HYPOGLYCAEMIA UNAWARENESS

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Hypoglycaemia (low blood glucose) can complicate any pharmacological therapy that artificially elevates circulating insulin concentrations in the blood. When the blood glucose falls, a series of counterregulatory responses should occur that act to restore the blood glucose before it has fallen low enough to affect brain function. In diabetes, defects in these counterregulatory responses can occur that increase the risk of severe hypoglycaemia. Circulating insulin concentrations are determined by the therapy, not automatically adjusted in response to need, and glucagon, an anti-insulin hormone produced by the pancreas from cells adjacent to those that should make insulin, does not rise in response to hypoglycaemia in many people with diabetes.

The most important loss of protection occurs when the person with diabetes loses the ability to recognise early hypoglycaemia – a situation known as hypoglycaemia unawareness and associated with other failures of the counterregulatory response. This greatly increases the risk of more severe hypoglycaemia, which can in turn lead to confusion, loss of personal control, and even coma and seizure. Awareness of hypoglycaemia can be restored by scrupulous avoidance of exposure to blood glucose concentrations of less than 300 mmol/l in daily life – not always easy to achieve.

New research is helping us devise new strategies to improve the defences against severe hypoglycaemia, including but not limited to technological advances in glucose sensing and insulin delivery and replacement of lost insulin secreting beta cells by transplantation, but these are not yet sufficiently efficient to be useful to the majority of people with diabetes. While we await progress in these fields of research, better ways of using insulin – and to a lesser extent, newer insulins – are helping patients with diabetes to achieve better glycaemic control, in which lower average blood glucose concentrations are not accompanied by increased hypoglycaemia rates. Intensive therapy regimens which include educating patients in how to use insulins flexibly and other programmes which train people to assess their hypoglycaemia risk are already delivering benefits in terms of reduced risk of severe hypoglycaemia.

CAN WE PREVENT TYPE 1 DIABETES?

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‘Can we prevent type 1 diabetes?’ In the years since the outcomes of the two largest trials aimed at type 1 diabetes prevention were reported (i.e. the ENDIT and DPT-1 efforts), many continue to ask this question; but perhaps with a more mature and realistic perspective. Indeed, while it is often spoken that these efforts ‘failed’, in reality, many important successes occurred and equally important, vital lessons were learned. Indeed, these trials validated that metabolic, immunological, and genetic markers of type 1 diabetes do allow for the ability to identify individuals at increased risk for the disease, often months to years in advance of symptomatic onset. Other positive outcomes range from the noted benefits of core laboratories to those indicating that logistically, large multi-center trials for type 1 diabetes prevention can effectively be established. These facets support (in part) a positive response to the question of ‘can’ we prevent type 1 diabetes, yet such a notion grows fallow without address of the question of ‘how’ do we prevent the disease. Many facets can be examined to address the issue of ‘how’. Studies of animal models have suggested a number of agents that might prove beneficial for efforts aimed at disease prevention. At the same time, multiple pilot- to small-trials have supported the potential efficacy of a limited number of agents for preventing type 1 diabetes.
Furthermore, at least two ‘dogmas’ for type 1 diabetes have come under recent question, both of which might have vital implications for efforts aimed at type 1 diabetes prevention. First, the concept that the onset of overt type 1 diabetes occurs at a time when ‘90% of the islet cells have been destroyed’ may not be accurate. Second, that the processes of islet cell destruction may result in an irreversible situation in terms of physiology may not be valid. Indeed, the concept of islet beta cell regeneration, as well as the existence of metabolically active islet cells years/decades after the onset of disease, provide interesting opportunities for therapeutic interventions. Indeed, the most effective means for disease intervention will likely involve combination therapies that target multiple pathways including those reversing autoimmunity, restoring proper immune regulation, disrupting beta cell apoptosis, and inducing beta cell regeneration. That said, any such efforts must take consideration of practical issues (e.g., costs for screening, potential application of therapeutic interventions, etc.) related to the prevention of type 1 diabetes outside of U.S. or European populations; concepts that have not been subject to a sufficient degree of discussion. This lecture will provide a historical review of attempts to prevent type 1 diabetes and combined with a retrospective analysis of those research experiences, will propose a model for future investigations that will, hopefully, turn discoveries into a practical means for the prevention and reversal of type 1 diabetes.

**IDF/WHO DIAGNOSIS REVISION INITIATIVE**

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The World Health Organization (WHO) in 1965 suggested diagnostic criteria and a classification for diabetes mellitus, but to little avail. Following the 1979 report of the US National Diabetes Data Group (NDDG), a second WHO Expert Committee convened and its report was published in 1980. Except for gestational diabetes, the recommended WHO classification and diagnostic criteria for diabetes were similar to those of the NDDG. The 1980 WHO classification and diagnostic criteria for diabetes were widely adopted and for the first time resulted in an internationally standardized approach to diagnosis and classification. In 1985 the WHO Study Group made some relatively minor modifications to these recommendations.

Following major advances in understanding the pathophysiology of different forms of diabetes in the 1980s and 90s, the American Diabetes Association (ADA) made new recommendations which were subsequently considered by the WHO Consultation Group, which published its final report in 1999. Major changes were recommended in the classification and staging of diabetes and diagnostic criteria for Impaired Fasting Glycaemia were introduced. Subsequently, in 2003, the ADA recommended further changes in the fasting plasma glucose concentration to define this category.

In November 2005 the WHO, in conjunction with the IDF, convened a Technical Guideline Development group with broad international representation to review this development and other emerging data, and make recommendations for the definition and criteria for diabetes mellitus and the intermediate states of glycaemia. These recommendations will be released at the IDF Congress. The background and potential impact of these recommendations will be presented.

**OPTIMISING INSULIN THERAPY**

**G B Bolli**

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In both type 1 and type 2 diabetes mellitus (T1, T2DM) there is stringent need to maintain A1C <7.0% since clinical diagnosis all life long. Large, prospective, intervention trials have shown that keeping A1C <7.0% is the most (and only!) powerful means to prevent onset of vascular complications and/or its progression.

In T1DM, it is mandatory to use basal+mealtime insulin. The gold standard of basal insulin is the continuous s.c. insulin infusion (CSII) because the regimen delivers soluble insulin in a predictable way, and is short-term programmable. As compared to multiple daily injections (MDI), CSII provides the highest flexibility in lifestyle, although A1C and risk of hypoglycaemia are no better than MDI. With MDI, basal insulin should be a long-acting analogue (either glargine once daily, or detemir in majority of patients twice daily), not NPH which should no longer be in use in T1DM (including children and elderly people). Rapid-acting analogues, not human regular insulin, should be given at each meal, including snacks in children. Combined with appropriate education, MDI allows to keep A1C <7.0%, prevents hypoglycaemia and hypoglycaemia unawareness, and prevents long-term complications.

