Lower carb diets and T2 Diabetes: Evidence base and practical implementation in UK NHS primary care
Dr David Unwin FRCGP, Royal College of GP Clinical expert in diabetes
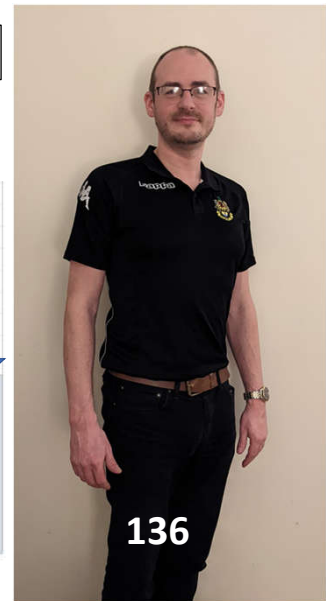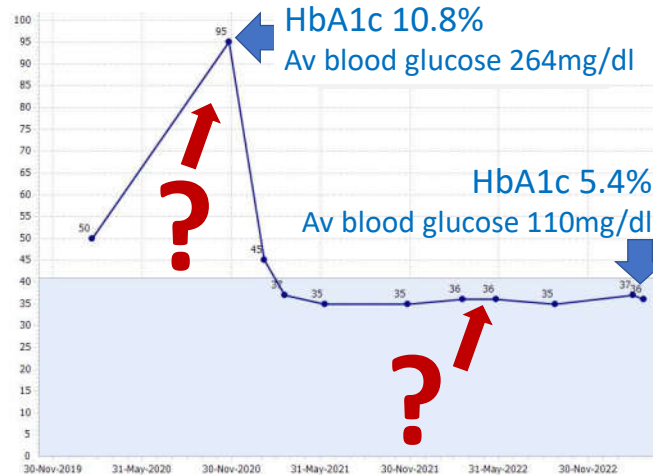
HbA1c*
2019 -2020

HbA1c 10.8%

Life years lost to diabetes:
*We estimate that for both Type 1 diabetes and Type 2diabetes each year with a HbA1c >7.5% loses around 100 life days.**

UK National Diabetes Audit and Office of National Statistics data

*Heald AH, Stedman M, Davies M, Livingston M, Alshames R, Lunt M, et al. Estimating life years lost to diabetes: outcomes from analysis of National Diabetes Audit and Office of National Statistics data. Cardiovascular Endocrinology & Metabolism. 2020;9(4):183-5.
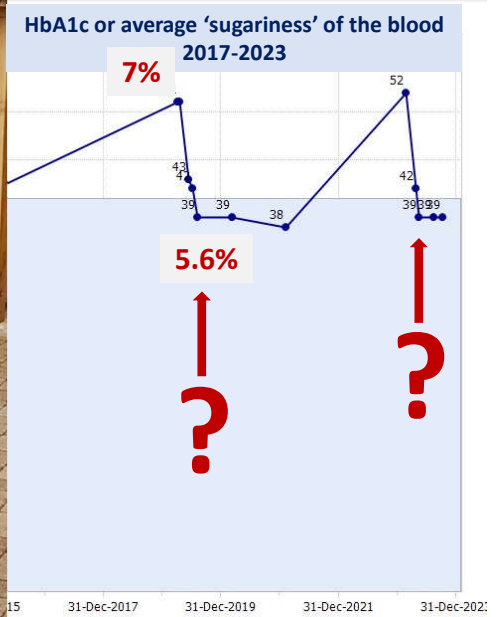
HbA1c in mmol/mol 2019 -2023

HbA1c 10.8%
Av blood glucose 264mg/dl

HbA1c 5.4%
Av blood glucose 110mg/dl

136

Drug-free type 2 diabetes remission for a
40 year old lasting over 2 years

5 years of drug-free T2 Diabetes Remission

HbA1c or average 'sugariness' of the blood 2017-2023

7%

5.6%

52

43
39   39
38
42
39 39 39

?

?

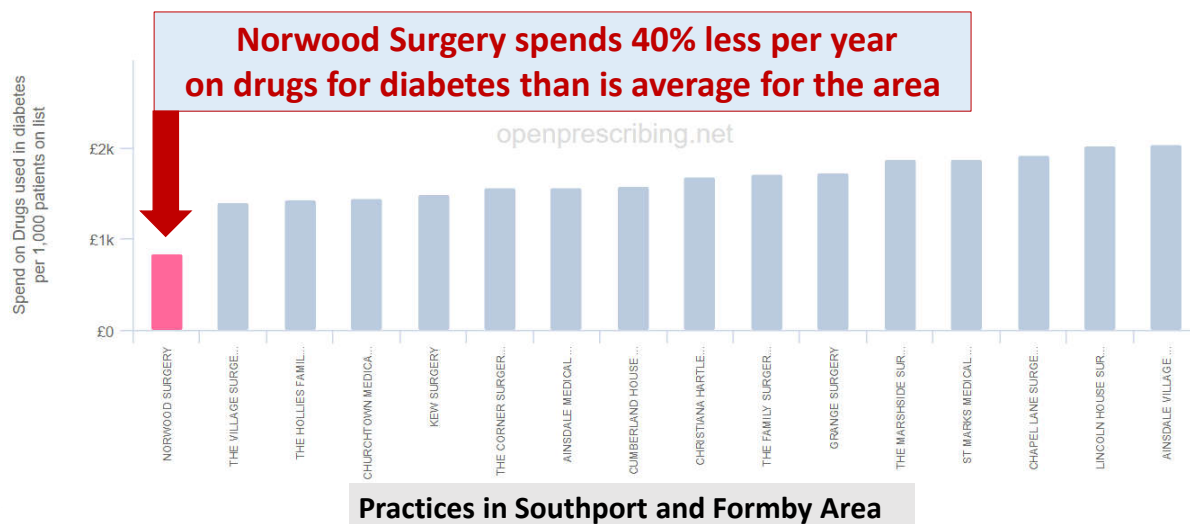15   31-Dec-2017   31-Dec-2019   31-Dec-2021   31-Dec-2023

Type 2 diabetes remission is defined as: previous diagnosis of type 2 diabetes (T2D) by WHO criteria and HbA1c <6.5% (<48mmol/mol) without antidiabetes medication.*

Type 2 Diabetes remission rates Norwood Surgery March 2017- May 2023; low carb approach

