



## Starvation amidst Plenty

Diabetes is said to be the disease of the century. The number of individuals suffering from diabetes in the year 2025 will be more than 10 times the number affected in 1985.<sup>1</sup> Disturbingly, recent estimates suggest that 1 in 3 children born in 2000 will eventually develop diabetes.<sup>2</sup> The consequences are devastating: diabetes causes one amputation worldwide every 30 seconds; it is a leading cause of blindness and kidney failure, with costs soaring to 132 billion dollars in 2002.<sup>3,4</sup> Bleak news but there is reason to rejoice - diabetics who control their blood sugar levels reduce their risk of complications to levels similar to healthy counterparts.

## What is diabetes?

Diabetes is the most common endocrine disorder. It is characterized by the inability of insulin to carry out its function. In type one diabetes mellitus, insulin cannot be produced while in type 2 diabetes mellitus - which affects 90% of diabetics - cells in the tissues and organs become insulin resistant.

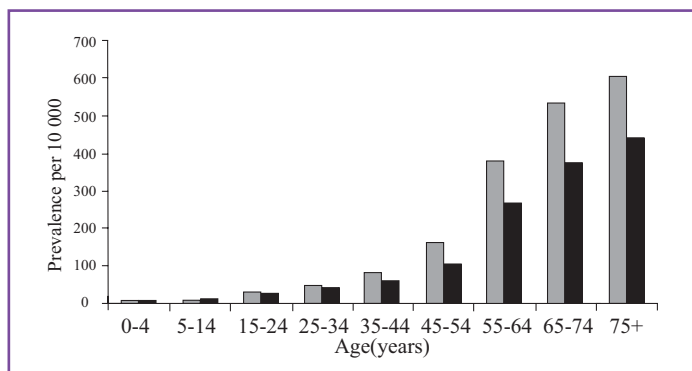
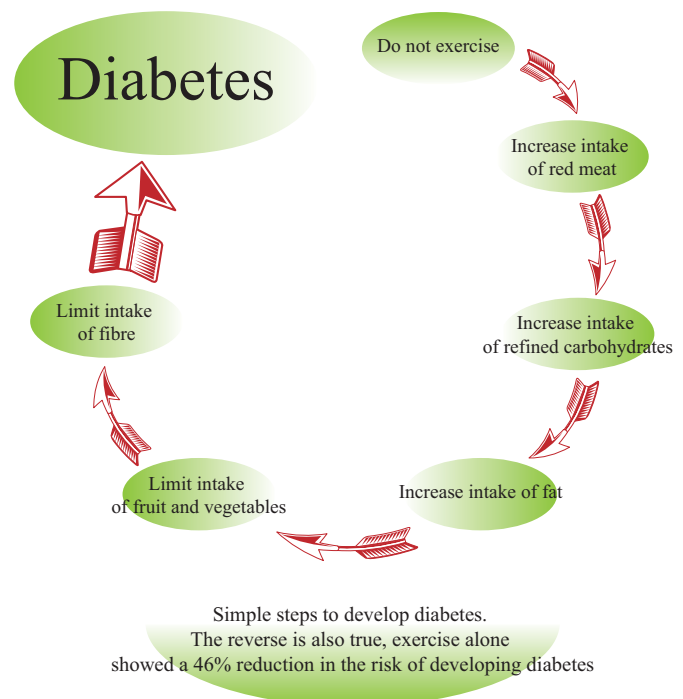
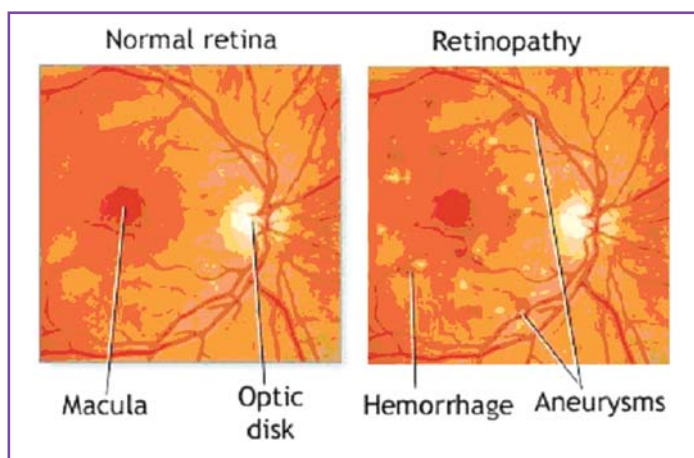


