Dr. Sharad Pendsey, M.D.,
Consultant Diabetologist, Dhantoli, Nagpur.

- **International Amputation Prevention Award US $ 2500**
- **Awarded Vishwanathan & Sam GP Moses Gold Medal Oration,**
- **Author“ Diabetic Foot - A Clinical Atlas ”**
- **Managing Trustee of “DREAM Trust”, a charitable trust.**
- **Thomas Award of 5000 EUROS for Diabetes Charity**
- **Chairman, National Diabetic Foot Education Program (NFEP)**
- **Awarded Gold medal & DFSI oration PGI Chandigarh 2015.**

Ketogenic Diet for Obesity: Friend or Foe?

SHARAD PENDSEY

DIABETES CLINIC & RESEARCH CENTRE, NAGPUR

GOOD FOOD, EVERYONE LOVES

- Eating good food is one the greatest pleasures in life.
- Hunger is the biggest side effect.
- All other pleasures have expiry date.

Future shock:

- Every urban family will have at least one obese person.
- Next generation Children most vulnerable

MOST DIFFICULT THINGS IN LIFE

- Say No to temptations
- Lifestyle modification
- 10% of body weight reduction
- Maintaining the lost weight is most difficult

Rebound weight gain is the rule

METABOLIC SYNDROME

All Cause Mortality & Carbohydrate Intake

ARIC- Atherosclerosis Risks in communities study, US observational
PURE- Prospective urban rural epidemiology study, 18 Countries

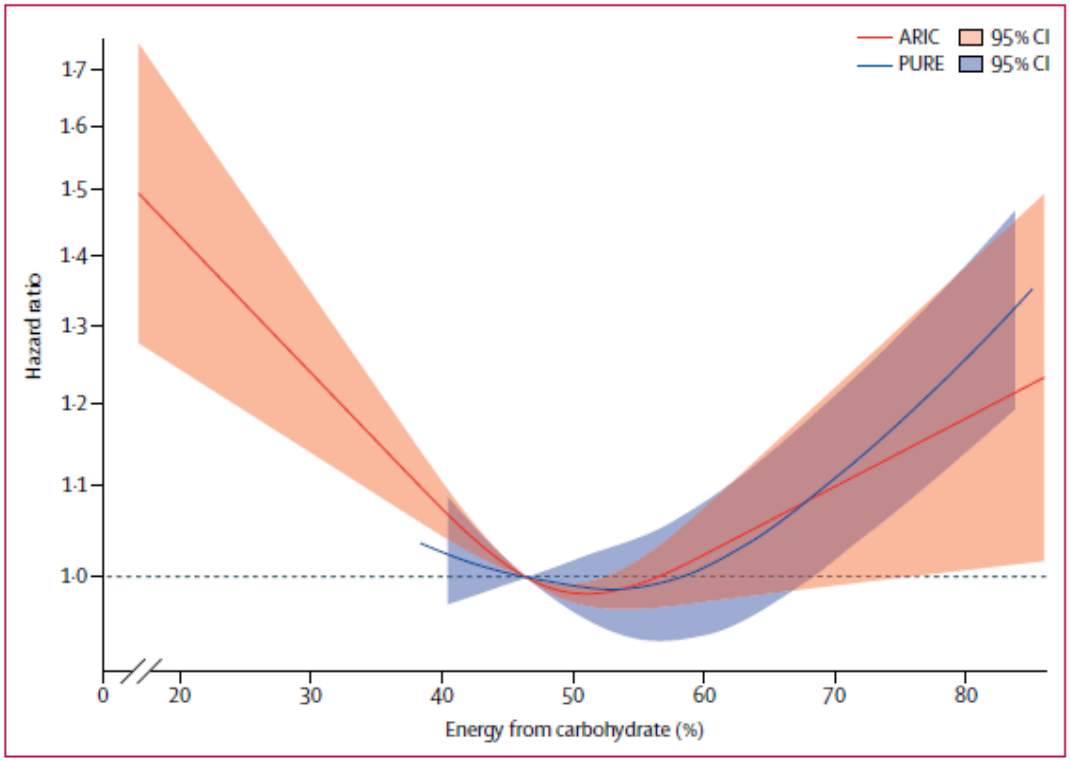


Figure 3: U-shaped association between percentage of energy from carbohydrate and all-cause mortality in the ARIC and PURE cohort studies

"PURE" challenges very definition of a Healthy diet

- In 1950s, CAD ↑ diet-heart hypotheses. Harmful effects of saturated fats
- In 1990s Low fat high carb paralled ↑ incidence of obesity & Diabetes.
- PURE team report higher intakes of fats & animal protein were associated with lower mortality.
- High carbohydrate intake was associated with increased mortality.
- **Do Meat beef, lamb& Dairy intakes increased survival or reduce Mortality?**
  Comments by Andrew Mente & Salim Yusuf

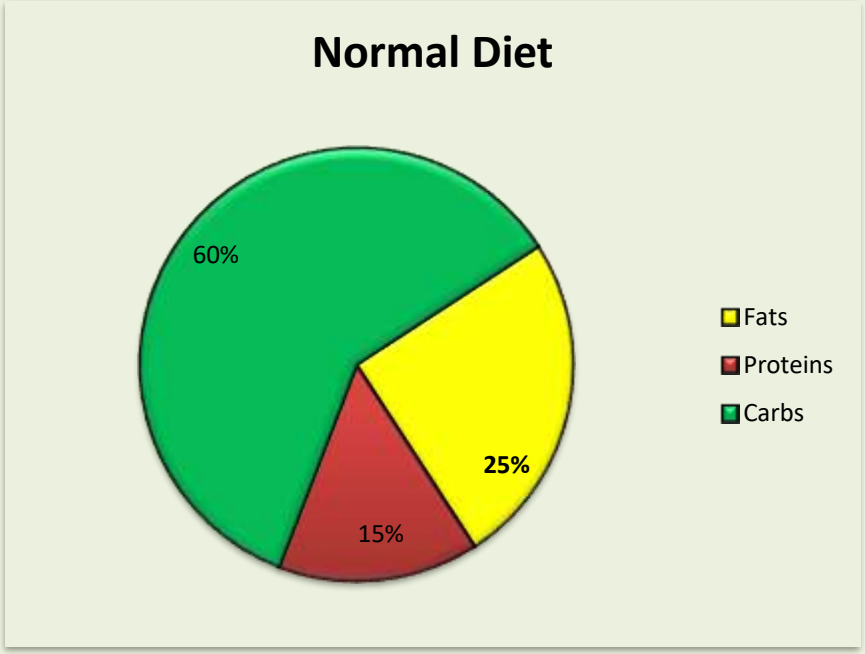
Published Online
August 16, 2018
http://dx.doi.org/10.1016/
S2468-7667(18)30160-9