In T2DM, the present strategy is aggressive treatment of hyperglycaemia with lifestyle changes, oral drugs, and early use of insulin, because T2DM is a condition of high risk of cardio-vascular disease. The simplest approach to initiate insulin in T2DM is once daily administration of a basal preparation in the evening to normalize fasting blood glucose (BO). This can be done using the cheapest insulin, NPH, or the more expensive long-acting insulin analogues glargine (once daily), or detemir (once daily in about 50% of T2DM subjects, twice daily in the remaining). Both NPH and long-acting analogues keep A1C <7.0% in T2
failing to oral drugs, but the risk of hypoglycaemia is about 50% less using the analogues vs. NPH. Because prevention of hypoglycaemia is at least as important as it is reduction in A1C, the basal insulin of choice is a long-acting insulin analogue. When starting basal insulin in T2DM, it is important that the evening insulin dose is titrated to fasting normoglycaemia (100 mg/dl, 5.5 mmol/l).

The titration may require weeks of time and large dose in subjects who are insulin resistant due to obesity, primarily visceral obesity (fatty liver). The modern view is that a large insulin dose should not worry neither the doctor nor the patient because insulin is healthy. When insulin is started in T2DM, an insulin sensitizer should be either continued or started (usually metformin, 2-3 g/day) to prevent excessive increase in body weight. Insulin detemir has the unique property of slightly limiting the insulin-induced increase in body weight vs. NPH and glargine. Secretagogues can be continued or withdrawn depending on ability of individuals to secrete endogenous insulin, with rapid-acting secretagogues preferred to sulphonylureas. In the future the most rational combination appears GLP-1 analogues (or DPP-IV inhibitors) and basal insulin. With basal insulin titrated to fasting euglycemia and oral drugs, about 50-60% of subjects with T2DM keep A1C <7.0%. In the remaining other subjects in whom HbA1c remains >7.0% despite fasting blood glucose at the target with evening basal insulin, it is important to treat mealtime hyperglycaemia with a rapid-acting insulin analogue (lispro, or aspart or glulisine).

‘FOR’

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There are at least 10 good evidence-based reasons for individuals with diabetes to make the switch from high GI to low GI carbohydrate foods.

1. Low GI foods and low GI mixed meals reduce postprandial glycaemia.
2. Low GI diets improve glycated haemoglobin levels by as much as many diabetes medications.
3. Low GI diets improve glycaemic control without increasing the risk of hypoglycaemic events.
4. Low GI diets enhance insulin sensitivity as assessed by the euglycaemic-hyperinsulminemic clamp.
5. Low GI diets improve markers of cardiovascular risk, including serum cholesterol, triglycerides and PAI-1.
6. In prospective observational studies, low GI diets reduce the risk of type 2 diabetes.
7. In weight loss studies, low GI diets increase the rate of body fat loss.
8. Low GI meals can be more satiating than macronutrient-equivalent high GI meals.
9. Low GI eating is easy to teach, easy to learn.
10. Judicious use of low GI foods is recommended by leading diabetes associations around the world, including the American Diabetes Association.

While critics of the GI claim that it is too variable and unpredictable because of differences in food processing, fat or protein content of mixed meals, the same is equally true of carbohydrate counting (which they support).

THE ECONOMICS OF DIABETES

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Methods. Current and future medical expenditures for diabetes care were calculated for each country from data describing national health expenditures and diabetes prevalence. In addition, the world literature on all diabetes costs and the cost-effectiveness of diabetes treatments was reviewed and summarised.

Results. Global health expenditures to treat and prevent diabetes and its complications will total at least USD232.0 billion in 2007. By 2025, this number will exceed USD302.5 billion. Expressed in international dollars (ID), which correct for differences in purchasing power, at least ID286.1 billion of goods and services will be consumed by diabetes in 2007, and at least ID381.1 billion in 2025. World diabetes treatment costs are growing more quickly than world population.

More than 80% of expenditures for medical care for diabetes are made in the world’s economically richest countries, not in the low- and middle-income countries where 80% of persons with diabetes will soon live. In the world’s poorest countries, not enough is spent to provide even the least expensive lifesaving diabetes drugs.

In poor and middle-income countries, medical care purchases primarily go towards preventing the immediate life-threatening diabetes complication, high blood sugar. Little appears to be spent to prevent cardiovascular disease, the predominant cause of death from diabetes, and little is available to treat cardiovascular or microvascular complications when they appear.

Higher-income countries spend large sums to treat diabetic complications. As a result, in these countries, even expensive interventions to
prevent these complications can be cost-effective. However, a long list of diabetes interventions is cost-effective around the globe, in both developing and developed locales. These include daily aspirin, smoking cessation, generic blood sugar-lowering pills, low-cost ACE-inhibitors and other pills that lower blood pressure, generic statin drugs to lower bad cholesterol, and foot care for persons at high risk of ulcers. In many or most settings, these treatments can save more money than they cost.

The world suffers huge losses in the form of foregone economic growth as a result of diabetes. Lost economic growth may be a relatively greater problem in poorer countries. Between 2005 and 2015, the World Health Organization (WHO) predicts net losses in national income from diabetes and cardiovascular disease of ID557.7 billion in China, ID303.2 billion in the Russian Federation, ID336.6 billion in India, ID49.2 billion in Brazil and ID2.5 billion in Tanzania (2005 ID).

However, the larger costs of diabetes arise from disability and loss of life caused by its preventable complications, including heart, kidney, eye and foot disease. Especially in poor and middle-income countries, the resulting loss of income devastates families. Perhaps 25 million years of life are lost annually to mortality caused by diabetes. Reduced quality of life may reach a similar magnitude among the living.

Just as diabetes harms economies, economies create diabetes. Policies towards agriculture, transportation, housing and land drive patterns of eating and exercise. Perhaps even more importantly, countries with less egalitarian distributions of income, wealth and power also have higher rates of insulin resistance, diabetes and cardiovascular disease. Economic inequality appears to be a cause of diabetes.

**Conclusion.** Diabetes is one of the world’s most important causes of expenditure, mortality, disability and lost economic growth. A long list of simple, cheap treatments can help prevent these losses and many of these treatments will actually save hard money in countries, rich and poor. In the world’s low- and middle-income countries, where most persons with diabetes live, few are treated cost-effectively.

