Beating Type 2 Diabetes into remission

Dr David Unwin FRCGP

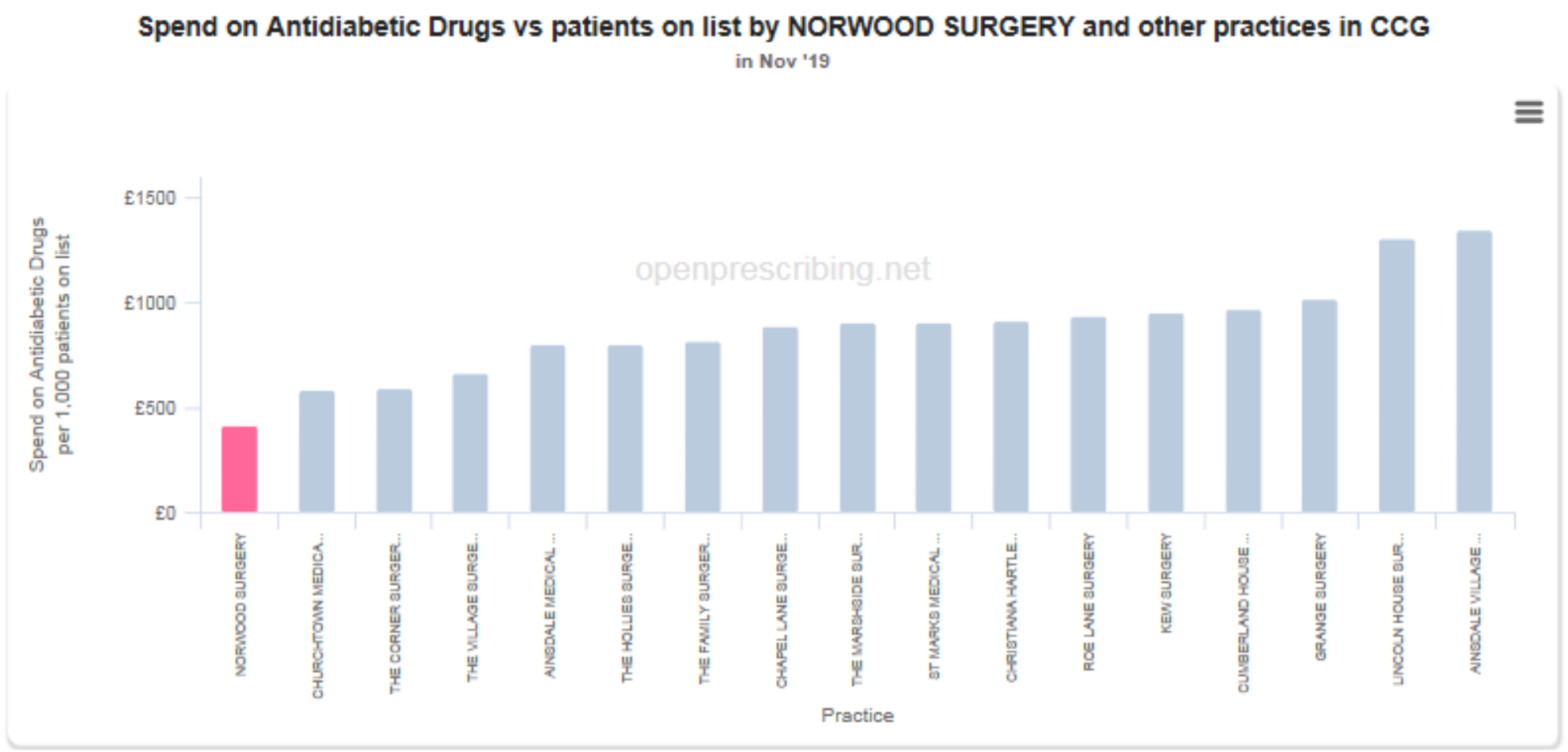
Disclosures:

- 49% T2D drug free remission, 83 cases to date
- Explaining the physiology of type 2 diabetes to patients in a way they can understand
- Cutting sugar and starchy carbs
- Do the improvements low carb achieves ‘drop off’ over time?

