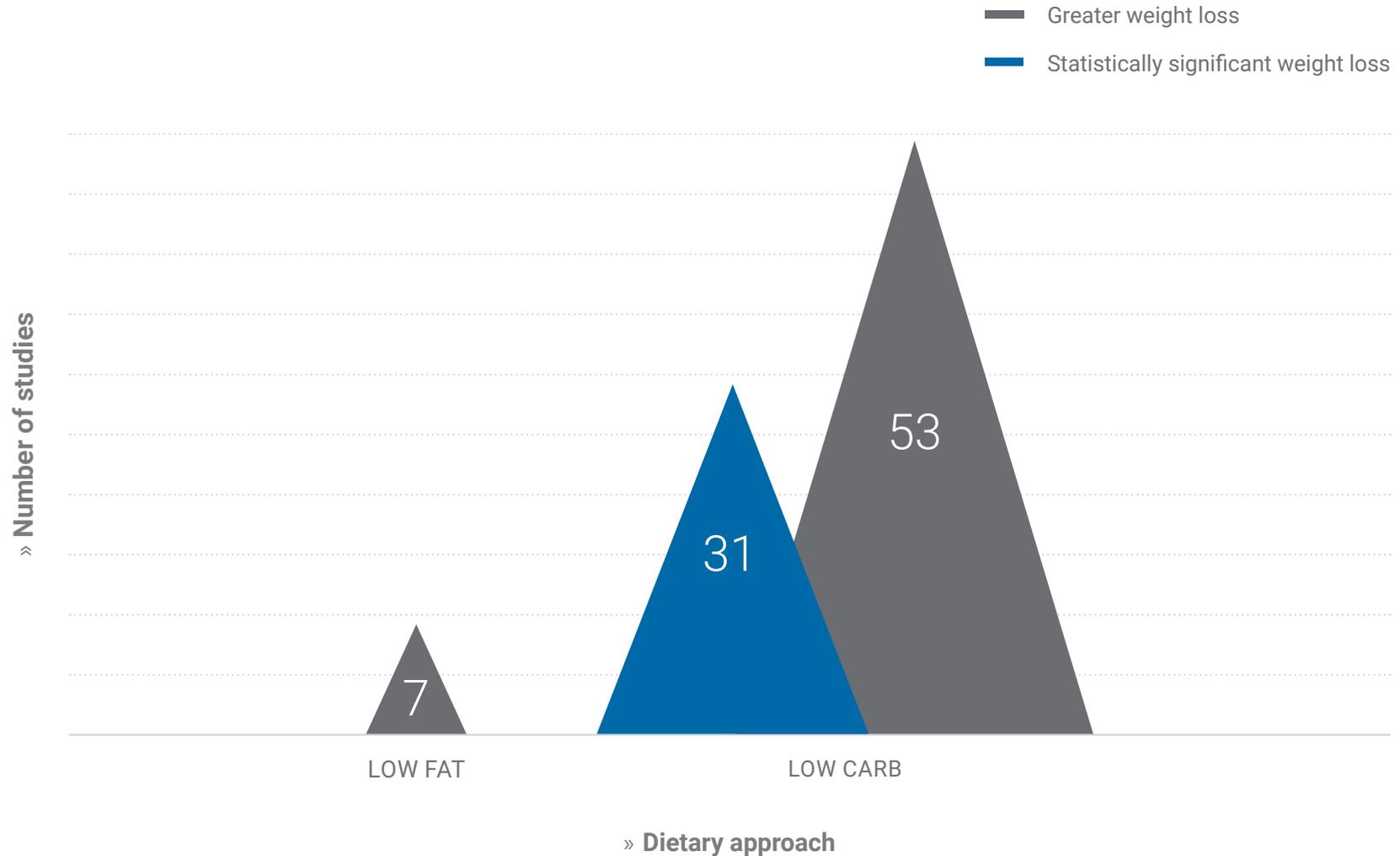
APPENDIX

# WHAT IS THE EVIDENCE?

RANDOMISED CONTROLLED TRIALS COMPARING LOW CARB DIETS OF LESS THAN 130G CARBOHYDRATE PER DAY TO LOW FAT DIETS OF LESS THAN 35% FAT OF TOTAL CALORIES