**HOW CLOSE ARE WE TO NON-INVASIVE BLOOD GLUCOSE MONITORING?**

**J S Christiansen**

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Strict glycaemic control is of crucial importance for both type 1 and type 2 diabetics, since the beneficial effects upon the development of vascular complications are well established. During the last 3 decades self-monitoring of blood glucose has been used extensively by diabetic patients in order to improve glycaemic control. Frequent spot measurements of blood glucose leading to mean daily blood glucose estimations, together with measurements of HbA1c, have for decades been the cornerstone in the treatment – both in terms of giving clinical advice, but also in giving patients the possibility of self-control. However, composite or average markers (arising from calculation of mean values) often conceal details that make the difference between success and failure in clinical medicine (as well as in many other aspects of life). For example, HbA1c measurements alone cannot identify whether fasting glucose levels or postprandial glucose excursions are too high. Self-monitoring of glucose is helpful, overcoming some of the limitations in HbA1c measurements, but frequent monitoring is inconvenient and expensive. The development of reliable and inexpensive means for continuous glucose monitoring with the options of the patient for on-line information is highly needed. Since 2001 so-called minimal invasive systems for continuous measurements of tissue glucose have been available, and since 2006 the first systems have been put on the market, which offers the patient the opportunity of on-line reading of glucose values. It is likely, that such systems will improve glycaemic control, and thus have a beneficial clinical impact, but this will depend on a number of different factors: The cost and the reliability of these systems are obvious factors of importance. Also, the convenience of the systems will highly influence the daily use. In this context the development of non-invasive systems will be a major leap forward. Many different physical and chemical methods for non-invasive monitoring of glucose have been tested, and some are in clinical development. So far, none of the systems have proven accurate and robust enough to be utilised in clinical practice. An overview of the different possibilities for non-invasive glucose monitoring and a status over some of the technical developments will be given. There can be little doubt that the successful translation of the technical advances into practically reliable tools will prove to be an enormous help for people with diabetes.

**STRESS IN EARLY LIFE LEADING TO OBESITY, METABOLIC SYNDROME AND DIABETES TYPE 2**

**G P Chrousos**

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Stress activates the central and peripheral components of the stress system, i.e. the hypothalamic-pituitary-adrenal (HPA) axis and the arousal/sympathetic system. The principal effectors of the stress system are corticotropin-releasing hormone (CRH), arginine vasopressin, the proopiomelanocortin-derived peptides, melanocyte-stimulating hormone and endorphin, the glucocorticoid, and the
catecholamines norepinephrine and epinephrine. The developing brain undergoes rapid growth and is characterized by high turnover of neuronal connections during the prenatal and early extrauterine life. These processes and, hence, brain plasticity, slow down during childhood and puberty and plateau in young adulthood. Hormonal actions in early life, and to a much lesser extent later, can be organizational, i.e., can have effects that last for long periods of time, frequently for the entire life of the individual. Hormones of the stress system and sex steroids have such effects, which influence the behavior and certain physiologic functions of individuals for life. Exposure of the developing brain to severe and/or prolonged stress may result in hyperactivity/hyperreactivity of the stress system, with resultant amygdala hyperfunction (fear reaction), decreased activity of the hippocampus (defective glucocorticoid negative feedback, cognition) and the mesocorticolimbic dopaminergic system (dysthymia, novelty seeking, addictive behaviors), hyperactivation of the HPA axis (hypercortisolism), suppression of reproductive, growth, thyroid and immune functions, and changes in pain perception. These changes may be accompanied by abnormal childhood, adolescent and adult behaviors, including excessive fear (inhibited child syndrome) and addictive behaviors, dysthymia and/or depression and gradual development of components of the metabolic syndrome X, including visceral obesity, diabetes mellitus type 2 and essential hypertension. Prenatal stress exerted during the period of sexual differentiation may be accompanied by impairment of this process, with behavioral and/or somatic sequelae. The vulnerability of individuals to develop varying degrees and/or components of the above life-long syndrome is defined by as yet unidentified genetic factors, which account for up to 60% of the variance. CRH has marked kindling properties, hence both of these hormones are crucial to the development of, and can each alone produce, the above syndrome. CRH and glucocorticoids may act in synergy, as in acoustic startle, while glucocorticoids may suppress or stimulate CRH, as in the hypothalamus and amygdala respectively. A CRH receptor type 1 antagonist antalarmin inhibits both the development and expression of conditioned fear in rats and has anxiolytic properties in monkeys. Profound stressors, such as those from sexual abuse, rape, etc., may elicit the syndrome in older children, adolescents and adults as well. Most frequently, chronic dysthymia and/or depression may ensue, associated with gastrointestinal complaints and/or the premenstrual tension syndrome. A lesser proportion of individuals may develop the classic posttraumatic stress disorder characterised by hypocrortisolism and intrusive and avoidance symptoms; in younger individuals it may present as dissociative personality disorder.

CREATING MODELS FOR HEALTH CARE DELIVERY THAT ADDRESS CHRONIC DISEASE
J Epping-Jordan

The World Health Organization (WHO) estimates that in 2005 chronic disease accounted for 60% of all deaths, and 80% of these occurred in low and middle income countries. Without change, health care systems will grow increasingly inefficient and ineffective as the chronic disease burden continues to grow. Effective prevention, management, and rehabilitation of chronic disease require an evolution of health care, away from approaches that are focused on treating acute symptoms towards co-ordinated, comprehensive systems of care.

All chronic diseases place similar demands on health systems, patients and families, and similar ways of organizing health care are effective regardless of biomedical etiology. These approaches are also applicable to HIV/AIDS, which requires comprehensive health services comparable to those needed for diabetes.

Several health care delivery models for chronic disease have been developed, including the Chronic Care Model, the Innovative Care for Chronic Conditions Framework, and the Integrated Management of Adult Illness. All emphasise the importance of strengthening primary health care to include clinical information systems, multidisciplinary health care teams, evidence-based decision support tools, and support for patient-self management. They also underscore the importance of using multifaceted approaches as opposed to ‘silver bullet’ interventions.

Integrated approaches to health care delivery have been shown to be effective across a wide range of countries and diseases. Selected evidence for diabetes and other conditions will be presented.

Latest projections from WHO indicate that total deaths from chronic disease will increase by a further 17% in the next 10 years, while deaths from infectious disease, maternal and perinatal conditions and nutritional deficiencies combined will decrease by 3%. Today’s health care leaders can no longer remain passive in the face of this transforming disease burden. These rapid changes require rapid responses – and health care delivery models for chronic disease show the way forward.