@lowcarbGP

Marcia aged 52, weight 97Kg
Insulin for her T2D since 2004,
90 units a day (3 injections)
For Marcia diabetes is a chronic disease

Marcia aged 53,
weight 79Kg
NO Insulin for her T2D



Savings for our 9,800 patient practice

= **£49,686/year**

**OpenPrescribing.net, EBM DataLab, University of Oxford, 2020. Accessed Feb 19th 2020*

Comparing the prescribing of NHS antidiabetic drugs, BNF 6.1.2 at Norwood GP surgery to local, regional and National figures. Jan 2015 to Nov 2019
Data from Openprescribing*

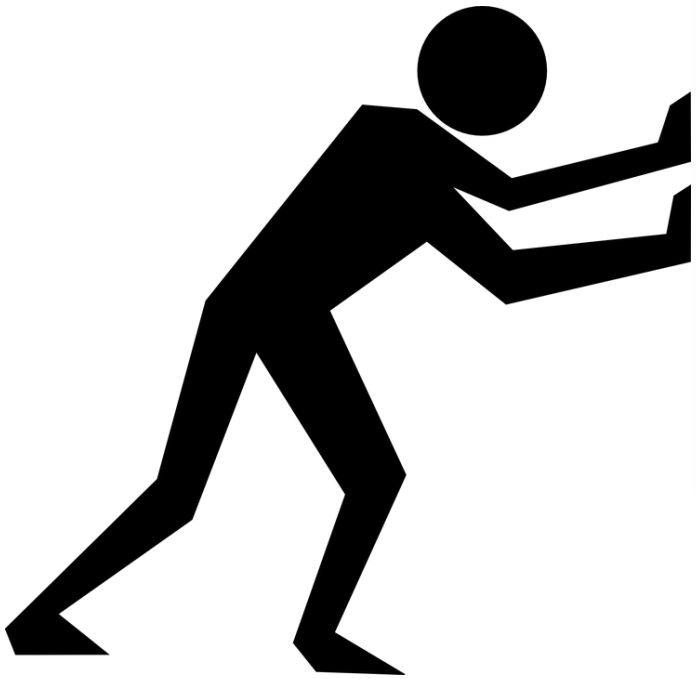
LOCAL, REGIONAL or NATIONAL	Year to November 2019				Prescribing trends Jan 2015 – Nov 2019					
					Items per 1000 patients			Cost per 1000 patients		
	Patients	Spend/Patient	Items/Patient	Possible saving	Jan 2015	Nov 2019	Change In%	Jan 2015	Nov 2019	Change In%
NORWOOD SURGERY, SOUTHPORT	9,800	£ 4.50	0.4	£49,686	32.3	30.6	-5%	£ 358	£ 421	+17%
SOUTHPORT AND FORMBY CCG	125,603	£ 9.57	0.7	£637,004	57.8	61.0	+6%	£ 537	£ 831	+55%
NORTH WEST COMMISSIONING REGION	7,560,393	£10.05	0.7	£41,971,719	57.6	61.9	+7%	£ 612	£ 888	+45%
NATIONAL EXPENDITURE FOR ENGLAND	60,223,283	£8.93	0.5	**£266,695,256**	52.3	57.8	+10%	£ 527	£ 794	+51%

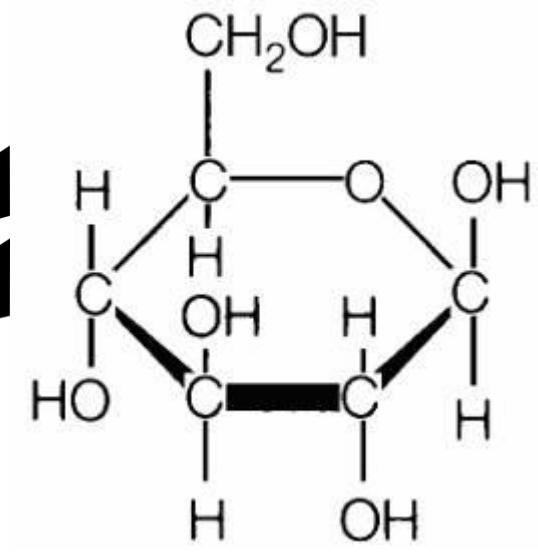
**OpenPrescribing.net, EBM DataLab, University of Oxford, 2020. Accessed Feb 19th 2020 with thanks to W Dale.*