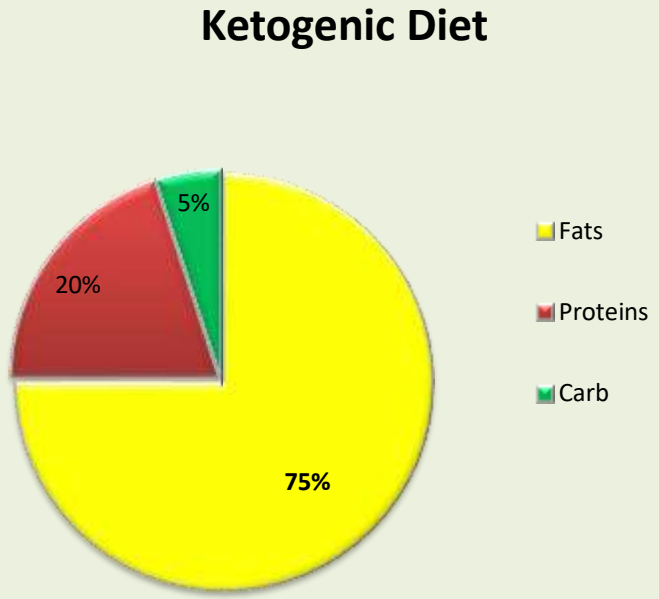
Obesity Management

Extreme Diets(Low Calories)

- Low carbohydrate, high fat (Ketogenic Diet)
- Low fat high carbohydrate
- Very low Calorie diet(VLCD) 600 cals / day
- Different fad diets
- Intermittent fasting 12 to16 hours
- Low calorie High Protein

Normal Diet Vs Ketogenic Diet





Carb 60%, Fats 25%

Carb 5%, Fats 75%

Physiology of Ketogenic Diet

- With low carb intake, body burns fats rather than glucose to provide energy.
- Liver converts fat into fatty acids and produces ketones bodies , which replace glucose as a primary energy source.
- Heart, muscle, and renal cortex can utilize KB while
  Brain utilizes ketones only in prolonged starvation.
- Erythrocytes do not utilize ketones as they do not have mitochondria. Liver does not utilize ketones as it does not have the necessary enzyme.

KETOGENIC DIET

- Succeeds in quick & robust weight loss.
- Best indicated for young, who desperately need to loose weight e.g. Marriageable Youth, Models.
- To initiate wt loss & then gradually increase carb.
- Before Bariatric surgery
- Can be given in children 6-18yrs with modifications.

Ketogenic Diet

Keto diet shows quick & greater weight loss

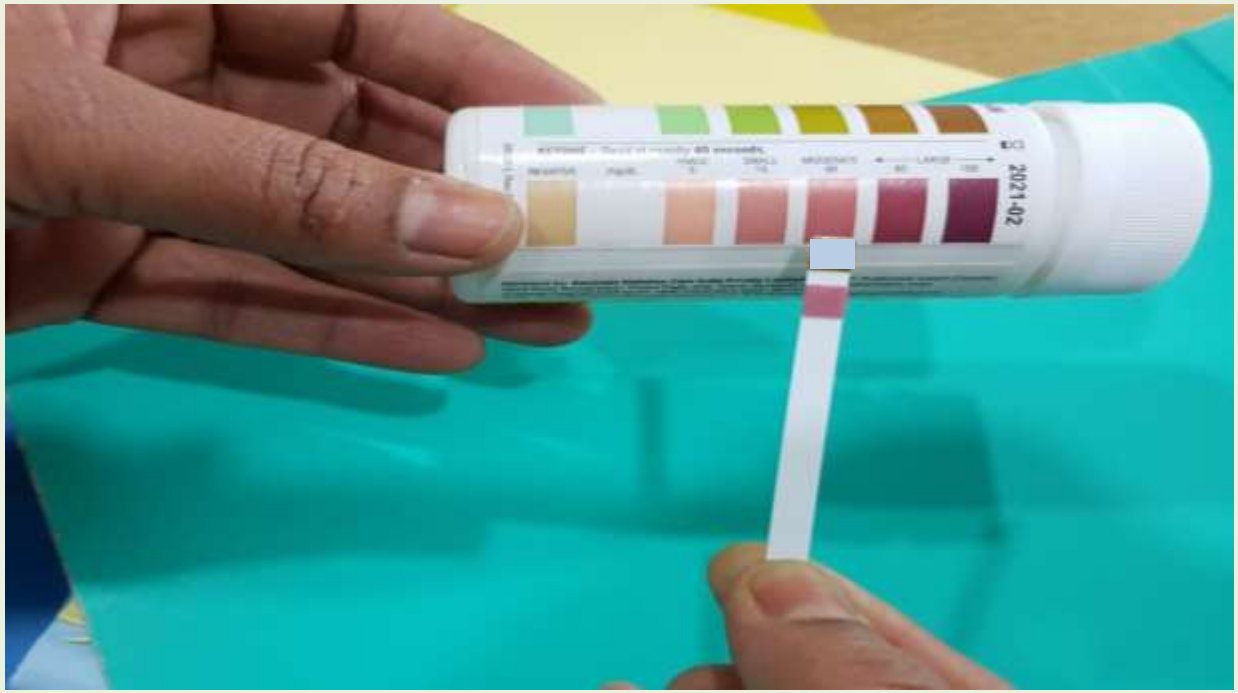
BY

- Improved satiety effect of proteins
- Appetite suppression by ketone bodies
- Reduced levels of ghrelin and leptin
- Increased lipolysis
- Reduced insulin levels

KETOGENIC DIET (Non veg)

KETOGENIC DIET (VEG)

Ketogenic Diet



Effectiveness & compliance is judged by Ketones in urine

Ketogenic Pharmacotherapy (SGLT2i)

- **Thrifty Hypothesis** : β- hydroxybutyrate is freely taken up by the heart & oxidized in preference to free fatty acids & glucose.