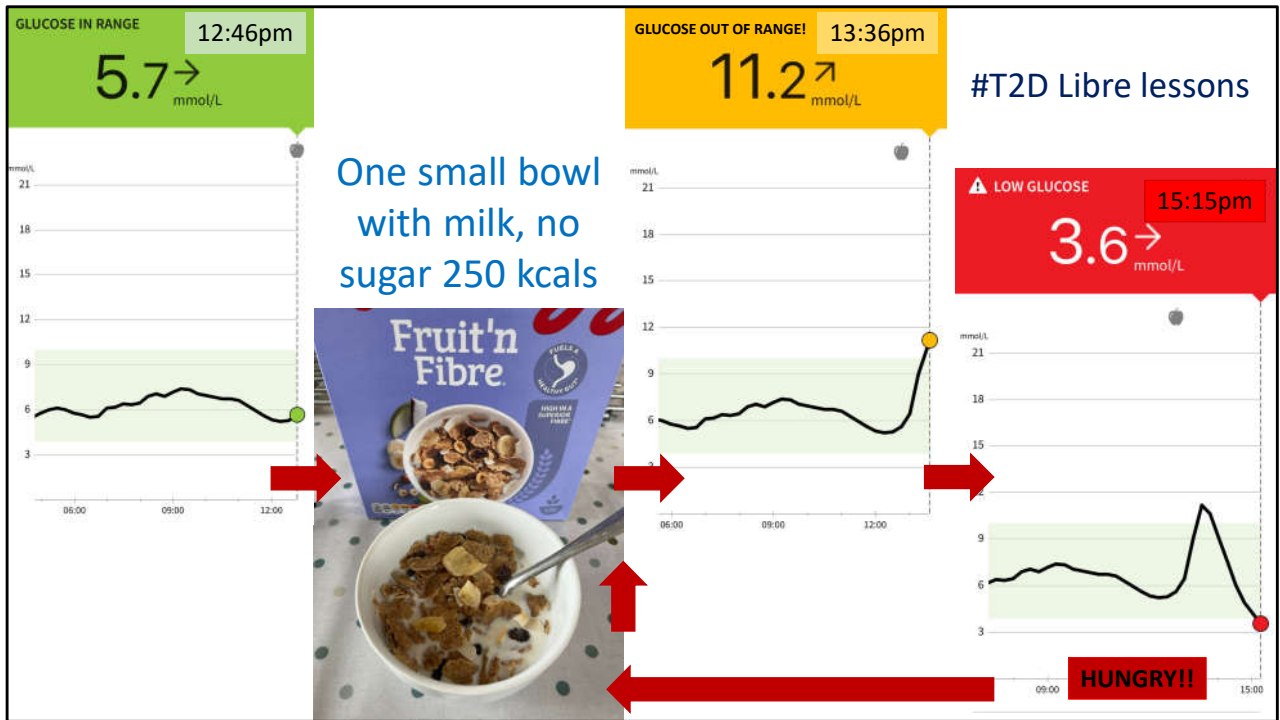| Data collected To:	Mean duration of low carb approach	Number of T2D cases in remission HbA1c <48*	Number choosing the approach	Remission rate for people who choose the low carb approach	Number of T2D patients on the diabetic register	Remission rate for Norwood practice
March 2017	13 months	15	48	31%	416	4%
May 2018	20 months	41	106	39%	454	9%
January 2019	22 months	59	123	48%	469	13%
March 2020	30 months	68	143	48%	485	14%
May 2022	28 months	117	224	52%	536	22%
May 2023	29 months	129	258	50%	569	23%

*Riddle MC, Cefalu WT, Evans PH, Gerstein HC, Nauck MA, Oh WK, et al. Consensus report: definition and interpretation of remission in type 2 diabetes. Diabetologia. 2021.

Spend on antidiabetic drugs (BNF 6.1) vs patients on list by NORWOOD SURGERY and other practices in Southport area. January 2022

Norwood Surgery spends 40% less per year on drugs for diabetes than is average for the area

Spend on Drugs used in diabetes per 1,000 patients on list

£2k

£1k

£0

openprescribing.net

NORWOOD SURGERY
THE VILLAGE SURGE...
THE HOLLIES FAMIL...
CHURCHTOWN MEDICA...
KEW SURGERY
THE CORNER SURGER...
AINSDALE MEDICAL...
CUMBERLAND HOUSE...
CHRISTIANA HARTLE...
THE FAMILY SURGER...
GRANGE SURGERY
THE MARSHSIDE SUR...
ST MARKS MEDICAL...
CHAPEL LANE SURGE...
LINCOLN HOUSE SUR...
AINSDALE VILLAGE...

Practices in Southport and Formby Area

Evidence for eating nutritious foods that don't put your blood sugar up to help people with T2D

GLUCOSE IN RANGE 12:46pm

5.7 → mmol/L

One small bowl with milk, no sugar 250 kcals

Fruit'n Fibre

GLUCOSE OUT OF RANGE! 13:36pm

11.2 ↗ mmol/L

#T2D Libre lessons
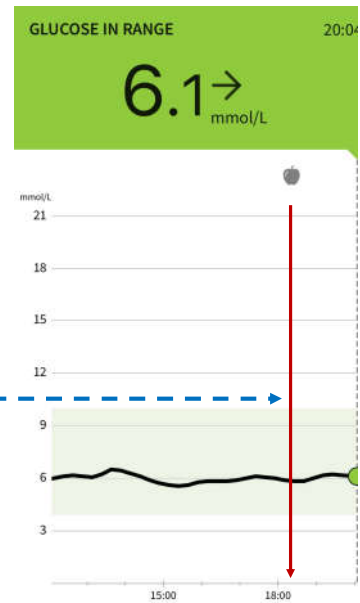
⚠ LOW GLUCOSE 15:15pm

3.6 → mmol/L

HUNGRY!!

8

T2D? Delicious food does not have to put your blood sugar up, if it's low carb

Someone with T2D Eats this plate of chicken butter curry with roasted sprouts here NOTHING HAPPENS to their blood glucose!

#T2D Libre lessons

Does a Ketogenic Diet Have a Place Within Diabetes Clinical Practice? Review of Current Evidence and Controversies

Diabetes Therapy

Research, treatment and education of diabetes and related disorders

→ Open access → Rapid publication → Enhanced features

'Unfortunately, no long-term evidence exists for the current guideline-driven approaches.

So all long-term dietary strategies for diabetes management remain an 'evidence-free zone.'