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

- **Liver function**
- **Triglyceride levels**
- **Central Obesity**
- **Insulin and Hunger**
- **What causes type 2 diabetes?**

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





Liver*cells
Muscle cells
Fat cells

*Also pancreas cells as triglyceride

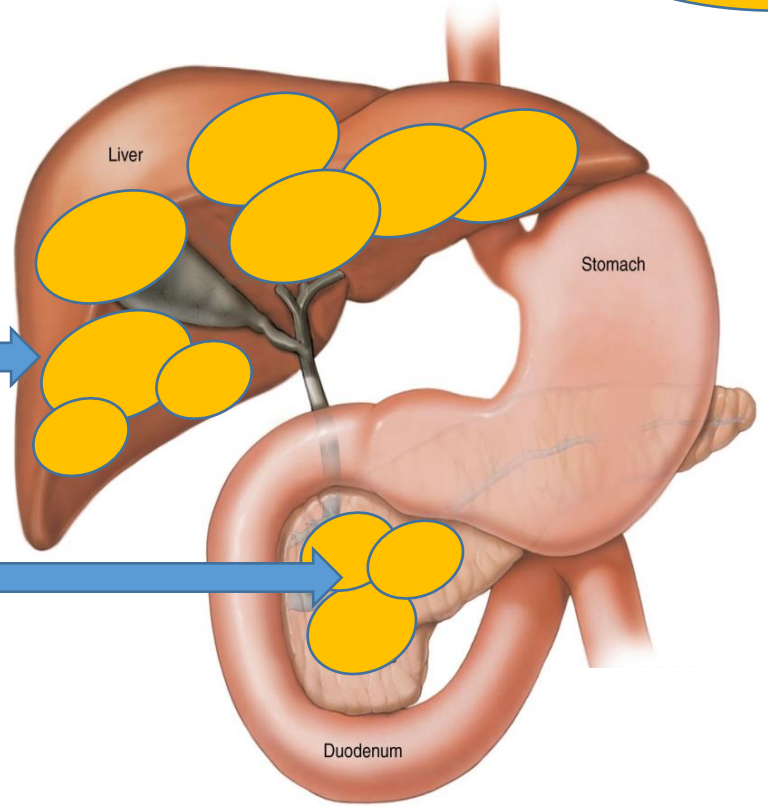
Insulin + Glucose → cells

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

Reduced carbohydrate intake*

Reduce circulating insulin

*Reduce liver fat

Lose weight

*Reduce pancreas fat

Reduce Insulin resistance

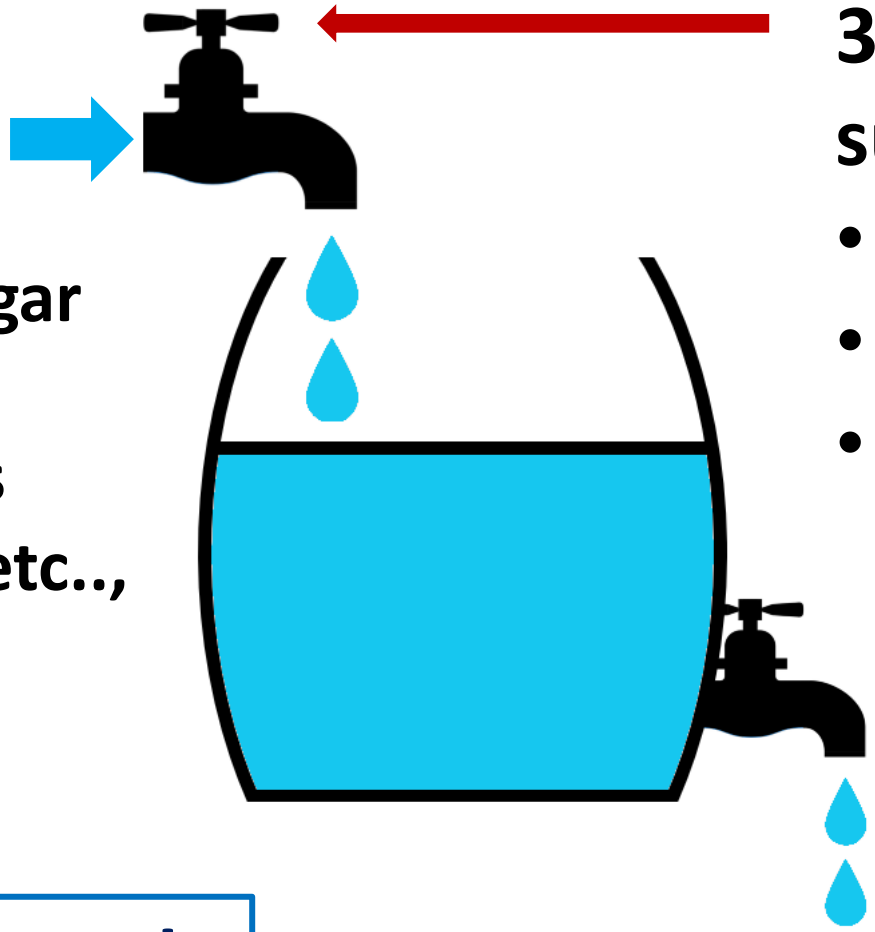
Increase insulin secretion

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.