- **β- hydroxybutyrate** increases external cardiac work at the same time as it reduces oxygen consumption,
  thereby improving cardiac efficiency by 24%.

- **Sotagliflozin**, a Dual SGLT1 and SGLT2Inhibitor, Therapy for Type2 Diabetes in Pipeline
  Increased glucose excretion in urine & stools(120gms)

SIDE EFFECTS OF KD

Short term Side effects
Dehydration (particularly if initial fast)
Hypoglycemia
Nausea/vomiting
Constipation
Hyperuricemia
Long term side effect
Loss of bone density
Growth retardation
Renal stones
Hyperlipidemia
Nutritional deficiency (Iron deficiency anaemia)

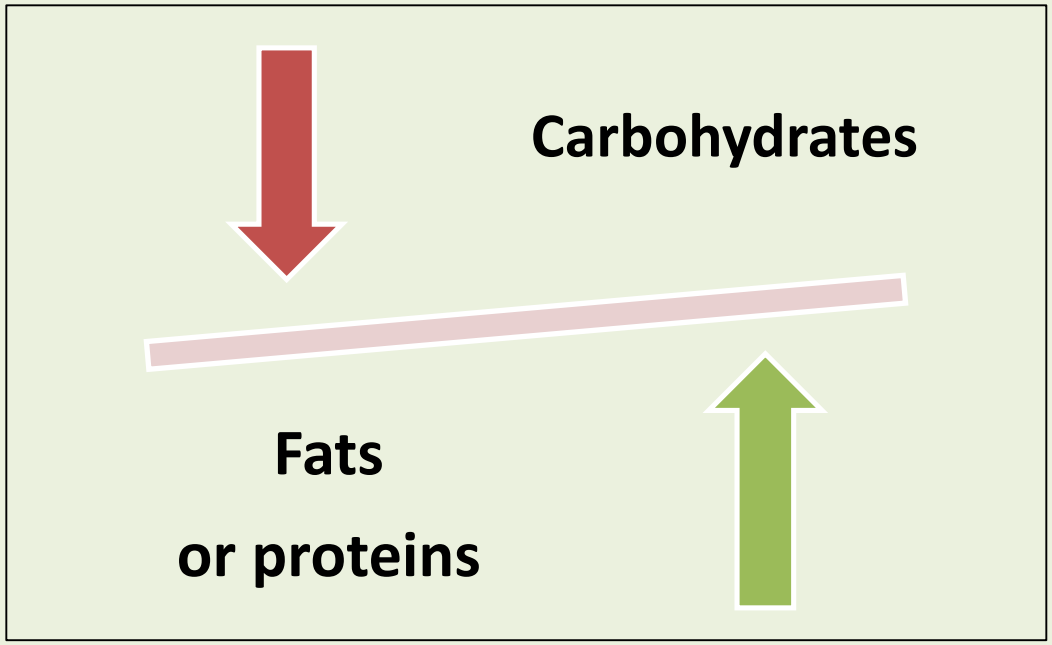
Contraindications

- Renal stone disease, renal impairment
- Severe dyslipidemia
- Hepatic disorders
- Diabetics on insulin ,sulfonylurea, SGLT-2 inhibitors
- Elderly patients
- With any other co morbidities

KETODIET FAILURES

- Not sustainable for long period
- Expensive (10000 to 80000 pm)
- Carb Craving
- Vegetarians find it too difficult

Proximate principles of Food



DEVELOPED
Carb 40%

DEVELOPING
Carb 80%

Reduce 5 Carbs : white rice,maida,potato,desert, juice and soft drinks

Consume one tablespoon of desi Ghee daily

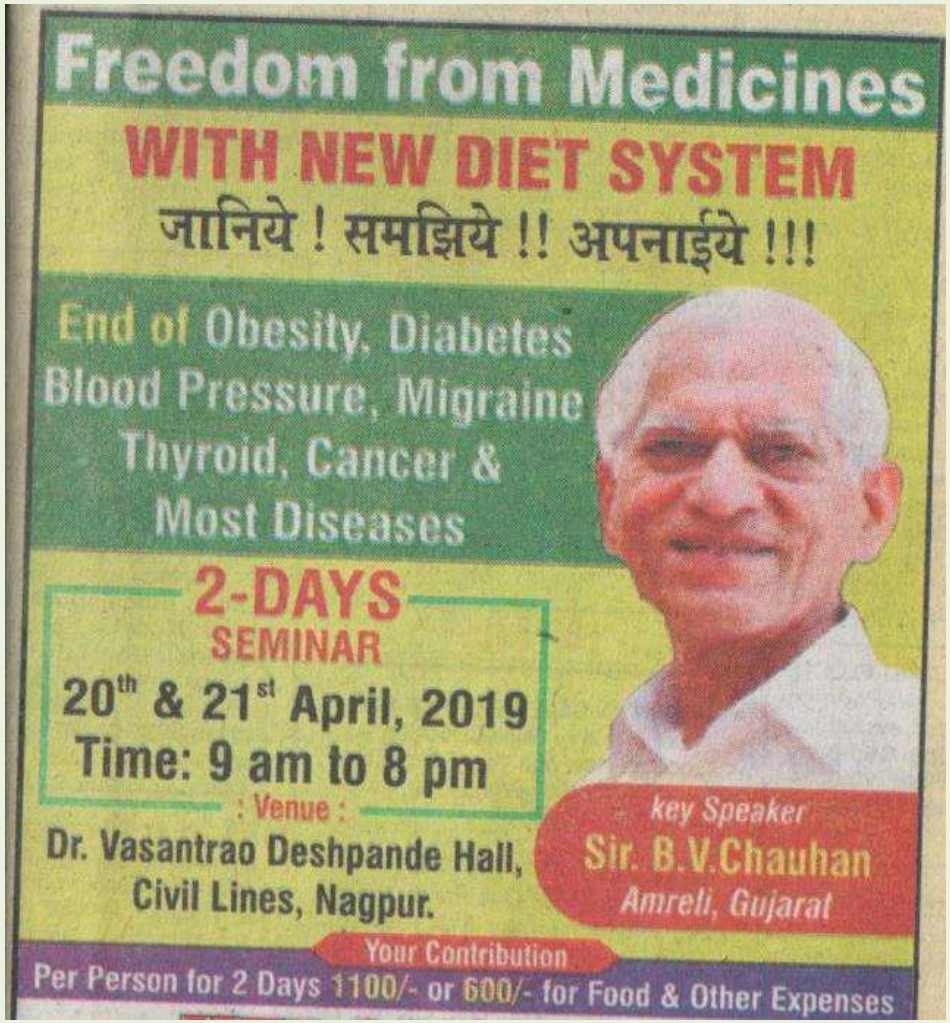
Ketogenic Diet for Obesity: Friend or Foe?