GENETIC SYNDROMES OF OBESITY
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Considerable attention has been paid to the secular changes in food intake and physical activity that underlie the recent rise in the prevalence of obesity.
However, there is compelling evidence that inter-individual differences in susceptibility to obesity have strong genetic determinants. In the past decade, there have been major advances in our understanding of the molecular constituents of the pathways that control mammalian energy homeostasis. We and others have described six human obesity syndromes that arise from genetic defects. We have identified several patients with congenital leptin deficiency. These children are hyperphagic, develop severe disabling obesity, impaired T cell mediated immunity and hypogonadotropic hypogonadism. In a clinical trial of daily subcutaneous injections of recombinant human leptin, sustained, beneficial effects on appetite, fat mass, hyperinsulinaemia and hyperlipidaemia have been observed. Leptin administration also permits the full progression of appropriately timed puberty and reverses impaired T cell mediated immunity.

We have recruited over 2 000 severely obese children to the Genetics of Obesity Study (GOOS). Using a candidate gene approach, we have identified several loss of function mutations in the melanocortin 4 receptor (MC4R), which cause a dominantly inherited syndrome that accounts for up to 5% of patients with severe, early-onset obesity, making this the commonest obesity syndrome to date. MC4R deficiency is characterised by hyperphagia, severe hyperinsulinaemia and increased linear growth and there is evidence for a genotype-phenotype correlation, as complete loss of function mutations result in a more severe phenotype.

The characterization of these syndromes and of patients with mutations in the genes encoding the leptin receptor, pro-opiomelanocortin (POMC) and prohormone convertase-1, has provided a better mechanistic understanding of the regulation of appetite and body weight in humans, which will have implications for the treatment of obesity and other metabolic disorders.

‘AGAINST’
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Carbohydrates can be classified according to their chemical structure or their physiological effects. The glycaemic index (GI) is based on the physiological effects of foods containing carbohydrate. Although diet books define glycaemic index as how rapidly blood glucose and insulin levels increase after eating carbohydrates, the GI actually measures the relative area under the postprandial glucose curve of 50 grams of digestible carbohydrate compared to 50 grams from a standard food.

Problems with the glycaemic index concept
Epidemiological studies and a small clinical trial report that subjects consumed a moderate GI diet. In the Insulin Resistance and Atherosclerosis Study the average GI was 58 and the average glycaemic load (GL) was 128 (1). It is unknown if further lowering of the GI can be achieved long-term.

The GI does not reflect actual amounts of carbohydrate contributed by individual foods in the usual diet and it only measures glucose above the baseline fasting glucose (2).

Individual blood glucose response to a food or meal is highly variable. For example, Australian potatoes have a GI of 87 to 101, placing them in the high GI category, whereas, potatoes in the US and Canada have a GI ranging from 56 to 77, placing them in the moderate GI category.

The GI is not necessarily the best indicator of healthy food choices. Soft drinks, candies, sugars, and high fat foods often have low to moderate GIs. The GI of foods can be altered by adding fat or adding or substituting sugars, especially fructose and sugar alcohols.

Outcomes from low GI compared with high GI diets
In type 1 diabetes there are 4 studies, average duration 4 weeks with 36 subjects, none reported improvements in A1C although 2 reported improvements in fructosamine; 2 reported no differences in A1C or fructosamine. In type 2 diabetes there are 12 studies, average duration 5 weeks with 175 subjects, 3 reported improvements in A1C and fructosamine; 5 reported no differences in A1C and 3 reported no differences in fructosamine. All studies are of a relatively short duration and the carbohydrate content of both diets was similar. A meta-analysis reported modest improvement in A1C (0.4% decrease) from a low GI-diet compared to a high GI-diet (3).

Other nutrition therapy interventions report greater decreases in A1C (1 to 2% decreases) (4).

Three epidemiologic studies report a low GI/GL is associated with a reduced risk of developing diabetes or prevalence of insulin resistance; however, 5 report no association between GI/GL and risk of developing diabetes, fasting insulin or insulin resistance, or adiposity. In 3 of the studies reporting no benefit from GI/GL, fiber was found to be beneficial associated with insulin resistance.

In weight loss studies of <6 months, weight response has been mixed. Two studies of >6 months, reported that lowering GI/GL in weight reduction diets did not provide any added benefit to energy restriction (5, 6).

Clinical use of the GI concept
Debate continues regarding the use of the GI for the management of diabetes and weight. In general, the total amount of carbohydrate eaten is a strong predictor of glycaemic response and monitoring total grams of carbohydrate by carbohydrate counting, exchanges, or experience-based estimation remains a key strategy (7). The GI concept and experience can be used to fine-tune carbohydrate servings. Food and
blood glucose data are used to determine if target blood glucose goals are being met or if changes in carbohydrate/food or medications are needed.

References

**TYPE 2 DIABETES IN INDIGENOUS POPULATIONS: BURDEN OF DISEASE AND CLINICAL CHALLENGES**

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Indigenous populations are experiencing an unprecedented epidemic of type 2 diabetes with rates as much as two to three times higher than in the non-Indigenous population. The challenge of defining Indigenous, limited and outdated data on prevalence and complications, varying operational practices and research methodologies make comparisons of diabetes rates among indigenous populations problematic. However, in order to enhance our understanding of the impact of high rates of Indigenous diabetes, information from indigenous populations worldwide on the rates of diabetes, its complications, and management is urgently needed.

The present talk attempts to address this information gap by providing an overview of the epidemiology, complications, and management of type 2 diabetes in indigenous populations on a global scale. The current understanding of the causes of diabetes including genetic, environmental, behavioural, socio-economic and cultural factors will also be examined. A more detailed exploration of the prevalence, incidence and care delivery considerations will be provided for three specific populations: Australian Aborigines, American Indians and Canadian Aboriginal populations.

Successful prevention and treatment strategies will be presented, highlighting the importance of socially and culturally appropriate long-term, primary prevention initiatives as well as targeted clinical interventions.

**STUDYING DIABETES IN IMMIGRANTS AND THEIR COUNTRIES OF ORIGIN**

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There is an alarming increase in the number of people with diabetes and cardiovascular disease worldwide but especially in people living in or who have migrated from the so called ‘developing countries’. For instance in the UK, people from the South Asian continent and those who are Black Caribbean have a frequency of type 2 diabetes 3-6 times more than European whites and the disease onset is 10-15 years earlier. The metabolic syndrome plays a central role in the pathogenesis of T2D and is found in increased frequency in South Asian living in the UK compared to European whites and may in part explain some of the differences observed between South Asians and European whites. Studies examining urban and rural populations in the same country have found that the frequency of diabetes is increased in the urban setting and is associated with an increasing BMI, although interestingly in some studies from India, rates of impaired glucose tolerance are similar in both settings.