1.Dietary sources of glucose:

- Table sugar
- Rice
- Potatoes
- Cereals etc..,



3.Or just turn off the supply of sugar?

- Fasting, VLCD
- Low carb diet
- Bariatric surgery

2.Glucose out:
Exercise
Insulin, gliclazide
SGLT2i drugs

T2 Diabetes control: A balance of sugar in and sugar out

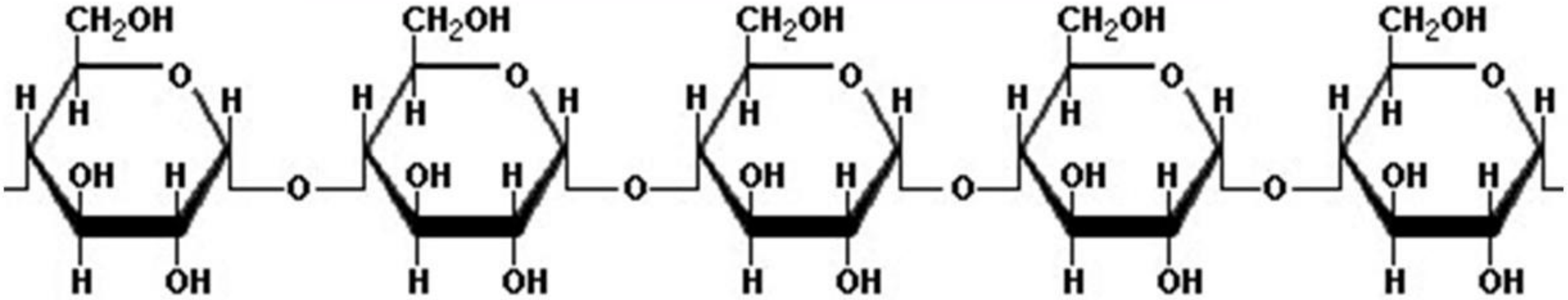
If you have Type 2 Diabetes glucose becomes a sort of metabolic poison.

The HbA1c is a measure of how ‘sugary’ your diet has been

Try asking “*where do you think the sugar comes from in your diet?*”

- The first priority is to cut out table sugar- but how do we help people who say they have already cut this out?