It is a Friend with many

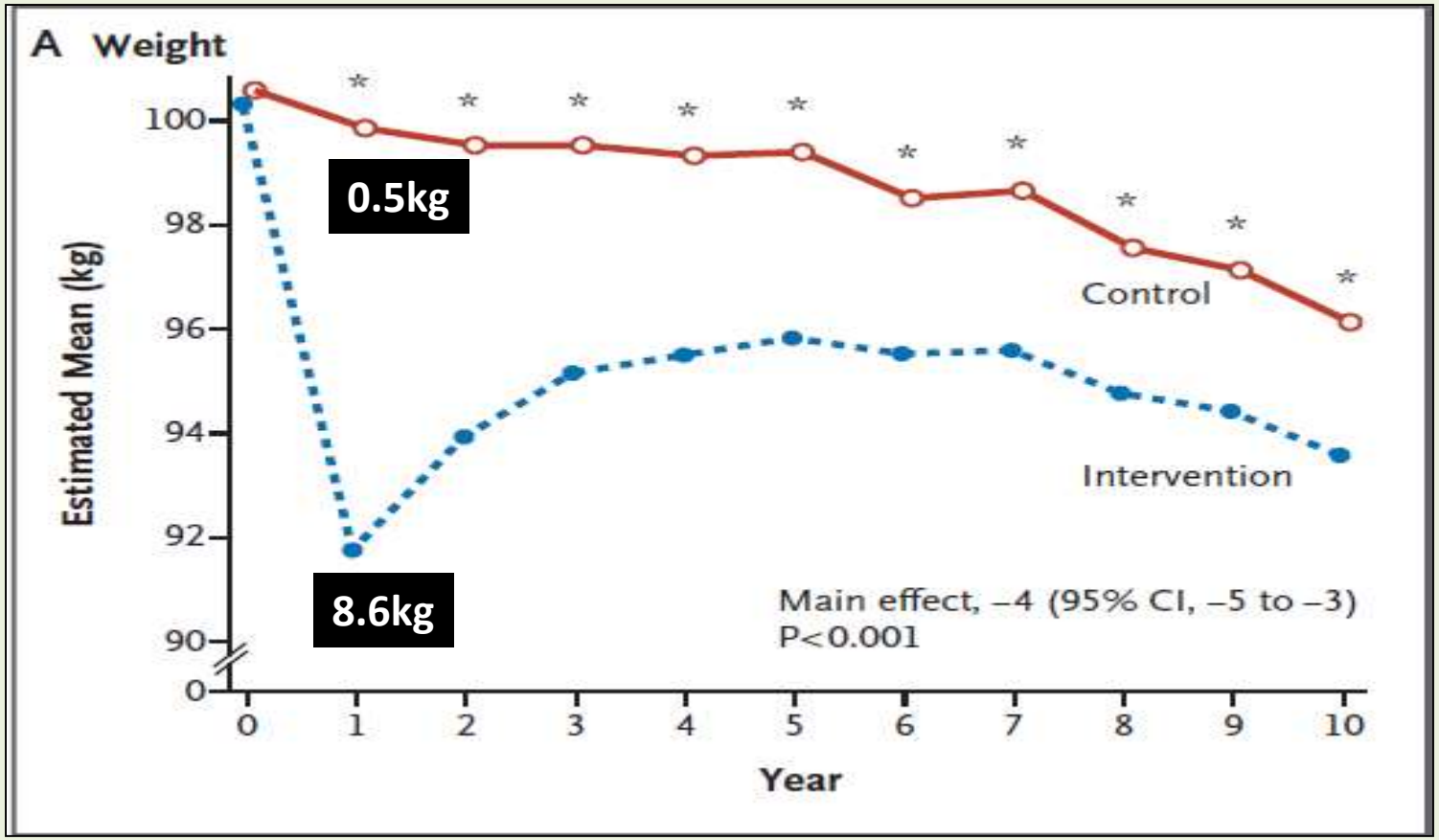
IF'S & BUT'S


Thank you

Reversal of Diabetes



LOOK Ahead Trial
(weight loss despite adequate carbohydrate intake)



3.5 kg

6.0kg

Weight loss during trial period

N Engl J Med 2013;369:145-54

Keto Diet –

Example of a pt. under my follow-up

Breakfast	4 eggs
Mid morning	Green vegetables
Lunch	150 gm of chicken + green vegetables
Evening snacks	Almonds, green vegetables Paneer 100gm
Dinner	150 gm of chicken + green vegetables

Proteins: 122 gm
Fats: 89 gm
Carb: 1.5 gm

Sustainable ?

Affordable ?

Harmful effects ?

Palatability ?