Whilst genetic factors are important in the aetiology of diabetes it is clearly the changing lifestyle that is fuelling the current epidemic of diabetes. Furthermore, results from T2D prevention studies from India, Finland and the States clearly indicate that our current priorities should be focused on assessing the best strategies to implement a healthy lifestyle. However, cultural habits and beliefs vary between populations and therefore it will be important when designing lifestyle interventions to design them in accord with the religious, cultural and social norms of that society. There are also environmental differences between ethnic groups: for instance about 600 million people world-wide, including more than 90% of the local Bangladeshi population living in London (UK), chew the nut of the Areca catechu palm (betel). Current data suggest a relationship between betel chewing and both diabetes and the metabolic syndrome. In Taiwan betel chewing is associated with a 37% relative risk increase of T2D compared to non-chewers. In a study of parent offspring pairs the odds ratio for the metabolic syndrome to offspring from paternal betel chewing was found to be 2.5. Similarly in Bangladeshi’s living in London betel chewing is associated with increased waist size.

In the last part of my talk I would like to re-open the debate as to whether different forms of diabetes exist in developing countries. In a previous WHO classification of diabetes the term malnutrition related diabetes mellitus (MRDM) was adopted that consisted of fibrocalculus pancreatic diabetes (FCPD) and protein deficient diabetes mellitus (PDDM). There is now clear evidence that FCPD is a distinct entity with for instance 30% of cases from Bangladesh and India carrying a mutation of the SPINK1 gene. Emerging evidence might also support that PDDM can be associated with a 37% relative risk increase of T2D compared to non-chewers. In a study of parent offspring pairs the odds ratio for the metabolic syndrome to offspring from paternal betel chewing was found to be 2.5. Similarly in Bangladesh’s living in London betel chewing is associated with increased waist size.
A TRIP DOWN THE INSULIN-SIGNALLING PATHWAY

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Since our discovery that the insulin receptor is an insulin-stimulated protein tyrosine kinase, my laboratory has focused its attention on how this early signal is converted to the final effects of insulin on metabolism and growth, how insulin signaling is altered in insulin resistant states such as type 2 diabetes and obesity, and what the impact of genetics is on these functions. We have shown that following the activation of the receptor kinase, several intracellular substrates become tyrosine phosphorylated. The best studied of these are a family of high molecular weight proteins termed insulin receptor substrates-1, 2, 3 and 4 (IRS-1 thru -4). These phosphorylated IRS proteins serve as intracellular messengers by docking to other intracellular signaling proteins that contain SH2 domains. This links insulin to two major intracellular cascades – one mediated by the enzyme phosphatidylinositol 3-kinase (PI 3-kinase) and the other mediated by the Ras-MAP kinase pathway. This forms an important point of diversion in insulin signaling and several potential points of regulation in disease. Using a wide range of genetic and biochemical approaches, as well as cellular, animal and human systems, my laboratory is attempting to define the specific pathways that lead to specific insulin actions and how they are modified in insulin resistant states. We are also attempting to identify genetic alterations which might contribute to the development of type 2 diabetes in humans and rodents, by gene expression using Affymetrix microarray analysis, proteomics and other techniques. In this work we have defined the roles of each of the IRS-proteins and isoforms of PI 3-kinase in insulin signaling and insulin resistance through the creation of cell lines and animal models in which these proteins are either eliminated by a genetic ‘knock-out’ or increased by overexpression. This also includes studies utilizing the technique of tissue specific gene inactivation to determine the role of insulin in various tissues of the body, including classical target tissues for insulin action such as liver, muscle and fat, as well as non-classical targets such as the brain and beta cell. We have also defined many of the mechanisms of insulin resistance, including the role of serine phosphorylation of insulin receptor and IRS-proteins; the SOCS proteins as inhibitors of insulin action; and the biology of adipocytes and their special role in insulin resistance. Most recently we have dissected insulin signaling in control of gene expression utilizing microarray analysis and the genetic models we have created to dissect insulin vs diabetes regulated events. In addition, we have used this approach to

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determine differences in visceral and subcutaneous fat that may account for the link between central obesity and insulin resistance.

DIABETES AND MITOCHONDRIA

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A characteristic of skeletal muscle in type 2 DM as well as obesity is a reduced oxidative enzyme capacity. An emerging body of data indicates this is due to mitochondrial dysfunction, which may contribute to muscle insulin resistance (IR), its capacity for fat oxidation and to the accumulation of skeletal muscle lipid content. These findings will be discussed including observations changes in the morphology of mitochondria and an especially sparse content of the sub-sarcolemmal population of mitochondria. The second portion of this lecture will examine the effects of physical activity intervention in obesity and type 2 DM on muscle mitochondria and with relation to insulin resistance, and compare effects of weight loss versus those derived from physical activity. These findings support the concept that there is a substantial acquired component to mitochondrial dysfunction that is amenable to intervention.

PATHOGENESIS OF DIABETIC COMPLICATIONS AND THE DESIGN OF NEW TREATMENTS

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Complications of diabetes affect many organs including the retina, kidney, heart, brain, peripheral limbs, nerves, arteries and even periodontal tissues. The major initiating factors causing these pathologies in diabetes are insulin deficiency or resistance and hyperglycemia. There are many other metabolic factors or glucotoxins derived from hyperglycemia and lack of insulin action also can cause adverse effects in these wide range of tissues. Interestingly, these systemic metabolic factors do not cause pathologies in all organs, for example the pulmonary vascular bed does not exhibit obvious pathologies even though it is densely vascularized as compared to the retinal circulation. Another example is that diabetes induces an increase in angiogenesis in the retina as opposed to a decrease in vascularization in the heart and the peripheral limbs. Therefore, local tissue responses to metabolic factors such as hyperglycemia are equally important in the manifestation of diabetic complications as systemic abnormalities. Thus, it has been very difficult to formulate a single mechanism that could explain all complications of diabetes.

“...does an excellent job in covering this important topic and will be useful to practitioners in both medical and surgical specialities.”