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?
Basmati rice	69	150	10.1
Potato, white, boiled	96	150	9.1
French Fries baked	64	150	7.5
Spaghetti White boiled	39	180	6.6
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
Eggs	0	60	0

Other foods in the very low glycaemic range would be chicken, oily fish, almonds, mushrooms, cheese

Rt Hon Matt Hancock MP UK Secretary of State for Health and Social Care

Department of Health & Social Care

Google Sugar PHC Unwin

@lowcarbGP

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.

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

Individualising diet NICE 1.3.6

SUN5 Nov

Glucose mmol/L

Carbs grams

21

7.5

3.9

5.0

Look blood glucose stable for days until it peaked at 10.4 after that single banana

MON6 Nov

Glucose mmol/L

Carbs grams

7.5

3.9

0

6.7

Daily Log

25 October 2017 - 7 November 2017 (14 Days)

LibreView

TUE7 Nov

Glucose mmol/L

Carbs grams

PRINTED: 07/11/2017

00:00 02:00 04:00 06:00 08:00 18:00 20:00 22:00

21

7.5

3.9

0

10.4

IN a case series of 169 T2D patients on a lower carb diet

In a primary care setting over an average of 30 months @lowcarbGP

83 in drug-free diabetes remission Aug 2020

Significant improvements in weight, liver function, lipids and blood pressure.

	HbA1c in mmol/mol			Total Cholesterol			HDL Cholesterol			Cholesterol Ratio			Triglyceride		
Averages	Start	Finish	Loss	Start	Finish	Loss	Start	Finish	Loss	Start	Finish	Loss	Start	Finish	Loss
83 cases in remission	71	49	**22**	4.9	4.4	**0.5**	1.2	1.3	**-0.1**	4.0	3.5	**0.5**	2.5	1.6	**0.9**

	HbA1c in %			Weight in Kg			Systolic BP in mmHg			Diastolic BP in mmHg			Gamma-G.T Level in U/L		
Averages	Start	Finish	Loss	Start	Finish	Loss	Start	Finish	Loss	Start	Finish	Loss	Start	Finish	Loss
49% remission	8.6	6.7	**1.9**	99.8	90.3	**9.5**	143	132	**11**	84	78	**6**	73	40	**33**

Insulin, sodium & blood pressure

Chronic sodium-retaining action of insulin M. Marlina Manhiani. Am J Physiol Renal Physiol. 2011 Apr; 300(4): F957–F965. Published online 2011 Jan 12. doi: 10.1152/ajprenal.00395.2010

Insulin's impact on renal sodium transport and blood pressure in health, obesity, and diabetes. Swasti Tiwari, Am J Physiol Renal Physiol 293: F974–F984, 2007.

Renal effects of insulin in man. J Nephrol. Quiñones-Galvan A 1997 Jul-Aug;10(4):188-91.

In insulin resistant (T2D) individuals compensatory hyperinsulinemia imposes a chronic antinatriuretic and antiuricosuric pressure on the kidney. This may provide an explanation for the clustering of insulin resistance with hypertension and hyperuricemia.

A system view and analysis of essential hypertension Journal of Hypertension. Botzer A et al. 36(5):1094–1103, MAY 2018

Our analysis suggests that insulin plays a primary role in hypertension, highlighting the tight link between essential hypertension and diseases associated with the metabolic syndrome