Say No To 5 Carbs

- Rice
- Maida
- Potato
- Sugar/Deserts
- Fruit juice/ soft drink

Low Carb Diet (calorie distribution)

Food Components	Standard	Suggested
Carbohydrates	60%	50%
Proteins	15%	20%
Fats	25%	30%

Low carb is not No carb

MEDITERRANEAN DIET

MEDITERRANEAN DIET
(adds years to life)

Food consumed along coastline of Mediterranean sea is considered to be healthy & heart friendly.

It is Red wine, Fish, Fruits &Vegetables, Nuts, Fresh olives & Olive oil.

MEDITERRANEAN DIET adds years to life.
INDIAN DIET adds life to years. Choice is yours

PREDIMED (Prevención con Dieta Mediterránea) study published in NEJM showed CV reduction with Medi diet. (2013)

Carbohydrate consumption & mortality

ARIC Study

- Observational study in U.S
- Began in 1987
- Follow up period 25 years.
- > 15000 patients.

- Impact of diet on CV events & overall mortality.

PURE Study

- Epidemiological chort study
- > 135000 Patients in 18 countries.
- Follow up: 7.4 years.

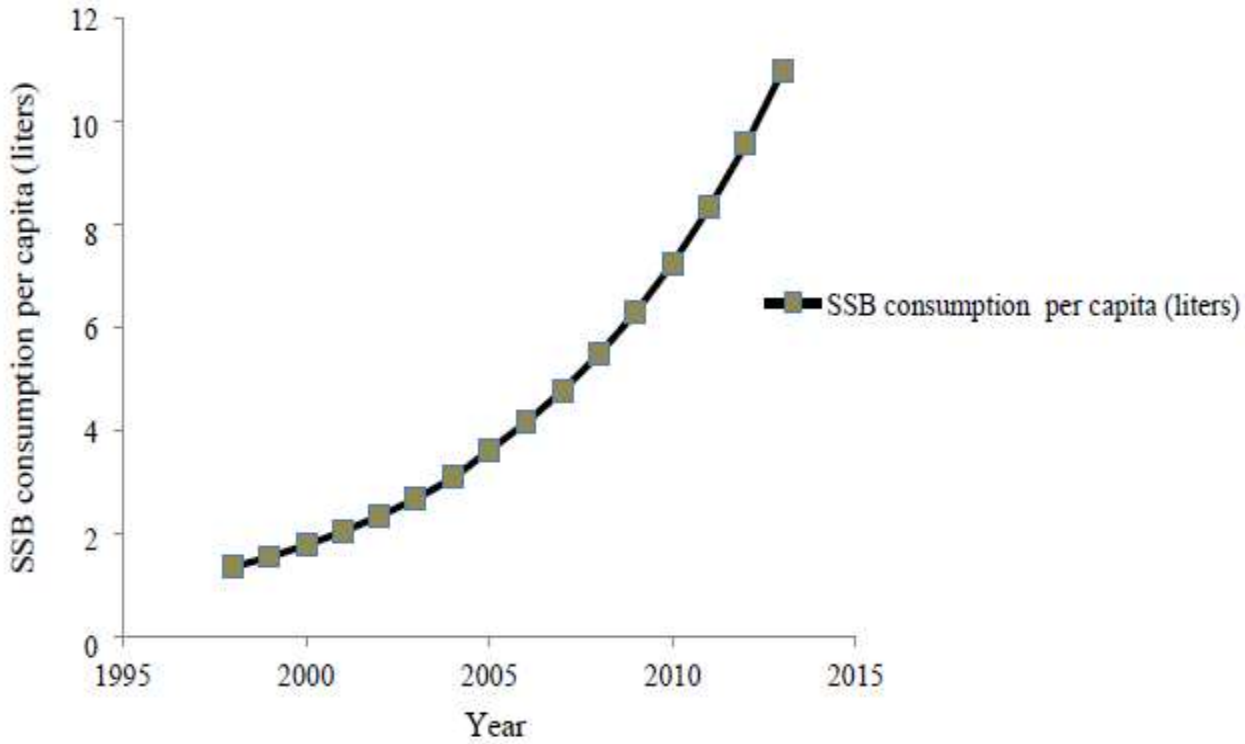
Primary outcome:

- Diet (fat and carbs) impact on total mortality & CV events.

www.thelancet.com/public-health Vol 3 September 2018

Sugar Intake, Obesity & Diabetes in India

Figure 6. SSB consumption in liters per capita in India, 1998–2013.



SSB
Sugar sweetened Beverages

" There is a proportionate rise in prevalence of obesity and type 2 diabetes in India"

Nutrients 2014, 6, 5955-5974; *PLoS Med.* ***2014, 11, doi:10.1371/journal.pmed.1001582.***

Carbohydrate consumption & mortality

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www.thelancet.com/public-health Vol 3 September 2018

Summary

- Across India, consumption of carbohydrates is higher than recommended.
- Consumption of **good carbs, low glycemic index** foods should be encouraged.
- Generally, protein consumption is less in Indians and adequate intake should be encouraged.
- Presently, long term effects of FAD diets, very low carb diet, ketogenic diet are not known and hence should not be recommended routinely.

Carbohydrates as an Enemy

In simple words,

- Indians consume excess carbohydrates mainly refined & processed carbs.
- Excess carbs linked to excess mortality.
- Excess carbs also worsen diabetes control. (vice versa is also true)

Summary

- Across India, consumption of carbohydrates is higher than recommended.

- **R**educe refined carbs to minimal.
- **R**eplace with whole grains.
- **R**estrict total carbs to 50%
- **R**efrain from FAD diets.

- .

Keto Diet –

example of a pt. under my follow-up

Breakfast	4 eggs
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Carb: 1.5 gm

Sustainable ?