Figure 1: prevalence by age and sex of all diabetes in the UK in 1992; (□) male and (■) female.<sup>5</sup>

Without insulin, cells are incapable of using glucose. This leads to elevated blood glucose levels while intracellular glucose becomes depleted. The consequences of diabetes stem from this shift in the distribution of glucose, the main energy source for cells. Without the action of insulin, the cells starve even in the overabundance of glucose in the blood: "Starvation Amidst Plenty". Simply put, diabetes is what happens when your cells are besieged. Inadequate insulin activity blockades glucose, which leads to inadequate cellular energy and a complete imbalance in metabolism, forcing your body into starvation mode, impeding the body systems function, causing a loss of homeostasis, which all promote disease. Appetite is stimulated, glucose stores in the liver are released, excess glucose in the blood is expelled in the urine leading to dehydration, tissue proteins are broken down as a fuel source and fat stores are accessed as an alternative fuel supply. Dehydration is especially harmful to the nervous system. Tissue protein breakdown leads to muscular wasting. Fatty acid utilization as a fuel source leads to the release of acidic ketone bodies that may cause metabolic acidosis and diabetic coma.<sup>6</sup> Continuous exposure to elevated glucose levels leads to tissue alteration, increasing the likeliness of cataract formation, nerve failure, digestive problems and predisposes individuals to develop cardiovascular complications such as poor peripheral blood flow, ulcer formation, myocardial infarction, kidney damage and retinal injury.

## How to develop Diabetes





Normal Retina vs. Diabetic Retinopathy. Notice how in Diabetic Retinopathy the blood vessels are leaking. This results in vision loss.

## The emergence of diabetes

There is a strong genetic component to type 2 diabetes with concordance of the disease in identical twins in 90% of cases.<sup>7</sup> The cause behind diabetes is poorly understood but the disease is a clear illustration of why it is important to take care of ourselves. We all know that we should exercise, avoid refined carbohydrates and saturated fats and maintain a healthy weight. Yet according to the Center for Disease Control, more than half of the US adult population does not get enough exercise.<sup>8</sup> Epidemiological evidence shows that dietary intake of refined carbohydrates such as corn syrup has quadrupled while fat

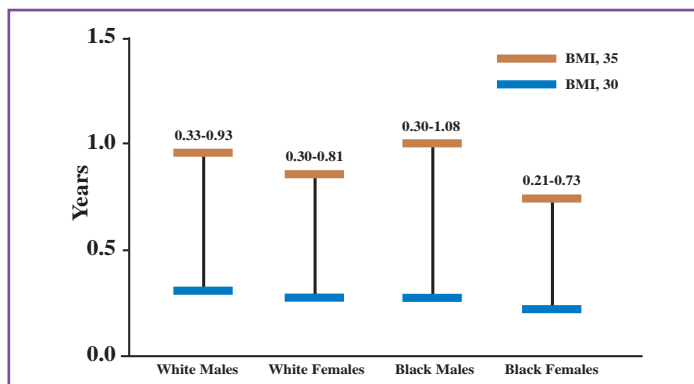


Figure 2: The potential gain in life expectancy in the US if obesity was eliminated. The body mass index (BMI) is a measure of the association between height and weight used to assess body fat and health risk.<sup>11</sup>

consumption has increased by nearly 30% from 1963 to 1997.<sup>9</sup> Weight control is becoming an increasingly common problem and the rates are climbing rapidly to the point where obesity is the number one health problem in the United States, affecting over 60% of the adult population.<sup>10</sup> Insulin resistance as seen in type 2 diabetes is largely

acquired and is a lifestyle-related disorder closely associated with poor dietary habits,<sup>12</sup> lack of physical activity<sup>13</sup> and obesity<sup>14</sup>.