Firman, C. H., D. D. Mellor, D. Unwin and A. Brown (2023). "Does a Ketogenic Diet Have a Place Within Diabetes Clinical Practice? Review of Current Evidence and Controversies." Diabetes Therapy.

Effect of low-fat diet interventions versus other diet interventions on long-term weight change in adults: a systematic review and meta-analysis

Dr Deirdre K Tobias, ScD • Mu Chen, ScD • Prof JoAnn E Manson, MD • Prof David S Ludwig, MD • Prof Walter Willett, MD • Prof Frank B Hu, MD

Interpretation

These findings suggest that the long-term effect of low-fat diet intervention on bodyweight depends on the intensity of the intervention in the comparison group.

When compared with dietary interventions of similar intensity, evidence from RCTs **does not support** low-fat diets over other dietary interventions for long-term weight loss.

Tobias DK, Chen M, Manson JE, Ludwig DS, Willett W, Hu FB. Effect of low-fat diet interventions versus other diet interventions on long-term weight change in adults: a systematic review and meta-analysis. The Lancet Diabetes & Endocrinology. 2015;3(12):968-79.

People following a low carb diet may well replace dietary carbohydrate with relative increases in dietary fat and/or protein.
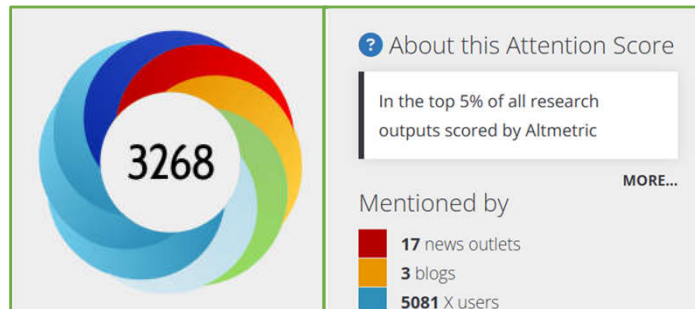
1.The increased dietary fat may cause your patients to worry about cardiovascular risk

2.The increased dietary protein may cause your patients to worry about kidney function

What predicts drug-free type 2 diabetes remission? Insights from an 8-year general practice service evaluation of a lower carbohydrate diet with weight loss.
BMJ Nutrition, Prevention & Health, 2023: p. e000544.

BMJ Journals

BMJ Nutrition, Prevention & Health

? About this Attention Score

In the top 5% of all research outputs scored by Altmetric

MORE...

Mentioned by
17 news outlets
3 blogs
5081 X users

By David Unwin, Christine Delon, Jen Unwin, Simon Tobin, Roy Taylor.

Cohort of 186 T2D low carb participants. Mean (SD) duration of diet: 33 (27) months						
Unwin D., Taylor R. et al., *What predicts drug-free type 2 diabetes remission? Insights from an 8-year general practice service evaluation of a lower carbohydrate diet with weight loss.* BMJ Nutrition, Prevention & Health, 2023: p. e000544.						
	Baseline measure median (IQR)	**Latest follow up median (IQR)**	**Difference Mean (SD)**	**% change**	**p value**	**Matched pairs n (%)**
Age (years)	63 (54, 73)	-	-	-	-	-
Weight (kg)	97 (84,109)	86 (76, 99)	-10 (8.9)	10.3	<0.001	181 (97%)
HbA1c (mmol/mol)	63 (54, 80)	46 (42, 53)	-21 (19)	33.3	<0.001	183 (98%)*
Serum cholesterol (mmol/L)	4.9 (4.1, 5.7)	4.3 (3.6, 5.0)	-0.5 (0.9)	10	<0.001	107 (58%)
HDL cholesterol (mmol/L)	1.1 (1.0, 1.3)	1.2 (1.0, 1.5)	+0.1 (0.3)	9	0.002	114 (61%)
Total chol/HDL ratio	4.0 (3.0, 5.0)	3.9 (3.0, 4.4)	0.5 (0.9)	12.5	<0.001	102 (58)
Calculated LDL cholesterol (mmol/L)	3.6 (2.9, 4.5)	3.1 (2.5, 3.6)	-0.5 (0.9)	13.9	<0.001	100 (54%)
Triglyceride (mmol/L)	2.1 (1.4, 3.2)	1.4 (1.0, 1.9)	-0.9 (1.2)	42	<0.001	108 (58%)
Systolic BP (mmHg)	140 (134, 150)	132 (122, 138)	-12 (16)	8.6	<0.001	128 (69%)
Diastolic BP (mmHg)	80 (78, 90)	78 (70, 80)	-5.8 (9.7)	7.2	<0.001	128 (69%)

186 patients with T2D advised on a low carbohydrate diet for an average of 33 months in UK NHS; HbA1c latest follow up

Overall 97% improved their diabetic control

Worse diabetic control (3%)

Better diabetic control (46%) but not enough To be in remission

T2D remission 94 people (51%)
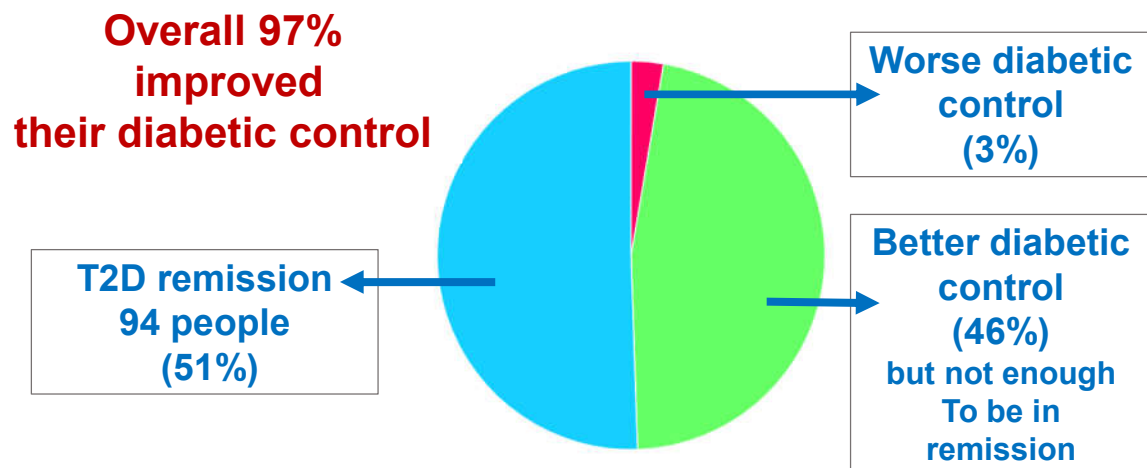
Unwin, D., et al., *What predicts drug-free type 2 diabetes remission? Insights from an 8-year general practice service evaluation of a lower carbohydrate diet with weight loss.* BMJ Nutrition, Prevention & Health, 2023: p. e000544.