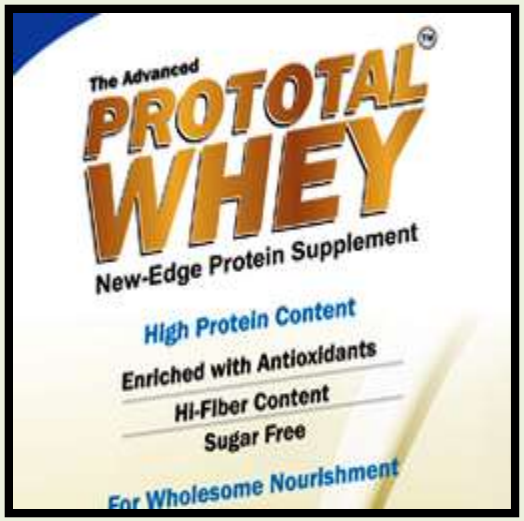
Affordable ?

Harmful effects ?

Palatability ?

Low Calorie Diet (1000 cal/day)
effect on restoration of Normoglycemia in Obese T2DM

- 12 weeks, 12 patients enrolled, baseline A1c 9%
- Responders: A1c < 6.5%, without anti-diabetic drugs.



60% carbohydrates were given
i.e.
600cal/day
i.e.
150 gm/day

Low Calorie Diet (1000 cal/day)
effect on restoration of Normoglycemia in Obese T2DM

Early morning	200 ml milk
Breakfast	30gm formula + 150ml milk
Mid morning	1 fruit
Lunch	30gm formula + 150ml milk
Evening	200ml veg soup + 150g fruit
Dinner	2 chappati + veggies + salad + buttermilk
Bedtime	30 gm formula + 150 milk

LCD diet (1000 cal/day)
Effect on restoration of Normoglycemia in Obese T2DM

- 6 patients Responders – normoglycemia + no oral anti-diabetic drugs

- Non responders – reduction in antidiabetic drug doses/ insulin
  weight reduction
  discontinuation of insulin in 1 patient

" However, long term studies are required to prove sustained benefits with such diets"

Guidelines on Carbohydrate Intake

RSSDI	ADA	ICMR
45-65% of total calorie intake	No specific recommended intake	55-60% of total daily calories

LOOK Ahead Trial
(weight loss despite adequate carbohydrate intake)

- **Type 2 DM with obesity were included, Follow-up for 11.5 years**
- **Effect of weight loss on CVD events.**

- **Intervention group**
  - **< 30% from fats**
  - **> 15 % from proteins**
  - **50% from carbs**

vs

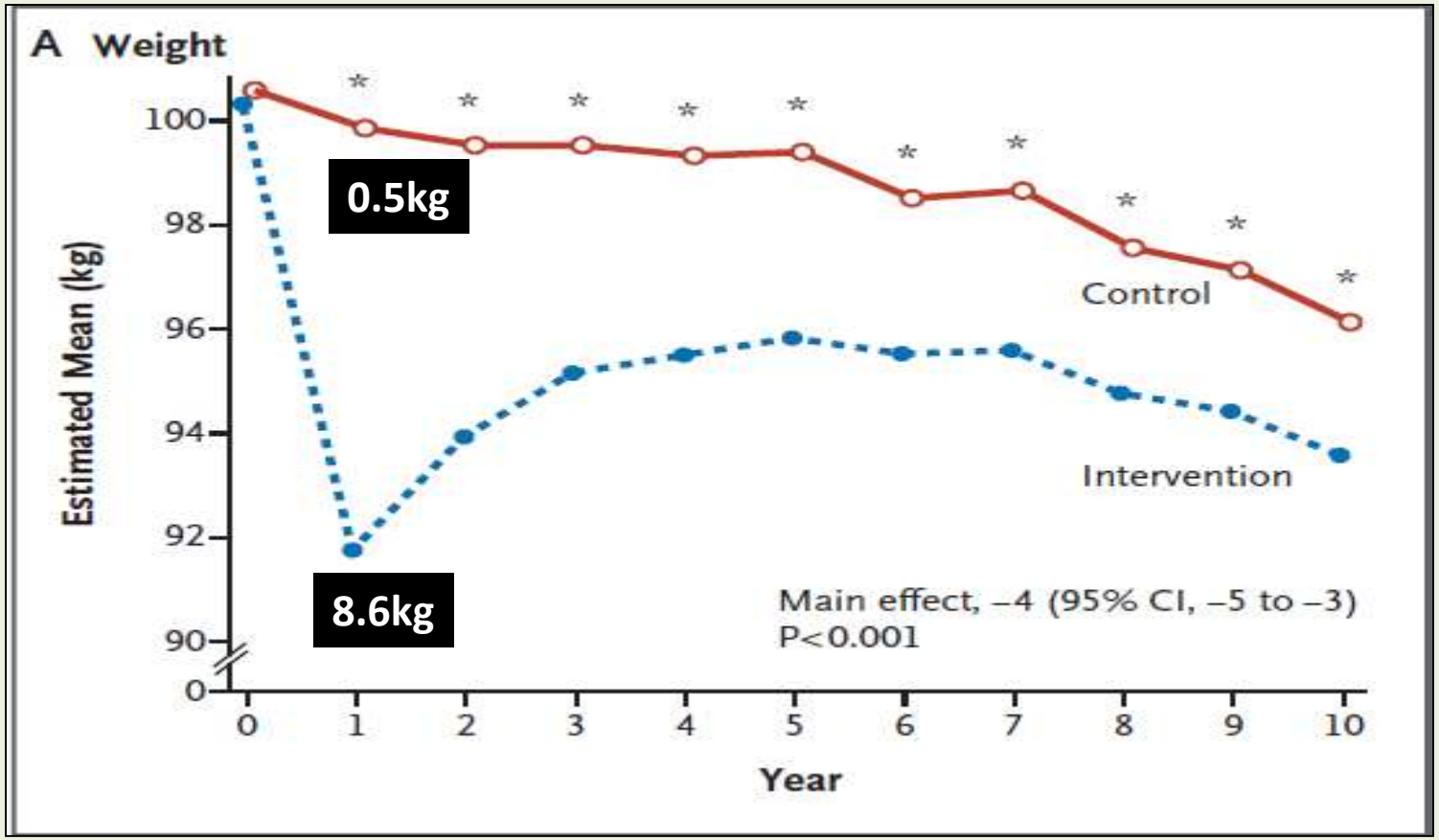
Control Group
routine diabetes care & education

" Patients in intervention group obtained 50% of total daily calorie intake from carbohydrates".