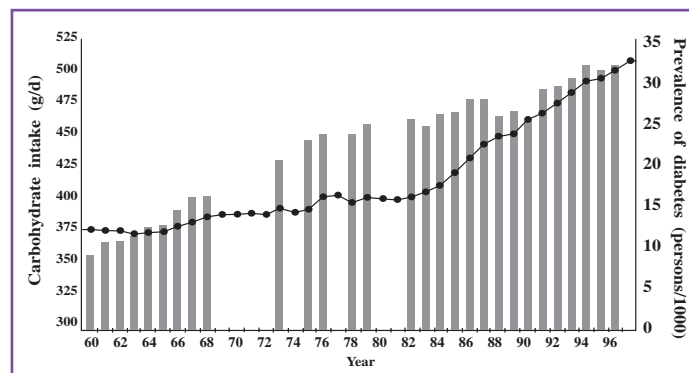


Figure 3: Increasing prevalence of type 2 diabetes (vertical bars) in the United States between 1960 and 1997 with increasing carbohydrate intake (●)<sup>20</sup>

## Dietary Habits and Diabetes

The glycemic load of food refers to the amount of glucose the tissues in the body are exposed to after a certain food is ingested. Foods associated with a high glycemic load result in a greater tissue exposure to glucose. Several studies have documented that a diet producing a high glycemic load is strongly associated with the development of type 2 diabetes mellitus and may even be the source of the condition.<sup>15-19</sup>

## The glucose fatty-acid cycle

### Elevated fatty acid levels:

- Inhibit glucose utilization
- Increase the release of glucose from stores in the liver
- Prolonged elevations reduce insulin secretion from the pancreas
- Lead to insulin resistance

A closer look at dietary patterns denotes the influence of a high glycemic load and excess fat consumption on the onset of diabetes. Epidemiological evidence reveals that refined carbohydrate consumption<sup>21,22</sup> and high meat intake<sup>23</sup> are both correlated with the incidence of diabetes and obesity. On the other hand, the presence of fiber<sup>24</sup> in the diet and fruit and vegetable<sup>25</sup> content prevents the development of the disease. No specific constituent of the diet is solely responsible for the emergence of diabetes but the overall quality of the diet is paramount to diabetes prevention.

# Physical Activity and Diabetes

Exercise improves glucose metabolism and insulin sensitivity thereby reducing the risk of diabetes and heart disease.<sup>26</sup>

The US Diabetes Prevention Program study demonstrated that 30 minutes of daily physical activity and a 5-10% body weight loss resulted in a 58% reduction in the risk of developing diabetes.<sup>27</sup> Another study performed by the Department of Endocrinology in Beijing looked at the impact of diet and exercise on the development of diabetes in patients with impaired glucose tolerance showing a 46% reduction in the risk of developing diabetes with exercise alone.<sup>28</sup>

# Obesity and Diabetes

The rate of obesity in US adults continues to increase.<sup>29</sup> This trend will potentially lead to a decline in life expectancy for upcoming generations.<sup>30</sup> Obesity increases the risk of heart disease and diabetes, two of the most common health problems in North America. Visceral adiposity (the presence of fat around the core) decreases insulin secretion and increases peripheral insulin resistance.<sup>31</sup> Two follow-up studies have demonstrated that an elevated body mass index (a measure of weight distribution) increases the risk of developing diabetes by a factor of 20.<sup>32</sup> In obesity, the presence of excess fat in the tissues leads to lipotoxicity - the accumulation of fat in organs that leads to cellular dysfunction and metabolic anomalies such as glucose intolerance.<sup>33</sup>

The prevention of diabetes is no different than the prevention of most chronic and degenerative conditions. Sound nutrition, exercise and a healthy lifestyle go a long way when it comes to the maintenance of healthy blood glucose and for those predisposed to soaring blood sugar levels, prevention is vital. Natural treatments to prevent and address insulin resistance are constantly emerging. Nutrients such as isohumulones from hops, corosolic acid from banaba,  $\beta$ -glucans from oats and hydroxycalcone from cinnamon improve insulin sensitivity, lower blood glucose levels, reduce the glycemic index of food, improve blood lipid profiles and improve outcome in diabetics.