# WHAT IS THE EVIDENCE?

There are 62 randomised controlled trials (RCTs) that have compared low carb diets of less than 130g of carbohydrates per day to low fat diets of less than 35% fat of total daily calories. Of these, 53 out of 62 RCTs (85%) found a greater weight loss with a low carb approach compared to a low fat approach. More importantly, 31 of the 62 RCTs (50%) demonstrated statistically significant weight loss.



# SUMMARY TABLE

| RCT | Duration   | LC Weight Loss | LF Weight Loss | Participants |
|-----|------------|----------------|----------------|--------------|
| 1   | 6 Months   | <b>8.5kg*</b>  | 3.9kg          | 22 v 20      |
| 2   | 12 Months  | <b>4.3kg</b>   | 2.5kg          | 20 v 17      |
| 3   | 6 Months   | <b>5.8kg*</b>  | 1.9kg          | 43 v 36      |
| 4   | 12 Weeks   | <b>9.9kg*</b>  | 4.1kg          | 16 v 14      |
| 5   | 12 Weeks   | <b>6.2kg*</b>  | 3.4kg          | 22 v 23      |
| 6   | 24 Weeks   | <b>12.7kg*</b> | 7.2kg          | 46 v 34      |
| 7   | 30-50 Days | <b>5.5kg*</b>  | 3.5kg          | 28 v 28      |
| 8   | 10 Weeks   | <b>7.0kg</b>   | 6.8kg          | 15 v 16      |
| 9   | 6 Weeks    | <b>6.2kg</b>   | 6.0kg          | 16 v 16      |
| 10  | 6 Weeks    | <b>6.4kg*</b>  | 4.2kg          | 12 v 11      |
| 11  | 3 Months   | <b>3.55kg*</b> | 0.92kg         | 40 v 39      |
| 12  | 12 Weeks   | <b>6.3kg</b>   | 5.3kg          | 49 v 47      |
| 13  | 12 Months  | <b>4.7kg*</b>  | 2.2kg          | 68 v 61      |
| 14  | 8 Weeks    | <b>7.8kg*</b>  | 6.4kg          | 48 v 45      |
| 15  | 3 Months   | <b>6.9kg*</b>  | 2.1kg          | 10 v 10      |
| 16  | 24 Weeks   | <b>11.1kg*</b> | 6.9kg          | 21 v 29      |
| 17  | 2 Years    | <b>5.5kg*</b>  | 3.3kg          | 83 v 94      |
| 18  | 8 Weeks    | <b>7.5kg*</b>  | 6.2kg          | 52 v 47      |
| 19  | 24 Weeks   | <b>11.9kg</b>  | 10.1kg         | 45 v 43      |
| 20  | 12 Weeks   | <b>10.1kg*</b> | 5.2kg          | 20 v 20      |
| 21  | 12 Months  | <b>14.5kg</b>  | 11.5kg         | 33 v 36      |
| 22  | 13 Weeks   | <b>13.2kg*</b> | 11.5kg         | 18 v 15      |
| 23  | 24 Months  | <b>2.34kg</b>  | <b>2.97kg</b>  | 31 v 30      |
| 24  | 3 Months   | <b>5.5kg*</b>  | 2.6kg          | 15 v 18      |
| 25  | 12 Months  | <b>5.6kg*</b>  | 1.4kg          | 59 v 60      |
| 26  | 4 Months   | <b>9.79kg*</b> | 6.14kg         | 20 v 20      |
| 27  | 8 Weeks    | <b>8.4kg*</b>  | 6.7kg          | 32 v 28      |
| 28  | 12 Months  | <b>3.1kg</b>   | <b>3.1kg</b>   | 47 v 49      |
| 29  | 2 Years    | 6.34kg         | <b>7.37kg</b>  | 154 v 153    |
| 30  | 24 Months  | <b>1.5kg</b>   | 0.2kg          | 28 v 40      |
| 31  | 12 Weeks   | <b>6.8kg</b>   | 5.2kg          | 18 v 15      |