N Engl J Med 2013;369:145-54.

LOOK Ahead Trial

(weight loss despite adequate carbohydrate intake)



3.5 kg

6.0kg

Weight loss during trial period

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Mediterranean diet

Mediterranean Diet	**Lower risk of T2DM**	**Improve glycemic control, insulin sensitivity Reduce risk of CVD**

Mediterranean diet: (similar to Indian diet)

- Plant based foods, fruits
- Nuts
- Olive oil
- Low to moderate intake of dairy products
- Fish and poultry (instead of red meat)

- *" 40-45% of total calories derived from carbohydrates"*

www.thelancet.com Vol 383 June 7, 2014; British Journal of Nutrition (2016), 116, 534–546

Carbohydrates as a Friend

In simple words,

- Indians consume excess carbohydrates – ***but has adequate quantity of dietary fiber***

- Evidence from large studies with standard carb intake has shown ***promising results – weight loss, diabetes control***

- ***ICMR & RSSDI categorically recommend 45-60% carb intake.***

Summary

- Across India, consumption of carbohydrates is higher than recommended.

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- **R**estrict total carbs to 50%
- **R**efrain from FAD diets.

- .

Mediterranean diet & DASH Diet

www.thelancet.com Vol 383 June 7, 2014

Mediterranean Diet	**Lower risk of T2DM**	**Improve glycemic control, insulin sensitivity Reduce risk of CVD**
DASH diet		**Better glycemic control & reduced CVD risk**

Mediterranean diet: (similar to Indian diet)

- Plant based foods, fruits
- Nuts
- Olive oil
- Low to moderate intake of dairy products
- Fish and poultry (instead of red meat)

Carbohydrates - essential component of every meal

Bad Carbs	Good Carbs
• Refined, e.g.maida • Sugar sweetened beverages • High intake of fructose. • High glycemic index foods.	• Whole grains • Unpolished rice • Resistant starch (green banana, uncooked oats) • High fiber diet • Legumes

LOOK Ahead Trial

- Type 2 DM with obesity were included, Follow-up for 11.5 years
- Effect of weight loss on CVD events.

- Intervention group vs routine diabetes care & education for weight loss.

	Intervention	Usual care group
At end of 1 year	8.6% of initial body weight	0.7%
At end of study	6%	3.5%

" Patients in intervention group obtained 50% of total daily calorie intake from carbohydrates".

N Engl J Med 2013;369:145-54.

Summary

- Across India, consumption of carbohydrates is higher than recommended.
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Food , everyone loves

Eating good food is one the greatest pleasures in life.
Hunger is the biggest side effect of dieting.

Future shock: Every urban family will have at least one obese person.
Next generation Children most vulnerable

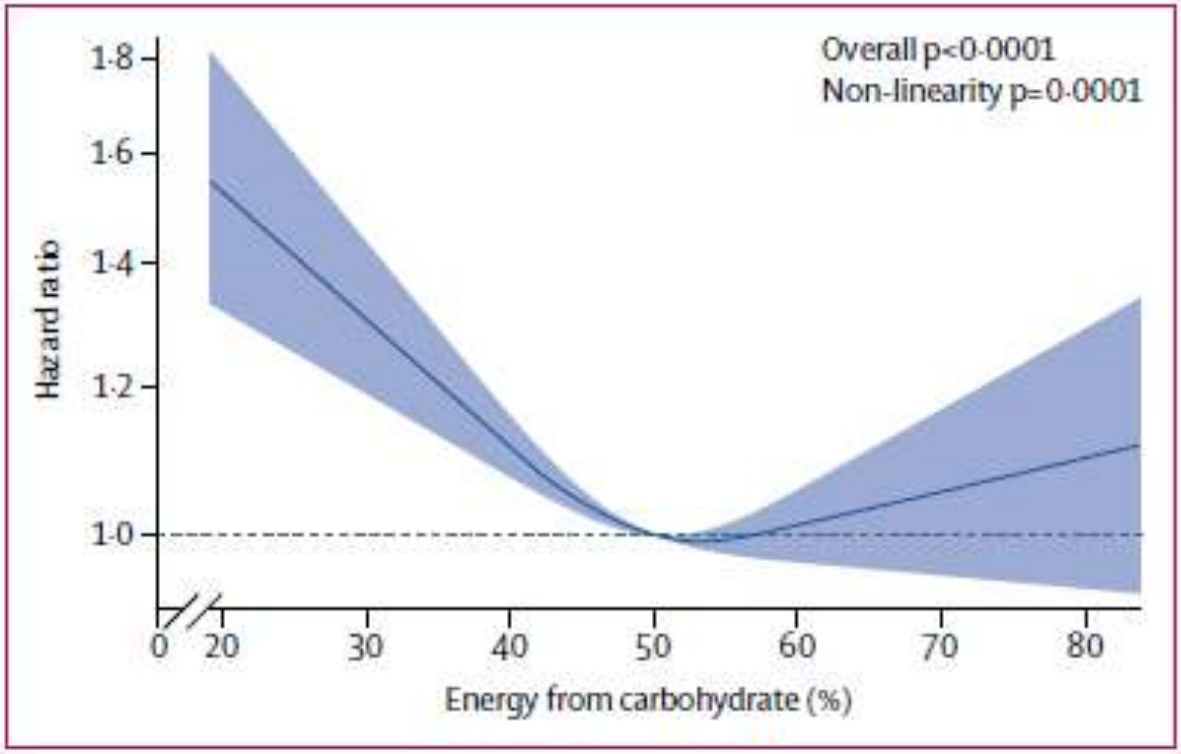


Figure 1: **U-shaped association between percentage of energy from carbohydrate and all-cause mortality in the ARIC cohort**

Paradigm Shift

	Olden days	Now a days
Family	Joint (Big)	Nuclear(2 to 4)
Cooking Methods	Primitive	Modern
Economy	Constrained	Greatly improved
Eating out	Extremely rare	Very common
Exercise	Frequent	Rare