# References

1 Canadian Diabetes Foundation. The Prevalence and Costs of Diabetes. The Changing Face of Diabetes in Canada. Retrieved May 23rd 2006, from Canadian Diabetes Foundation website: [http://www.diabetes.ca/Section\\_About/prevalence.asp](http://www.diabetes.ca/Section_About/prevalence.asp)

2 Gruber A, Nasser K, Smith R, Sharma JC, Thomson GA. Diabetes prevention: is there more to it than lifestyle changes? *Int J Clin Pract.* 2006 May;60(5):590-4.

3 Canadian Diabetes Foundation. The Prevalence and Costs of Diabetes. The Changing Face of Diabetes in Canada. Retrieved May 23rd 2006, from Canadian Diabetes Foundation website: [http://www.diabetes.ca/Section\\_About/prevalence.asp](http://www.diabetes.ca/Section_About/prevalence.asp)

4 The American Diabetes Association. Diabetes Statistics. Retrieved May 25th, 2006, from

The American Diabetes Association website: <http://www.diabetes.org/diabetes-statistics.jsp>

5 Mulnier HE, Seaman HE, Raleigh VS, Soedamah-Muthu SS, Colhoun HM, Lawrenson RA. Mortality in people with type 2 diabetes in the UK. *Diabet Med.* 2006 May;23(5):516-21.

6 Sherwood L. (1997). *Human Physiology From Cells to Systems.* (3rd Edition). Toronto: Wadsworth Publishing Company.

7 Ferri F, Ferri's Clinical Advisor: Instant Diagnosis and Treatment. 2003 Edition. Toronto: Mosby

8 Center for Disease Control and Prevention (CDC). Adult participation in recommended levels of physical activity--United States, 2001 and 2003. *MMWR Morb Mortal Wkly Rep.* 2005 Dec 2;54(47):1208-12.

9 Gross LS, Li L, Ford ES, Liu S. Increased consumption of refined carbohydrates and the epidemic of type 2 diabetes in the United States: an ecologic assessment. *Am J Clin Nutr.* 2004 May;79(5):774-9.

10 Wyatt SB, Winters KP, Dubbert PM. Overweight and obesity: prevalence, consequences, and causes of a growing public health problem. *Am J Med Sci.* 2006 Apr;331(4):166-74.

11 Olshansky SJ, Passaro DJ, Hershov RC, Layden J, Carnes BA, Brody J, Hayflick L, Butler RN, Allison DB, Ludwig DS. A potential decline in life expectancy in the United States in the 21st century. *N Engl J Med.* 2005 Mar 17;352(11):138-45.

12 Baxter AJ, Coyne T, McClintock C. Dietary patterns and metabolic syndrome--a review of epidemiologic evidence. *Asia Pac J Clin Nutr.* 2006;15(2):134-42.

13 Gill JM, Hardman AE. Exercise and postprandial lipid metabolism: an update on potential mechanisms and interactions with high-carbohydrate diets. *J Nutr Biochem.* 2003 Mar;14(3):122-32. Review.

14 Lebovitz HE. Insulin resistance--a common link between type 2 diabetes and cardiovascular disease. *Diabetes Obes Metab.* 2006 May;8(3):237-49.

15 Livesey G. Low-glycaemic diets and health: implications for obesity. *Proc Nutr Soc.* 2005 Feb;64(1):105-13.

16 Salmeron J, Manson JE, Stampfer MJ, Colditz GA, Wing AL, Willett WC. Dietary fiber, glycemic load, and risk of non-insulin-dependent diabetes mellitus in women. *JAMA.* 1997 Feb 12;277(6):472-7.

17 Salmeron J, Ascherio A, Rimm EB, Colditz GA, Spiegelman D, Jenkins DJ, Stampfer MJ, Wing AL, Willett WC. Dietary fiber, glycemic load, and risk of NIDDM in men. *Diabetes Care.* 1997 Apr;20(4):545-50.

18 Schulze MB, Liu S, Rimm EB, Manson JE, Willett WC, Hu FB. Glycemic index, glycemic load, and dietary fiber intake and incidence of type 2 diabetes in younger and middle-aged women. *Am J Clin Nutr.* 2004 Aug;80(2):348-56.

19 Meyer KA, Kushi LH, Jacobs DR Jr, Slavin J, Sellers TA, Folsom AR. Carbohydrates, dietary fiber, and incident type 2 diabetes in older women. *Am J Clin Nutr.* 2000 Apr;71(4):921-30.