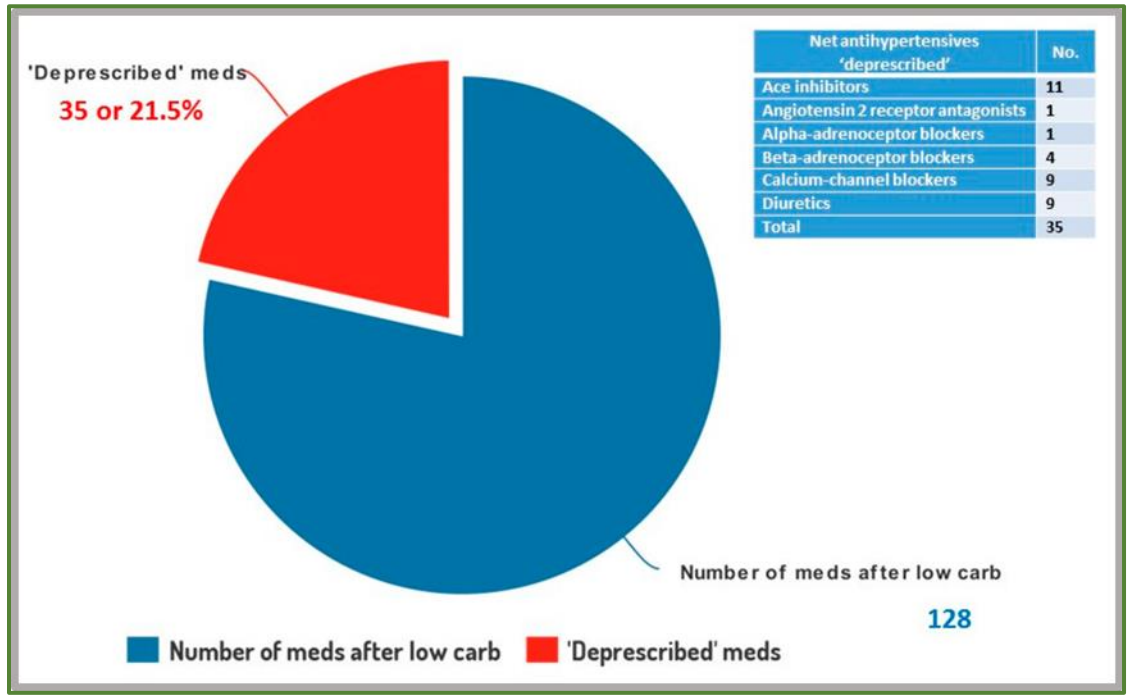
Glycemic index, glycemic load, and blood pressure: a systematic review and meta-analysis of randomized controlled trials. Evans C. et al The American Journal of Clinical Nutrition, Volume 105, Issue 5, 1 May 2017, Pages 1176–1190,

This review of healthy individuals indicated that a lower glycemic diet may lead to important reductions in blood pressure

Substantial and Sustained Improvements in Blood Pressure, Weight and Lipid Profiles from a Carbohydrate Restricted Diet: An Observational Study of Insulin Resistant Patients in Primary Care

Overview of attention for article published in International Journal of Environmental Research and Public Health, July 2019

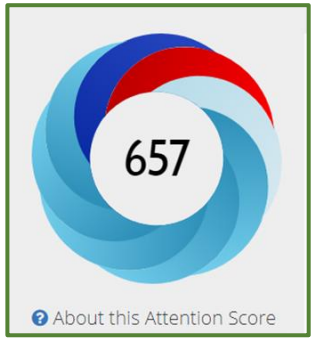
Environmental Research and Public Health



Net antihypertensives 'deprescribed'	No.
Ace inhibitors	11
Angiotensin 2 receptor antagonists	1
Alpha-adrenoceptor blockers	1
Beta-adrenoceptor blockers	4
Calcium-channel blockers	9
Diuretics	9
Total	35

Systolic BP in mmHg			Diastolic BP in mmHg		
Start	Finish	Loss	Start	Finish	Loss
143	132	**11**	84	78	**6**

Altmetric has tracked 14,775,904 research outputs across all sources so far. Compared to these this one has done particularly well and is in the 99th percentile: it's **in the top 5% of all research outputs ever tracked** by Altmetric.