Renal function?: Serum creatinine for 132 people with T2 Diabetes. Before and after a low carb diet for an average of 30 months

p = <0.0001

Improved creatinine: 67%

Worse creatinine: 29%

No change: 4%
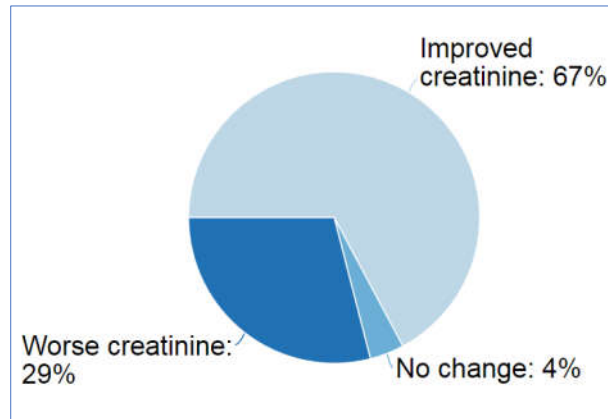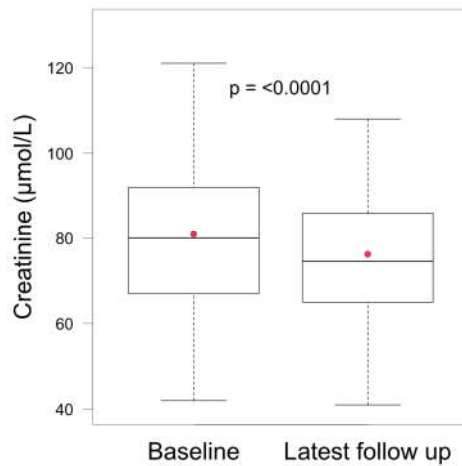
Mean improvement in creatinine 4.71umol/l

Unwin D, et al. **Renal function in patients following a low carbohydrate diet for type 2 diabetes: a review of the literature and analysis of routine clinical data from a primary care service over 7 years**. Current Opinion in Endocrinology, Diabetes and Obesity. 2021.

Association between changes in carbohydrate intake and long term weight changes: prospective cohort study

Participants
136432 men and women aged 65 years or younger

Main outcome measure
Weight change within a four year period

Results
Among men and women, increases in glycemic index and glycemic load were positively associated with weight gain. For example, a 100 g/day increase in starch or added sugar was associated with 1.5 kg greater weight gain over four years,
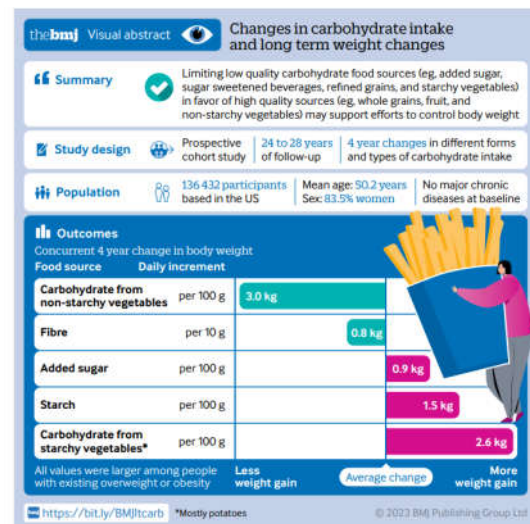
Wan Y, Tobias DK, Dennis KK, Guasch-Ferré M, Sun Q, Rimm EB, et al. Association between changes in carbohydrate intake and long term weight changes: prospective cohort study. BMJ. 2023;382:e073939.

BDA Invited review September 2021

Paper: Dietary strategies for remission of type 2 diabetes: A narrative review

Five dieticians: Adrian Brown, Paul McArdle, Julie Taplin, Trudi Deakin, Duane Mellor
Five clinicians: David Unwin, Jennifer Unwin, Sean Wheatley, Campbell Murdoch, Aseem Malhotra,

Practice Points

●Type 2 Diabetes (T2DM) remission should be considered as a treatment goal for people living with T2DM Therefore, it should be positively discussed with this in mind.
Based on the evidence from clinical trials weight loss (typically 15kg or greater) is the main driver & predictor of remission.

●Total dietary replacements (TDR) and low carbohydrate diets have been demonstrated as being effective in facilitating weight loss & remission of T2DM.
The dietary approach should be one which the individual can maintain for the long term.

●TDR and low carbohydrate diets, if appropriately supported, are considered safe and should not be avoided in suitable individuals who find these approaches acceptable. Clinicians should therefore aim to support their use within clinical practice as part of person-centred diabetes care.

Brown A, McArdle P, Taplin J, Unwin D, Unwin J, Deakin T, et al. Dietary strategies for remission of type 2 diabetes: A narrative review. Journal of Human Nutrition and Dietetics. 2021;n/a(n/a).

Low carb and lipid profiles?: data from 1,633 people recruited to eight RCTs were included

Conclusions: Large randomized controlled trials of at least 6 months duration with carbohydrate restriction appear superior in improving lipid markers when compared with low-fat diets. **Dietary guidelines should consider carbohydrate restriction as an alternative dietary strategy for the prevention/management of dyslipidemia for populations with cardiometabolic risk.**

Gjuladin-Hellon T, Davies IG, Penson P, Amiri Baghbadorani R. Effects of carbohydrate-restricted diets on low-density lipoprotein cholesterol levels in overweight and obese adults: a systematic review and meta-analysis. Nutr Rev. 2018.