| RCT | Duration  | LC Weight Loss | LF Weight Loss | Participants |
|-----|-----------|----------------|----------------|--------------|
| 32  | 12 Weeks  | <b>8.0kg*</b>  | 6.4kg          | 24 v 21      |
| 33  | 1 Year    | <b>13.7kg</b>  | <b>13.7kg</b>  | 55 v 51      |
| 34  | 1 Year    | <b>5.1kg</b>   | 3.1kg          | 62 v 64      |
| 35  | 48 Weeks  | <b>11.37kg</b> | 9.62kg         | 57 v 65      |
| 36  | 3 Months  | <b>5.0kg</b>   | 3.7kg          | 63 v 66      |
| 37  | 24 Weeks  | <b>12.0kg</b>  | 11.5kg         | 46 v 47      |
| 38  | 6 Months  | <b>6.0kg</b>   | 5.9kg          | 57 v 174     |
| 39  | 1 Year    | 2.1kg          | <b>3.0kg</b>   | 40 v 40      |
| 40  | 6 Weeks   | <b>6.1kg*</b>  | 3.9kg          | 15 v 15      |
| 41  | 24 Weeks  | <b>7.1kg*</b>  | 4.7kg          | 28 v 30      |
| 42  | 3 Months  | <b>7.6kg*</b>  | 4.3kg          | 22 v 19      |
| 43  | 6 Months  | <b>4.3kg</b>   | 4.0kg          | 29 v 30      |
| 44  | 6 Months  | <b>2.6kg</b>   | 1.4kg          | 12 v 12      |
| 45  | 8 Weeks   | <b>7.4kg</b>   | 6.5kg          | 12 v 12      |
| 46  | 6 Months  | <b>6.8kg</b>   | 5.6kg          | 53 v 57      |
| 47  | 3 Months  | 3.4kg          | <b>4.1kg</b>   | 150 v 150    |
| 48  | 12 Months | <b>11.8kg*</b> | 6.9kg          | 55 v 55      |
| 49  | 1 Year    | 2.9kg          | <b>3.7kg</b>   | 30 v 30      |
| 50  | 6 Months  | <b>8.5kg*</b>  | 3.5kg          | 43 v 35      |
| 51  | 52 Weeks  | 9.8kg          | <b>10.1kg</b>  | 41 v 37      |
| 52  | 6 Months  | <b>9.1kg</b>   | 8.9kg          | 25 v 24      |
| 53  | 6 Months  | <b>8.0kg</b>   | 5.7kg          | 21 v 17      |
| 54  | 6 Months  | <b>1.6kg*</b>  | 0.6kg          | 30 v 32      |
| 55  | 4 Months  | <b>14.7kg*</b> | 5.05kg         | 45 v 40      |
| 56  | 12 Weeks  | 11.9kg         | <b>12.2kg</b>  | 20 v 18      |
| 57  | 32 Weeks  | <b>12.7kg*</b> | 3.0kg          | 12 v 13      |
| 58  | 18 Months | <b>5.0kg*</b>  | 2.4kg          | 32 v 33      |
| 59  | 10 Weeks  | <b>25.8kg*</b> | 2.08kg         | 10 v 10      |
| 60  | 12 Months | <b>7.9kg*</b>  | 1.7kg          | 16 v 18      |
| 61  | 2 Years   | <b>6.8kg</b>   | 6.6kg          | 33 v 28      |
| 62  | 12 Months | <b>6.0kg</b>   | 5.3kg          | 304 v 305    |

Greater weight loss in bold, with \* indicating statistically significant weight loss.

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