20 Gross LS, Li L, Ford ES, Liu S. Increased consumption of refined carbohydrates and the epidemic of type 2 diabetes in the United States: an ecologic assessment. *Am J Clin Nutr.* 2004 May;79(5):774-9.

21 Ibid.

22 Salmeron J, Manson JE, Stampfer MJ, Colditz GA, Wing AL, Willett WC. Dietary fiber, glycemic load, and risk of non-insulin-dependent diabetes mellitus in women. *JAMA.* 1997 Feb 12;277(6):472-7.

23 Baxter AJ, Coyne T, McClintock C. Dietary patterns and metabolic syndrome--a review of epidemiologic evidence. *Asia Pac J Clin Nutr.* 2006;15(2):134-42.

24 Stevens J, Ahn K, Juhaeri, Houston D, Steffan L, Couper D. Dietary fiber intake and glycemic index and incidence of diabetes in African-American and white adults: the ARIC study. *Diabetes Care.* 2002 Oct;25(10):1715-21.

25 Baxter AJ, Coyne T, McClintock C. Dietary patterns and metabolic syndrome--a review of epidemiologic evidence. *Asia Pac J Clin Nutr.* 2006;15(2):134-42.

26 Ferrara CM, Goldberg AP, Ortmeyer HK, Ryan AS. Effects of aerobic and resistive exercise training on glucose disposal and skeletal muscle metabolism in older men. *J Gerontol A Biol Sci Med Sci.* 2006 May;61(5):480-7.

27 Ratner RE; The Diabetes Prevention Program Research. An update on the Diabetes Prevention Program. *Endocr Pract.* 2006 Jan-Feb;12 Suppl 1:20-4.

28 Pan XR, Li GW, Hu YH, Wang JX, Yang WY, An ZX, Hu ZX, Lin J, Xiao JZ, Cao HB, Liu PA, Jiang XG, Jiang YY, Wang JP, Zheng H, Zhang H, Bennett PH, Howard BV. Effects of diet and exercise in preventing NIDDM in people with impaired glucose tolerance. The Da Qing IGT and Diabetes Study. *Diabetes Care.* 1997 Apr;20(4):537-44.

29 Ogden CL, Carroll MD, Curtin LR, McDowell MA, Tabak CJ, Flegal KM. Prevalence of overweight and obesity in the United States, 1999-2004. *JAMA.* 2006 Apr 5;295(13):1549-55.

30 Olshansky SJ, Passaro DJ, Hershov RC, Layden J, Carnes BA, Brody J, Hayflick L, Butler RN, Allison DB, Ludwig DS. A potential decline in life expectancy in the United States in the 21st century. *N Engl J Med.* 2005 Mar 17;352(11):138-45.

31 Lebovitz HE. Insulin resistance--a common link between type 2 diabetes and cardiovascular disease. *Diabetes Obes Metab.* 2006 May;8(3):237-49.

32 Wyatt SB, Winters KP, Dubbert PM. Overweight and obesity: prevalence, consequences, and causes of a growing public health problem. *Am J Med Sci.* 2006 Apr;331(4):166-74.

33 Slawik M, Vidal-Puig AJ. Lipotoxicity, overnutrition and energy metabolism in aging. *Ageing Res Rev.* 2006 Apr 19

# The Next Generation Cardiovascular Magnesium!

## Cardio•Mag 2.0

It was Russian researchers who first guessed that using *orotic acid* to support the renewed biosynthesis of critical components of the genetic “instruction” machinery would help the heart to recover its function after a crisis.\* And over the course of the last three decades, clinical trials using **Magnesium Orotate** have given overwhelming support to their hypothesis.\* **Cardio•Mag<sup>2.0</sup>** is the reformulation of our original Cardio•Mag magnesium supplement, providing the most advanced cardiovascular support\* of true, *fully-reacted* magnesium orotate. **Cardio•Mag<sup>2.0</sup>** combines the heart health benefits of both the mineral and orotic acid in one compound,\* at a clinically-documented\* dose.



\*These statements have not been evaluated by the Food and Drug Administration. This product is not intended to diagnose, treat, cure, or prevent any disease.