26 5 2010

Low Carb Diet

- Reduces insulin levels
- Reduces Triglycerides
- Prevents Hunger
- Promotes Better weight loss than low fat diet
- Easy to follow

Low Carb Diet (calorie distribution)

Food Components	Standard	Suggested
Carbohydrates	60%	50%
Proteins	15%	20%
Fats	25%	30%

Low carb is not No carb

Glycemic index of common food

Food	Glycemic index
Wheat whole	40
Maida	70
White bread	78
Rice (white)	60
Legumes	25
Rajma	29
potato	70
Mango	55
Skim milk	32
Full fat milk	41
curd	33

Say No To 5 Carbs

- Rice
- Maida
- Potato
- Sugar/Deserts
- Fruit juice/ soft drink

Editorial

The PURE team report that higher intakes of fats (including saturated fatty acids, monounsaturated fatty acids, and total polyunsaturated fatty acids) and animal protein were each associated with lower mortality, whereas carbohydrate intake was associated with increased mortality.

Do meats and dairy reduce mortality? Animal products

(including beef, lamb, and dairy) are the major sources of

saturated fatty acids and monounsaturated fatty acids

in most populations studied in PURE. Since saturated

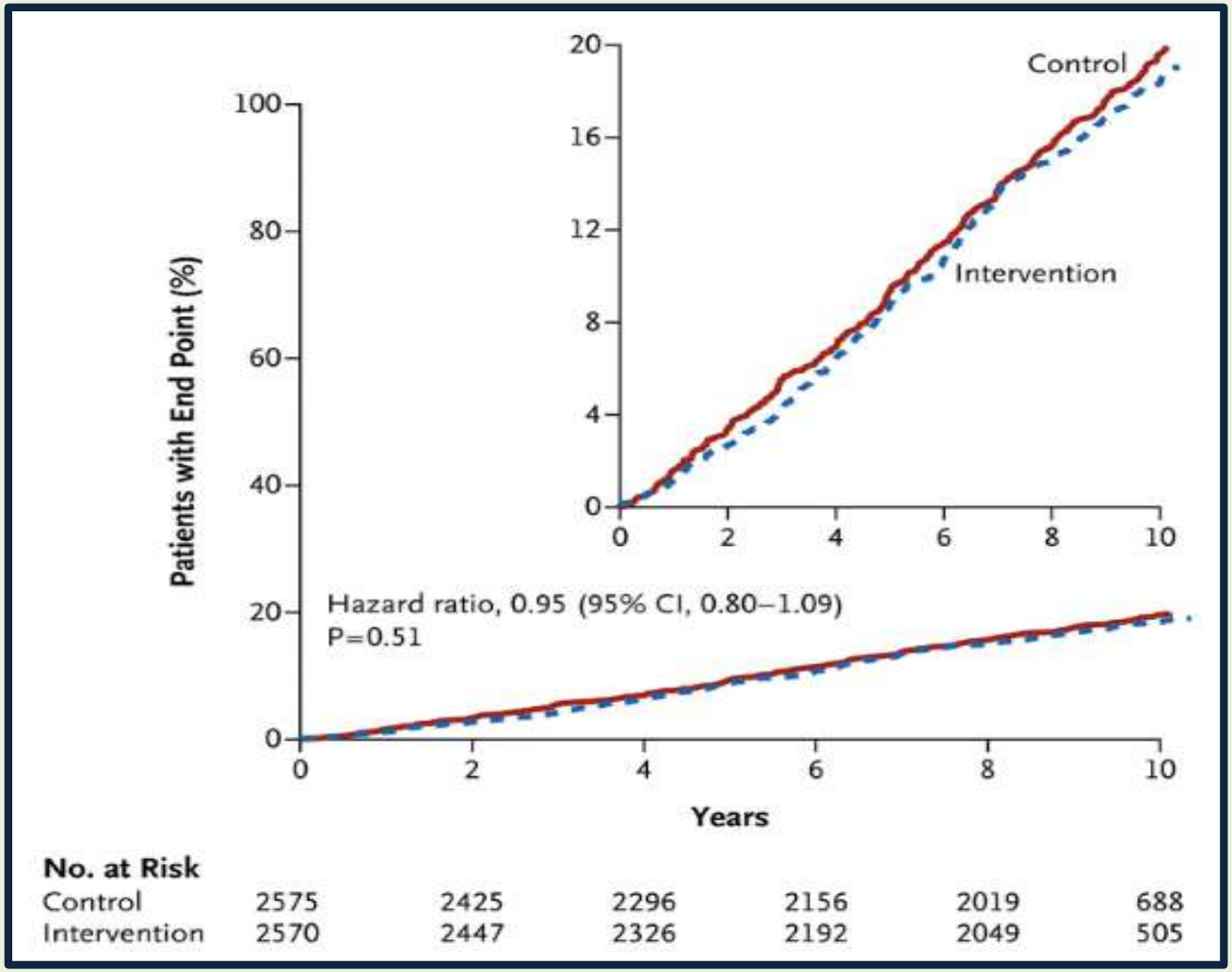
fatty acids, monounsaturated fatty acids, and animal

protein were all inversely associated with mortality,

is the real finding simply that meat and dairy intakeswere associated with increased survival?

Estefania Toledo, Miguel A Martínez-González,* Published **Online
August 29, 2017

WEIGHT REDUCTION LOOK AHEAD STUDY DID NOT YIELD ANY POSITIVE CVD OUTCOMES



- **<u>Long term (9.6 years follow up</u>) did not demonstrate any significant difference in CV morbidity and mortality (p=0.51)**

Study had to be terminated

Look AHEAD Research Group, N Engl J Med. 2013 Jul 11;369(2):145-54

BURDEN OF OVERWEIGHT & OBESITY

Area	2005	2030
Globally	1.3 billion	3.3 billion
	33%	57.8%
India	177 million	342.8 million
	16.9%	32.8%
China	345.5 million	810.4 million
	30.2%	72.3%

International Journal of Obesity 2008; 32: 1431 – 1437