Dose-dependent effect of carbohydrate restriction on HbA1c (%) in patients with type 2 diabetes at the 6-month follow-up analysis of 29 RCTs
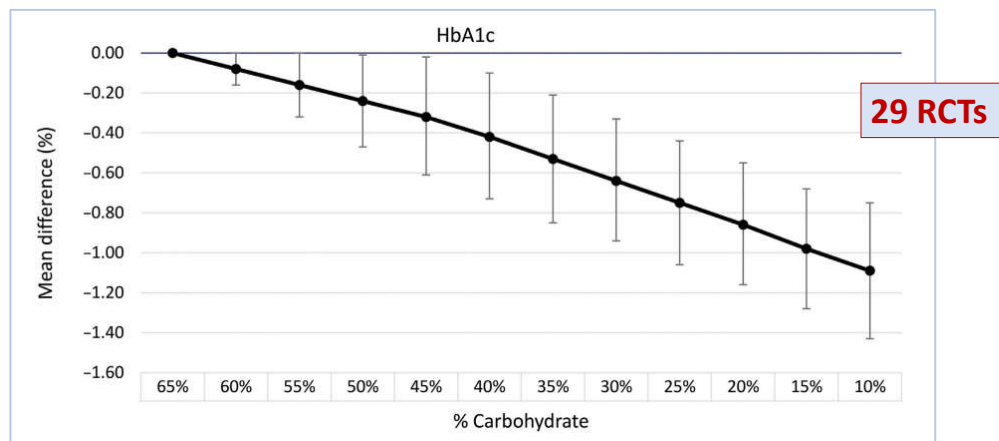
Conclusions: Carbohydrate restriction can exert a significant & important reduction on levels of cardiometabolic risk factors in patients with type 2 diabetes. Levels of most cardiometabolic outcomes decreased linearly with the decrease in carbohydrate intake.

Jayedi A, et al. Dose-dependent effect of carbohydrate restriction for type 2 diabetes management: a systematic review and dose-response meta-analysis of randomized controlled trials. Am J Clin Nutr. 2022. Social Determinants of Health Research Center, Semnan University, Iran;

Nutrition Therapy for Adults With Diabetes or Prediabetes: A Consensus Report

American Diabetes Association. Diabetes Care

Health care providers should:
1) emphasize nonstarchy vegetables,
2) minimize added sugars and refined grains,
3) choose whole foods over highly processed foods to the extent possible

Reducing overall carbohydrate intake for individuals with diabetes has demonstrated the most evidence for improving glycemia and may be applied in a variety of eating patterns that meet individual needs and preferences.

For individuals with type 2 diabetes not meeting glycemic targets or for whom reducing glucose-lowering drugs is a priority, reducing overall carbohydrate intake with a low- or very-low-carbohydrate eating pattern is a viable option

Committee ADAPP. 5. Facilitating Behavior Change and Well-being to Improve Health Outcomes: Standards of Medical Care in Diabetes—2022. Diabetes Care. 2022;45(Supplement_1):S60-S82.

Implementation in practice

?

Psychology

Physiology

Psychology matters

1. Patient goals, choice and hope

2. Feedback

3. Carb addiction

HbA1c 8.6%

80
75
70
65
61
57
60
55
51
50
6.5%
45
40
35
30
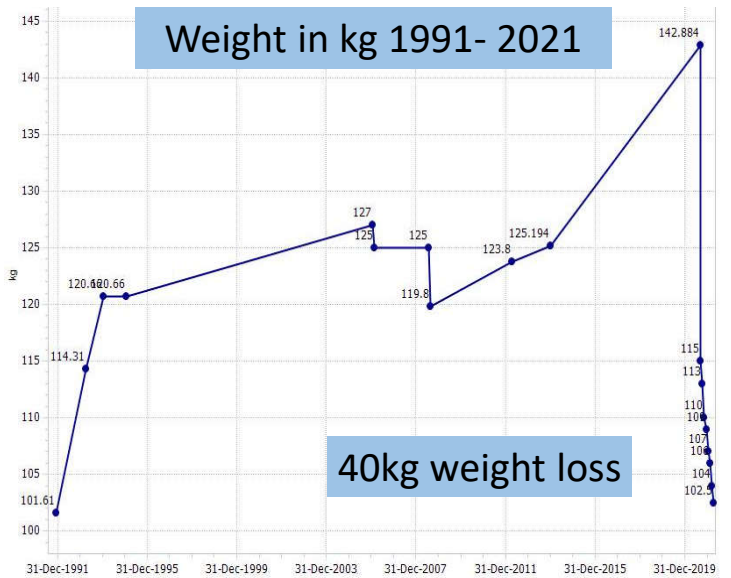25
20
15

mmol/mol
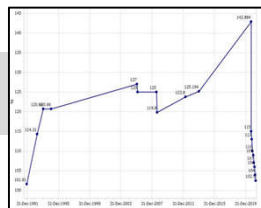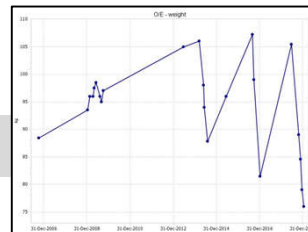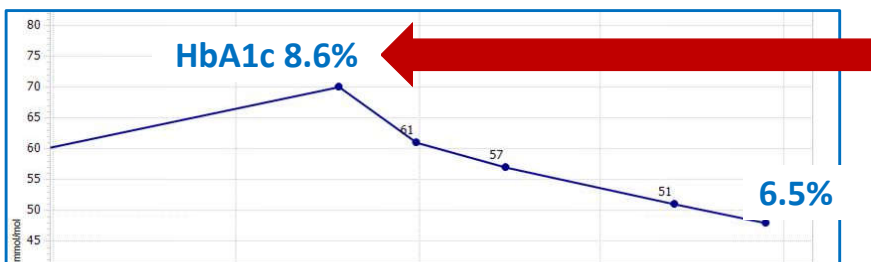
T2 Diabetic control HbA1c

HOPE

1.Patient goals

This patient able to come off SIX repeat medications!!
GOAL fewer meds (SE)

Dapagliflozin 10mg tablets — STOPPED [ ]
take one daily, 56 tablet
Last Issue: 26-Jul-2021

Gliclazide 80mg tablets — STOPPED [ ]
Two To Be Taken Twice A Day, 224 tablet
Last Issue: 08-Sep-2021

Metformin 500mg tablets [ ]
take two tablets twice daily, 224 tablet
Last Issue: 14-Jan-2022

Simvastatin 20mg tablets [ ]
TAKE ONE AT NIGHT, 56 tablet
Last Issue: 14-Jan-2022

TEE2 testing strips (Spirit Healthcare Ltd) [ ]
use as directed, 50 strip
Last Issue: 14-Jan-2022

Review Date: 03-Sep-2020

Once you have requested your prescription via the surgery,
please contact your chosen pharmacy to check if your
medication is ready, not the surgery. Thank you.
PLEASE INFORM THE SURGERY OF ANY CHANGE OF
ADDRESS OR CONTACT NUMBERS.