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However, recent studies to understand the adverse effect of hyperglycemia have taken advantage of developments in vascular cell biology and the use of cultured specialized vascular cells in order to determine the biochemical mechanisms which are mediating the adverse effects of elevated glucose levels in vascular cells cultured from retina, kidney, heart and peripheral heart vessels. The results from these studies have provided support for several mechanisms that have described the formation of metabolites of glucose which may be toxic for vascular cells. These glucotoxins include advanced glycation products, oxidants and osmolites such as sorbitol. Equally important to the formation of glucotoxins, hyperglycemia also has been shown to alter cellular signaling pathways such as protein kinase C (PKC), MAP kinases and PI3K/Akt cascades, which can cause vascular cell dysfunction, apoptosis and specific pathologies in a variety of vascular and cardiovascular tissues. New therapeutic agents have been designed to neutralize glucotoxins as well as to normalize signaling kinases in order to stop, reverse and prevent various forms of diabetic complications. Results from clinical trials using PKC inhibitor, ruboxistaurin, have recently yielded positive results to prevent loss of visual acuity in diabetic patients with macular edema.

The development of PKC isoform inhibitor as a new treatment of diabetic microvascular complications supports the idea that hyperglycemia induced changes in cell signaling is an important cause of diabetic complications. In addition, therapies to prevent and stop diabetic vascular complications are possible even in the presence of hyperglycemia.

WILL STEM CELLS PROVIDE THE CURE?

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Recent improvements in the success of islet transplantation therapy for the treatment of type 1 diabetes have provided critical proof of principle that cell replacement therapy can allow liberation from insulin injections and freedom from hypoglycaemia in those with type 1 diabetes. This is exciting progress; however, this success has also highlighted a crippling shortage of donor material, with existing rates of organ donation sufficient to transplant less than 1% of people with type 1 diabetes. This is further complicated by the knowledge that more than one donor is required to provide sufficient purified islets for a single recipient to stop insulin injections. As a result of these shortages of donated material, there is an overwhelming demand for new sources of insulin-producing cells and a world-wide research effort is underway to develop novel and abundant sources of transplantable glucose-sensing insulin-producing cells. Much of this effort over the last five years has focused on the huge potential of stem cells.

The exciting potential of recent advances in stem cell biology for many current fields of regenerative medicine lies in the extraordinary flexibility of these cells, which are both self-renewing and capable of developing into a multitude of adult cell types. In the quest to generate abundant and renewable sources of insulin-producing cells, many novel and innovative approaches have been pioneered over the last five years. These include work with immature starting cell populations such as embryonic stem cells (ESC) and stem cells from bone marrow or umbilical cord blood. These cells are both self-renewing and, under the right conditions, are capable of giving rise to many different adult cell types. Continually improving protocols are being developed to drive these cells towards the formation of insulin-producing cells. However, success is not limited to cells of embryonic or developmental origin. Recent success has also come from studies on more mature adult stem cells (ASC), from organs including the pancreas, the liver and the spleen. Driving the formation of insulin-producing cells from adult stem cells may offer a number of advantages and this is an area of world-wide research interest at present.

Whatever the starting cell type, there are many challenges facing researchers at present. To generate cells which can be safely utilised in transplantation, the highest standards of efficacy and safety must be met. Firstly, on a functional level, generated cell populations must have the capacity to sense changes in blood glucose concentrations and respond efficiently by secreting active insulin. Cell populations must be capable of growth and expansion in laboratory culture to generate useful numbers and must have an optimised lifespan, but at the same time must have controlled growth when transplanted, to avoid tumour formation. Optimised cell populations would also ideally be able to avoid immune destruction when transplanted. Lastly, cell populations must be grown under critically controlled conditions in the laboratory, free from any animal products or microbiological contaminants. Each one of these demands represents a significant challenge to researchers in the field. However, these challenges must be met if we are to utilise the extraordinary opportunity that stem cells represent. Here, we will assess progress over the last five years and critically evaluate the potential of stem cells to provide an abundant and renewable source of insulin-producing cells for transplantation therapy for the treatment of type 1 diabetes.
WHEN AND HOW TO INVESTIGATE THE DIABETIC PATIENT FOR CORONARY HEART DISEASE

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The number of adults with diabetes worldwide is predicted to increase from 135 million in 1996, to more than 300 million by 2025 and this is likely to be followed by an epidemic of coronary heart disease (CHD). Much of this CHD burden will be subclinical until it presents without warning as sudden death, myocardial infarction, cardiac failure, or arrhythmia.

Previously, a diagnosis of CHD made through screening of asymptomatic people with diabetes led to important additions to medical therapy such as aspirin and statin medication. Today, such a preventive strategy is indicated following a diagnosis of diabetes alone. The other reasons often cited for screening included the institution of anti-ischaemia medications such as beta-blockers and the consideration of revascularization if unexpected extensive CHD was discovered. However, it is unclear even today, what the benefits of these latter two interventions are in asymptomatic patients with diabetes and whether screening is currently justified. This talk will examine what is known about asymptomatic CHD in diabetes, and describe the changing role of CHD screening as reflected by the screening guidelines. Aggressive medical therapy can be justified in most subjects with diabetes, but there may be some higher-risk asymptomatic patients who could benefit from revascularization and/or medical therapy for myocardial ischemia. Silent myocardial ischemia (SMI) might be used to identify these high-risk individuals.

In the general population, angina is the first manifestation of CHD in about half the individuals – the remaining subjects present, without warning, with myocardial infarction or sudden cardiac death. In subjects with diabetes, the proportion with CHD who present with angina is similar but a presentation with sudden death is more common. The primary prevention of myocardial infarction is of paramount importance in diabetes because subsequent death and heart failure are significantly increased when compared with the general population. The case for CHD screening in diabetes is also supported by the fact that symptoms are a particularly unreliable guide to CHD severity and ‘total ischemic burden’ when compared with the general population. The reasons for this are debated, but it is likely that cardiovascular autonomic neuropathy, accelerated atherosclerosis, altered central pain perception, and possibly increased positive coronary artery remodeling in diabetes play significant roles.

A SCIENTIFIC APPROACH TO PREVENTING AND TREATING DIABETIC FOOT DISEASE

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Introduction. The social deprivation and inaccessibility to health care does account for the difference between diabetic foot management in developed and underdeveloped countries. A programme focusing on the organization of diabetes care was initiated in Brazil to establish diabetes teams. However, foot problems received no emphasis. The National Health System (DataSUS) does not register amputation causes: available data come from isolated hospital studies and costs are also underestimated. Lack of podiatrists, scarce resources, foot problems, and poor knowledge among health professionals were also a problem.

Objectives. To implement the Save the Diabetic Foot Project to 1) persuade the policy-makers to understand the huge impact; 2) train professionals in foot examination techniques and care; 3) implement a specialist diabetic foot clinic; and 4) spread the project to other Brazilian states to reach amputation reduction.