- 49% T2D drug free remission, 83 cases to date
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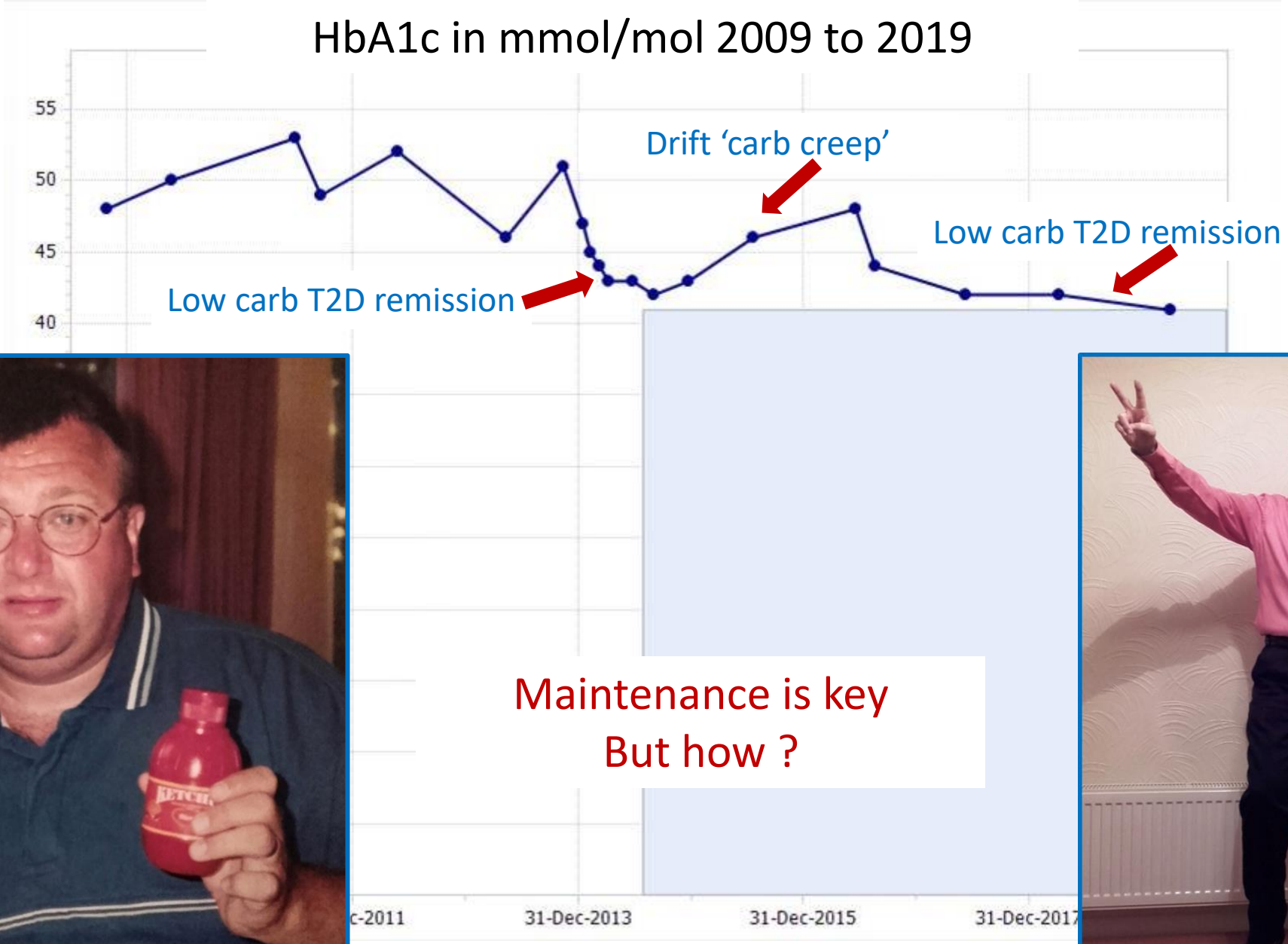
Comparing Norwood GP low carb clinic (est. March 2013)
Type 2 Diabetes drug-free remission rates
March 2017 to June 2020

Data from March 2013 To:	Mean duration of low carb diet	Number of T2D Cases on diet	Number of T2D cases in remission HbA1c <48*	Remission rate
March 2017	13 months	48	15	31%
May 2018	20 months	106	41	38%
January 2019	22 months	123	59	47%
March 2020	30 months	143	68	47.6%
June 2020	29 months	166	82	49.4%

*Type 2 diabetes drug-free remission defined as:
Previous diagnosis of type 2 diabetes by WHO criteria and a HbA1c<6.5% (<48 mmol/mol) without antidiabetes medication. Roy Taylor. Beating type 2 diabetes into remission. BMJ. 2017;358:j4030.