Allopurinol 300mg tablets — STOPPED [ ]
take one daily, 56 tablet
Last Issue: 14-Jan-2022

Amitriptyline 10mg tablets — STOPPED [ ]
One To Be Taken At Night, 56 tablet
Last Issue: 14-Jan-2022

Co-codamol 8mg/500mg tablets [ ]
One Or Two To Be Taken Four Times A Day When
Required — STOPPED
100 tablet
Last Issue: 26-Jan-2021

Compact testing strips (Roche Diabetes Care Ltd) [ ]
use as directed, 51 strip

Co-tenidone 100mg/25mg tablets [ ]
take one daily, 56 tablet — STOPPED
Last Issue: 14-Jan-2022

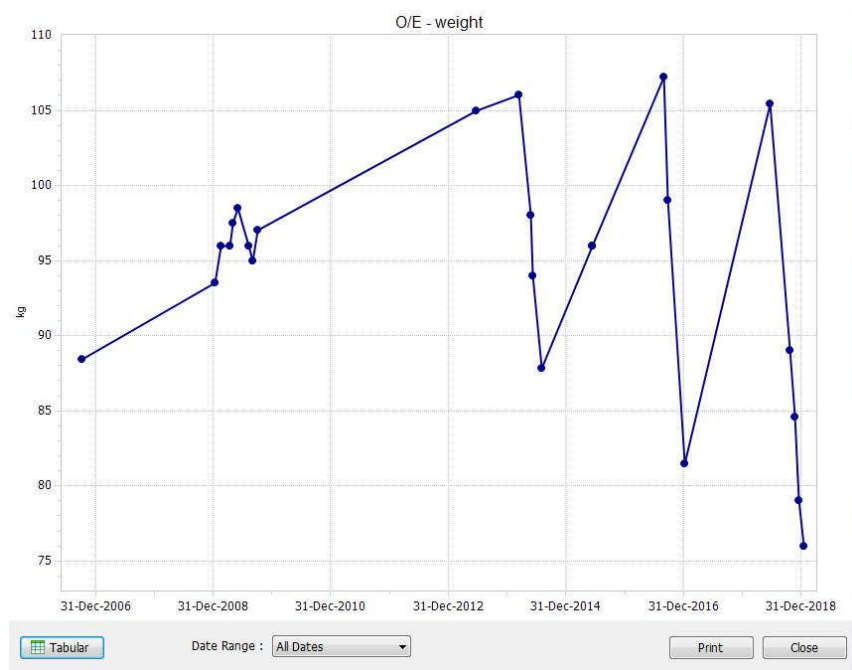**Psychology; 2. Feedback is key to behaviour change**

Weight in kg 1991- 2021

40kg weight loss

Graph or belt??

He used to use this hole before!

2.Physiology

Explaining the physiology of type 2 diabetes to patients in a way they can understand
Including:

- **Liver function**
- **Triglyceride levels**
- **Central Obesity & Hunger**
- **Type 2 diabetes itself**

1. HbA1c is a measure of how **'sugary'** your blood has been over the past 3 months.

2. '**Sugary blood**' damages the lining of blood vessels (glycocalyx) rapidly, so 'Time in range*' matters too!

3.The hormone insulin can be thought of as pushing glucose out of the blood stream and into cells to reduce blood sugar. In some cells it becomes fat so that excess dietary sugar leads to central obesity, fatty liver & T2D

*Wright, L.A. and I.B. Hirsch, *Metrics Beyond Hemoglobin A1C in Diabetes Management: Time in Range, Hypoglycemia, and Other Parameters.* Diabetes Technol Ther, 2017. **19**(S2): p. S16-S26.

*Nieuwdorp, M., et al., Loss of Endothelial Glycocalyx During Acute Hyperglycemia Coincides With Endothelial Dysfunction and Coagulation Activation In Vivo. Diabetes, 2006. 55(2): p. 480-486.

Figure 2. Prevalence of complications versus percentage of time spent in optimal range (70-180 mg/dL or 3.9-10.0 mmol/L).
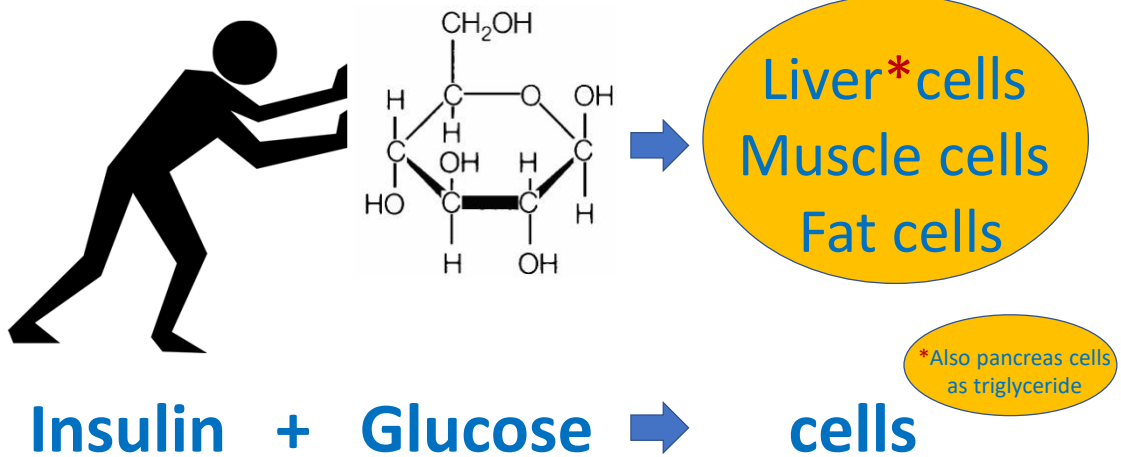
Unless provided in the caption above, the following copyright applies to the content of this slide: © The Author(s) 2021. Published by Oxford University Press on behalf of the Endocrine Society. All rights reserved. For permissions, please e-mail: journals.permissions@oup.comThis article is published and distributed under the terms of the Oxford University Press, Standard Journals Publication Model (https://academic.oup.com/journals/pages/open_access/funder_policies/choru s/standard_publication_model)