Material and methods. An outpatient foot clinic was implemented with the local government agreement without sophisticated procedures. Main tools available were 10g monofilaments, tuning forks, simple mats. Mandatory removal of shoes/sandals to detect those at risk being the key message. Two day foot workshops based on the British experience were the training approach for local and other Brazilian states health professionals (doctors and nurses) after previous selection in order to initiate the process of foot clinic national set up according to the International Consensus Practical Guidelines.

Results. Nearly 9 000 professionals have participated in the 39 workshops from the period of 1992 to 2006, which have been conducted on annual basis since 2001 and linked to national scientific meetings (Brazilian Endocrinology and Diabetes Societies). A significant increase in foot clinics has been reached: from only one in 1992 to 66 in 2006. Practical Guidelines pilot implementation has been analyzed among 302 records from 3 sites in Brasilia showing 26% with loss of protective sensation, 57.7% at the hospital had had an ulcer and 9% at the health centres. Inadequate footwear was found among 35.8% at the Federal Senate foot clinic and 65.5% at the reference hospital and health centre. A retrospective analysis (1989-1991) showed 45% of the amputations registered among diabetic patients. From 1992-2000, there was a 77.8% trend towards reduction. A true interdisciplinary cooperation has been verified when
Compared to the basic team and vascular surgeons, daily support is available. Major amputation has kept reduction trends although minor amputations have increased. The diabetic foot centre inauguration linked to the orthotics and prosthetics department (1999) spread insole provision to other 6 regional foot clinics: from 198 (1999) it reached 6 279 (2005).

**Discussion.** Problems remain: public hospital peripheral arterial disease management is still dramatic due to lack of vascular surgeons and resources. Provision of a better structure and implementation of simple planter pressure evaluation and casting clinics at the established foot clinics is crucial. Extension of training to the initial number of 4 000 basic care health professionals is still on plan grounds by the Ministry of Health.

**Conclusion.** The Save the Diabetic Foot Project has had notable achievements which have contributed to change the foot problems concerning perception and management in Brazil and inspired other Latin American countries. No sophisticated plan was ever made and the crucial approach was education of health professionals involving general clinicians, specialists and nurses from Amazonian states, underdeveloped areas of north, northeast and centre-west to the more developed areas in the southeast and south of Brazil. The lesson of interdisciplinary management and prevention has been learned by many of them and certainly will help the patients to be given the opportunity to receive a proper foot care.

THE ART AND SCIENCE OF DIABETES EDUCATION

**A Philotheou**

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Education has been the liberating process enabling people with diabetes to participate fully in their long term health and happiness. To realize their human potential they are required to adjust to the metabolic demands of their condition, balance the various aspects of their life as well as overcome society’s attitudes of ignorance and discrimination. Implicit in this process is the role of the diabetes educator who, within the wider context of a skilled and caring team, seeks to empower them and bring forth their courage and will to change. This presupposes a willingness on the carers’ part to accept the reality that patients, within their own sociocultural background, are trustworthy and capable of making self-management choices and, moreover, are responsible for these choices.

Embracing such philosophy requires a critical change in the axis of our scientific thinking, from the acute biomedical model and vertical education to a more daring biopsychosocial equal-partners concept and practice with emphasis on life issues and interactive learning. Whereas many professionals would hesitantly shy away from their patients’ intricate life complexities, responding instead with a preprogrammed quick-fix solution (at times supplanted by automated voice-mails or computer generated algorithms), enlightened educators might use additional or alternative dimensions without in any way negating the value of the scientific basis of modern therapies. Strict reliance on the biomedical model of diabetes, undoubtedly essential in bringing relief from present and future suffering, tends to oversimplify the illness experience.

Additional skills, not traditionally included in professional curricula, could be learnt from the domain of human sciences and the arts to complement our basic scientific and reductionist training. Guidelines, thresholds values, target goals, GI indices, carb counts, basal rates, corrective doses ... delivered in prescriptive fashion are indeed important and appreciated by many. The challenge remains, however, how to bridge the gap between this abstract, non-visual theoretical knowledge and something more familiar, closer to the heart, more developmentally and culturally appropriate. Most health professionals are aware of the need to grasp the concept of ‘wholeness’, of the unique identity of the person with diabetes living in an alienating world with the prospects of illness, discrimination, disability and handicap looming ahead.

How do we translate this awareness into action? A method more applicable to developing the attitudes and skills necessary to cope with the daily challenges of a life with diabetes might be well worth exploring. What forms of human expression can support the daunting task of learning to live with a demanding, restrictive and relentless life-long condition threatened by the ever present fear of acute and chronic complications? Story telling, subjective experiences as expressed by the patients themselves, metaphors, poetry, painting, music, meditation: these art forms have remained immutable since ancient times and yet are eternally alive at the image of humanity and its emotional needs. The cognitive power of the metaphor as a teaching aid, ‘connecting’ the educator exuding confident rational knowledge and the hesitant learner on unfamiliar territory, plays a unique role in all cultures and socioeconomic levels. In whichever form they take place, one-to-one or group communication, in a village under a tree, in a high-tech consulting room or on a computer screen, shared experiences and a more vivid ‘imageability’ and learning offer, to both learner and teacher, different ways of understanding the diabetic life. Intertwoven with either strictly taught strategies or even impersonal handouts, such methods may have a greater chance of succeeding in bridging that gap.
The symbol of the Yin and Yang, depicting the perfect balance between the interactions of opposites in the universe, will guide this discussion highlighting some of the ethical principles of Taoism and the mutually interdependent roles of the arts and sciences in the field of diabetes education. The questioning of some of our biomedical certainties will hopefully not provoke misunderstanding and mistrust but rather encourage open-mindedness and even the quest, on this continent, to associate the best of our modern science with the concepts of health and illness within the framework of traditional African culture.