HbA1c in mmol/mol 2009 to 2019



Maintenance is key
But how ?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Type 2 Diabetes: Diabetic Medications on a Low Carbohydrate Diet - A Summary & Suggestions

BJGP RCGP Royal College of General Practitioners

There are **3 main** considerations for the use of diabetic medications in type 2 diabetes with a low carbohydrate 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**. Br J Gen Pract. 2019;69(684):360-1

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

American Diabetes Association. Diabetes Care

Consensus recommendations

- A variety of eating patterns (combinations of different foods or food groups) are acceptable for the management of diabetes.
- Until the evidence surrounding comparative benefits of different eating patterns in specific individuals strengthens, health care providers should focus on the key factors that are common among the patterns:
  - Emphasize nonstarchy vegetables.
  - Minimize added sugars and refined grains.
  - 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 select adults with type 2 diabetes not meeting glycemic targets or where reducing antiglycemic medications is a priority, reducing overall carbohydrate intake with low- or very low-carbohydrate eating plans is a viable approach.

- Hope is central to behaviour change
- 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 different ways & is a realistic goal for many patients.
- Improving Type 2 diabetes with a low carb approach can also improve weight, blood pressure, lipid profiles, liver function and self esteem

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References:

- **Low carbohydrate diet to achieve weight loss and improve HbA1c in type 2 diabetes and pre-diabetes: experience from one general practice.** Practical Diabetes. Unwin D, Unwin J**.** 2014;**31**(2):76 2014
- **Diabesity**; **Perhaps we can make a difference after all?** Diabesity in PracticeVol No.4 2014 Unwin DJ
- **A patient request for some 'deprescribing'.** DJ Unwin & SM Tobin. BMJ 2015; 351 doi: http://dx.doi.org/10.1136/bmj.h4023 (Published 03 August 2015) This is about how diet can help a patient who wants to come off his medication for diabetes do it safely
- **Raised GGT levels, Diabetes and NAFLD: Is dietary carbohydrate a link? Primary care pilot of a low carbohydrate diet** David J. Unwin[1], Daniel J. Cuthbertson[2], Richard Feinman[3] & Victoria S. Sprung[2]**.** Diabesity in Practice; September 2015
- **It is the glycaemic response to, not the carbohydrate content of food that matters in diabetes and obesity: The glycaemic index revisited** | Unwin | Journal of Insulin Resistance 2016
- **Outcomes of a Digitally Delivered Low-Carbohydrate Type 2 Diabetes Self-Management Program: 1-Year Results of a Single-Arm Longitudinal Study** Saslow LR, Summers C, Aikens JE, Unwin DJ. JMIR Diabetes 2018;3(3):e12 Participants with elevated baseline HbA1c (≥7.5%) who engaged with all 10 weekly on line low carb modules reduced their HbA1c from 9.2% to 7.1% (P<.001) 2018
- **Adapting diabetes medication for low carbohydrate management of type 2 diabetes: a practical guide**. Murdoch C, Unwin D, Cavan D, Cucuzzella M, Patel M. Br J Gen Pract. 2019;69(684):360-1. 2019
- **A simple model to find patient hope for positive lifestyle changes: GRIN.** Unwin D, Unwin J. Journal of holistic healthcare Volume 16 Issue 2 Summer 2019.
- **Substantial and Sustained Improvements in Blood Pressure, Weight and Lipid Profiles from a Carbohydrate Restricted Diet: An Observational Study of Insulin Resistant Patients in Primary Care**. International Journal of Environmental Research and Public Health. Unwin, David J.Tobin, Simon D.Murray, Scott W.Delon, Christine Brady, Adrian J. July 2019 doi:10.3390/ijerph16152680
- **Low-Carbohydrate Diets in the Management of Obesity and Type 2 Diabetes: A Review from Clinicians using the Approach in Practice** Kelly T, Unwin D, Finucane F. International Journal of Environmental Research and Public Health. 2020;17(7):2557.