The hormone insulin can be thought of as pushing glucose out of the blood stream and into cells to reduce blood sugar. In some cells it becomes fat so that excess dietary sugar leads to central obesity, fatty liver & T2D

Liver*cells
Muscle cells
Fat cells

*Also pancreas cells as triglyceride

Insulin + Glucose ➡ cells

Type 2 diabetes results in part from accumulation of fat in the liver and pancreas

Triglyceride

Liver fat: linked to insulin resistance

Pancreatic fat: inhibits B cell function -cannot produce enough insulin
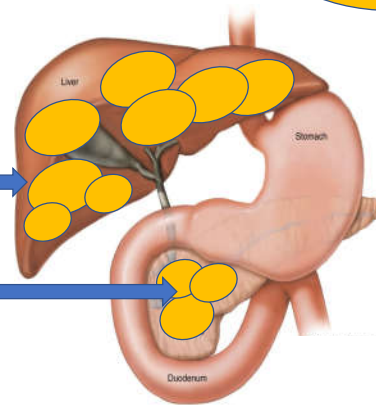
Reversal of type 2 diabetes: Normalisation of beta cell function in association with decreased pancreas and liver triacylglycerol. Lim EL1, Hollingsworth KG, Taylor R. Diabetologia. 2011 Oct;54(10):2506-14. doi: 10.1007/s00125-011-2204-7.

Insulin and fuel usage

We are dual-fuel, hybrid engines too

Recently a lady weighing 105 Kg asked me why am I always hungry?- when I have all this food on board already

Reduced carbohydrate intake ⬅

Reduce circulating insulin

*Reduce liver fat   Lose weight   *Reduce pancreas fat

Reduce Insulin resistance   Increase insulin secretion

Reversing T2 Diabetes

***Reversal of type 2 diabetes: Normalisation of beta cell function in association with decreased pancreas and liver triacylglycerol**. Lim EL1, Hollingsworth KG, Taylor R. Diabetologia. 2011 Oct;54(10):2506-14. doi: 10.1007/s00125-011-2204-7.

A high blood sugar?

1. See this as a 'puzzle to be solved' rather than a 'problem'
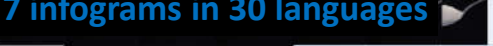
2. Usually it's something you ate

3. Try asking 'where is the sugar in my diet coming from?'

A Starch Molecule
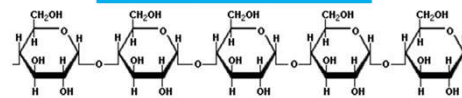
Many glucose molecules are linked together – enzymal digestion will break them up again

Food Item	Glycaemic index	Serve size g	How does each food affect blood glucose compared with one 4g teaspoon of table sugar?										
			Dr D Unwin, Dr G Livesey. It is the glycaemic response to food that matters in diabetes and obesity. Journal of Insulin Resistance. 2016;2016;1(1), a8										
Basmati rice	69	150	10.1										
Potato, white, boiled	96	150	9.1										
French Fries baked	64	150	7.5	GOOGLE 'PHC Unwin Sugar'									
Spaghetti White boiled	39	180	6.6	7 infograms in 30 languages									
Sweet corn boiled	60	80	4.0										
Frozen peas, boiled	51	80	1.3										
Banana	62	120	5.7										
Apple	39	120	2.3										
Wholemeal Small slice	74	30	3.0										
Broccoli	15	80	0.2	Other foods in the very low glycaemic range would be chicken, oily fish, almonds, mushrooms, cheese, meat									
Eggs	0	60	0										

A lower carb diet for type 2 diabetes: In this condition your metabolism struggles to deal with sugar- so its consumption needs cutting back dramatically-

Sugar – cut it out altogether, although it will be in the blueberries, strawberries and raspberries you are allowed to eat. Cakes and biscuits are a mixture of sugar and starch that make it almost impossible to avoid food cravings; they just make you hungrier!!

Reduce starchy carbs a lot… Remember they digest down into surprising amounts of sugar. If possible just cut out the 'White Stuff' like bread, pasta, rice, crackers and breakfast cereals.

All green veg/salads are fine…Eat as much of these as you can –***turn the white stuff green*** So that you still eat a good big dinner try substituting veg such as broccoli, courgettes or green beans for your mash, pasta or rice – still covering them with your gravy, Bolognese or curry! Tip: try home-made soup – it can be taken to work for lunch and microwaved. Mushrooms, tomatoes, and onions can be included in this.

Fruit is trickier…
Some tropical fruits like bananas, oranges, grapes, mangoes or pineapple have too much sugar in and can set those carb cravings off. Berries are better and can be eaten; blueberries, raspberries, strawberries, apples and pears too.

Eat healthy proteins…
Such as non-processed meat, eggs (three eggs a day is not too much), fish – particularly oily fish such as salmon, mackerel or tuna –are fine and can be eaten freely. Plain **full fat** yoghurt makes a good breakfast with the berries. Processed meats such as bacon, ham, sausages or salami are not as healthy and should only be eaten in moderation.

GOOGLE 'PHC Unwin Sugar'

Fats are fine in moderation…
Yes, fats can be fine in moderation: olive oil is very useful, butter may be tastier than margarine and could be better for you! Coconut oil is great for stir fries. Four essential vitamins A, D, E and K are only found in some fats or oils. Please avoid margarine, corn oil and vegetable oil.

Beware 'low fat' foods. They often have sugar or sweeteners added to make them palatable. Full fat mayonnaise and pesto are definitely on!!

Cheese only in moderation…
It's a very calorific mixture of fat, and protein.

Snacks: avoid, as habit forming. But un-salted nuts such as almonds or walnuts are OK to stave off hunger. The occasional treat of strong dark chocolate 70% or more in small quantity is allowed.

Eating lots of green veg with protein and healthy fats leaves you properly full in a way that lasts

Alcohol is full of carbs…
Sadly many alcoholic drinks are full of carbohydrate – for example, beer is almost 'liquid toast' hence the beer belly!! The odd glass of dry white, red wine or spirits is not too bad if it doesn't make you hungry afterwards – or just plain water with a slice of lemon.

Sweeteners can trick you…
Finally, about sweeteners and what to drink – sweeteners have been proven to tease your brain into being even hungrier, making weight loss more difficult – drink tea, coffee, and water or herb teas. (100ml milk is 1 teaspoon of sugar)

Important On medication? Check this first with your Doctor or HCP

PS some folk need more salt on a low carb diet

Type 2 Diabetes: Diabetic Medications on a Low Carbohydrate Diet - A Summary & Suggestions
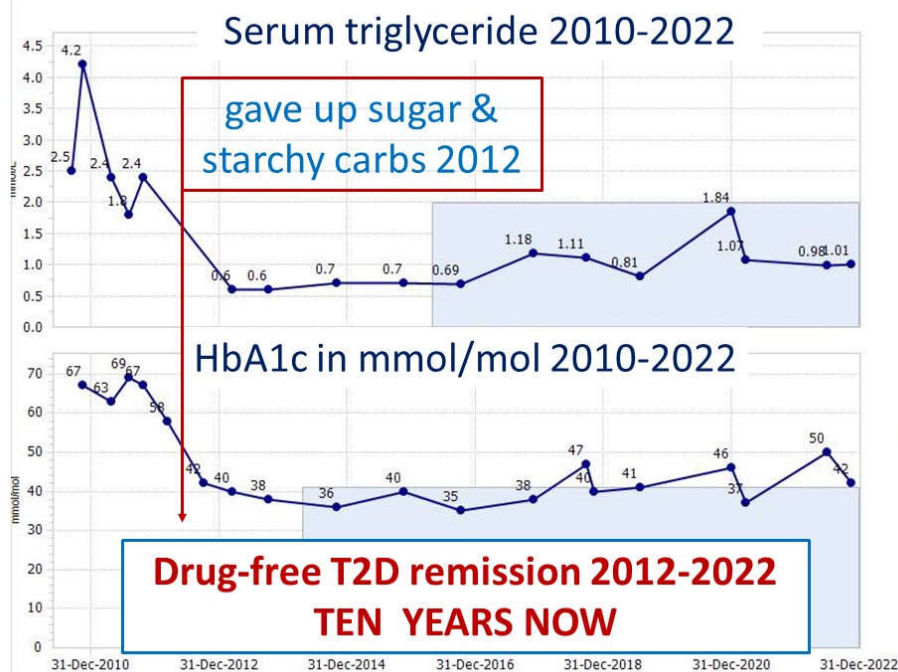
There are **3 main** considerations for the use of diabetic medications in type 2 diabetes with a low carb diet:

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

Drug Group & example	Action	Hypo risk?	Suggested action (to continue/stop)
Biguanides -Metformin	Reduce hepatic gluconeogenesis, and reduce peripheral insulin resistance	No	Optional, consider clinical pros/cons.
GLP-1 agonists -Liraglutide	Slow gastric emptying. Glucose dependent pancreatic insulin secretion.	No	Optional, consider clinical pros/cons.
Insulins	Exogenous insulin	Yes	Reduce/Stop (*see below)
Sulfonylureas -Gliclazide	Increase pancreatic insulin secretion	Yes	Stop (or if gradual carbohydrate restriction then wean by e.g. halving dose successively)
Meglitinides -Replaglinide	Increase pancreatic insulin secretion	Yes	Stop (or if gradual carbohydrate restriction then wean by e.g. halving dose successively)
SGLT-2 inhibitors -Dapagliflozin	Increase renal glucose secretion	No	Stop (Concern over risk of ketoacidosis, unusually the blood glucose may be normal)
Thiazolidinediones-Rosiglitazone	Reduce peripheral insulin resistance	No	Usually stop. Concern over risks usually outweighs benefits.
DPP-4 inhibitors -Sitagliptin	Inhibit DPP-4 enzyme	No	Stop. No significant risk, but no benefit in most cases.

Murdoch C, Unwin D, **Adapting diabetes medication for low carbohydrate management of type 2 diabetes: a practical guide**. British Journal of General Practice. 2019;69(684):360-1

Serum triglyceride 2010-2022

gave up sugar & starchy carbs 2012

HbA1c in mmol/mol 2010-2022

Drug-free T2D remission 2012-2022
TEN YEARS NOW

Is low carb sustainable?

Low carb can deliver long term improvements in cardiovascular risk
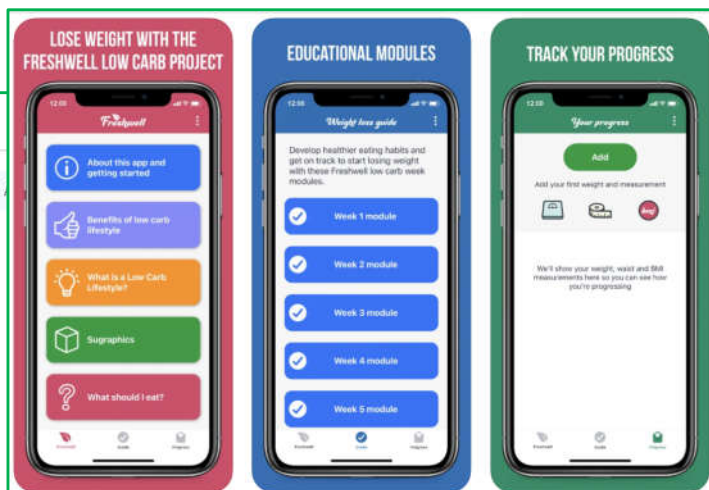
Freshwell Low carb App
A free low carb App
to download
on your phone

Now accredited for use throughout the NHS and certified as compliant with the UK NICE guidelines on what is required for a structured education programme for type 2 diabetes. QOF DM014 ✅

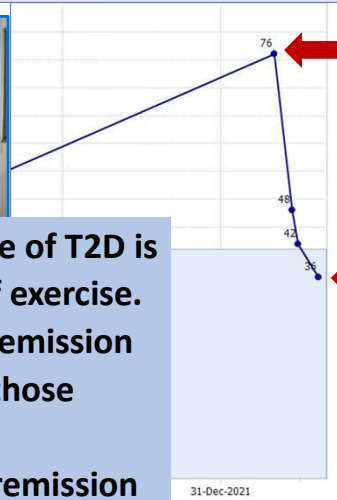HbA1c the average sugariness of blood

2nd Sept 2022 **9.1%**
He cut the carbs here

15 march 2023 **5.4%**
Drug-free
T2D remission!
lost 19kg weight

- For most patients the cause of T2D is dietary not stress or lack of exercise.
- Type 2 diabetes drug-free remission can be achieved in 50% of those advised on a low carb diet
- The idea of drug free T2D remission gives hope

31-Dec-2021