**AMP KINASE: WHAT HAVE WE LEARNT?**

**N Ruderman**

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AMP-activated protein kinase (AMPK) plays a major role in the regulation of cellular lipid and protein metabolism in response to such stimuli as exercise, changes in fuel availability and various hormones including leptin and adiponectin. Recent studies indicate that abnormalities in cellular lipid metabolism are involved in the pathogenesis of the metabolic syndrome, possibly because of dysregulation of AMPK and a closely related molecule malonyl-CoA. In keeping with this notion, treatments that activate AMPK (exercise, caloric restriction, AICAR, thiazolidinediones and metformin) have been shown to reduce or prevent components of the metabolic syndrome in humans and experimental animals. In addition, AMPK activation has been shown to inhibit fatty-acid induced inflammation, oxidative stress, and mitochondrial dysfunction (pathogenetic factors for the metabolic syndrome) in cultured cells. An increasing body of evidence has also linked AMPK to various cancers. Thus, it has been demonstrated that the tumor suppressor LKB1 is perhaps the major upstream kinase that phosphorylates and activates AMPK, and that another tumor suppressor, tuberous sclerosis complex 2 (TSC 2), is phosphorylated and activated by AMPK. In addition, AMPK inhibits the mammalian target of rapamycin (mTOR), an enzyme implicated in the pathogenesis of both insulin resistance and certain cancers. The relevance of these findings is suggested both by the increased abundance of enzymes down-regulated by AMPK, such as acetyl-CoA carboxylase (ACC), fatty acid synthase and mTOR in various prostate cancer cells and the observation that activation of AMPK both diminishes the abundance of these enzymes and impairs the growth and survival of these cells. Whether other cancer cells with a similar enzymatic makeup are equally sensitive to growth inhibition by AMPK remains to be determined. Also requiring study is whether dysregulation of AMPK could contribute to the increased prevalence of certain cancers in people with the metabolic syndrome.

**CARDIOLOGICAL ASPECTS**

**L Rydén**

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Despite improvement in the treatment of cardiovascular disease there is evidence that individuals with diabetes have not gained the same benefit as their non-diabetic counterparts. In fact the relative impact of diabetes on cardiovascular mortality is steadily increasing. Cardiologists seem more focused on measures directed towards the manifestation of the cardiac condition and do not fully appreciate the need for simultaneous interactions directed towards the underlying metabolic disorder to reach full effect of the therapy for the cardiac disorder. Diabetologists have succeeded in improving treatment for insulin dependent diabetes mellitus.

As regards non-insulin dependent diabetes increased attention has lately been devoted to therapeutic measures that may decrease the risk for cardiovascular complications, but there is still a need for considerable improvement. Enhanced cooperation between diabetologists and cardiologists is a key to success in this respect. The prevalence of type 2 diabetes, about 90% of the diabetic population, increases rapidly due to an ageing population in combination with increasing overweight and decreased physical activity. The increasing prevalence suggests a considerable rise in diabetes related cardiovascular disease in the near future.

It is not only overt diabetes that relates to an enhanced risk for cardiovascular disease. This risk increases continuously throughout a wide spectrum of glycaemia, starting already at levels that, according to present definitions, are considered as normal. The proportion of patients with known diabetes is around 20-25% among people with acute or stable manifestations of coronary artery disease. The actual proportion of impaired glucose tolerance or previously undetected diabetes is, however, considerably higher amounting to around 60%. Screening for diabetes and hyperglycaemia, by means of oral glucose tolerance testing, is therefore recommended in such patients.

In the present coronary care setting it seems that evidence-based treatment of acute coronary diseases in patients with concomitant diabetes is under-utilised. Moreover there is a considerable discrepancy between recommended treatment targets and actual management of traditional risk factors, in particular hypertension and hyperlipidaemia among diabetic high risk patients. It may be assumed that an improved application of established treatment modalities would improve the outcome for the diabetic patients, however, only to a certain extent. Diabetes-specific disturbances, including hyperglycaemia and a decreased thrombolytic capacity, are certainly...
important contributors to the high morbidity and mortality that follows diabetes and impaired glucose tolerance. The potential for interaction with these disturbances by means of metabolically directed treatment will be reviewed.

A limitation when issuing preventive and/or therapeutic recommendations is lack of data from trials on accurately characterised diabetics. Prospective stratification of diabetic patients in large clinical trials and documentation of their glucose lowering treatment and metabolic characteristics or, even better, studies on pure diabetic populations are sparse. This is astonishing in the light of the increasing commonness of diabetes mellitus and the high prevalence of diabetic patients among those with manifestations of coronary artery disease. It should encourage further research in this field.

THE POLITICS OF OBESITY

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Cardiovascular disease (CVD) is the major cause of death and disability in the Western world, for both men and women. Half of the European population dies from CVD. Most alarmingly, 30% of those who die from CVD do so under the age of 65. Risk factors for CVD are well identified, which means that the burden of CVD can be reduced if prevention action focuses on the main risk factors. These risk factors are the same on all continents and among people of all ethnic groups, men and women alike. Most of them interact with each other, rapidly increasing the risk if they are more than one or two. Pending concerted actions, they are all possible to effectively counteract, many of them indeed in a fairly easy way. From a societal perspective efforts directed against several of these risk factors are cost effective. Diabetes is a major risk factor for CVD and overweight and lack of physical activity are strong risk factors for diabetes and thereby also for CVD.

Call for joined professional and political activities

The medical profession alone cannot handle the problem of CVD. This fact was the most important background to the need for a Heart Plan for Europe as proposed by the European Society of Cardiology (ESC). The document outlines specific objectives on how the incidence of CVD in Europe can and must be reduced. Importantly it is heavily underlined that cardiovascular health must be addressed within the framework of a Public Health Action Programme, thereby necessitating strong political collaboration.

Under the Austrian EU Presidency, early 2006, a declaration on diabetes with a similar aim was issued and accepted. It was called upon by collaborative initiatives of the European Association for the Study of Diabetes and the Austrian Ministerial Department of Health. This plan underlines the great and rapidly increasing burden of diabetes much related to increasing overweight and lack of physical activity.

Many of the preventive issues raised in this document are of a similar kind as those in the European Heart Health Plan. This is not astonishing considering the great impact of, in particular, type 2 diabetes on the development of macrovascular disease. Moreover prevention of cardiovascular disease must in itself incorporate a great effort to improve the general management of diabetic patients.

Promoting Heart Health – a European consensus

In 2004 and 2005, the Council of Health Ministers of the European Union (EU) adopted conclusions on cardiovascular health as agreed on by experts in cardiology, health promotion and public health with the European Commission, the European Heart Network and the European Society of Cardiology as main stakeholders. The Health Council called upon Member States to include heart health promotion in their national public health strategies and invited the European Commission to promote cardiovascular health in the framework of the Public Health Action Programme. The content of the Council Conclusions covers all aspects of heart health promotion, from further research in the field of cardiovascular prevention in a broad sense over population preventive measures to high risk prevention.

Continued efforts and enhanced collaboration of diabetologists and cardiologists will be very helpful in accomplishing the plans made and agreed upon.

GLOBAL EPIDEMIOLOGY OF TYPE 1 AND TYPE 2 DIABETES

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Type 1 diabetes (the predominant form in the young) accounts for about 5 - 10% of the total burden of diabetes. There are large geographical differences in incidence, the highest incidence being reported from Northern Europe (30 - 49 cases per 100 000 per year) and the lowest in China and Venezuela (0.1 case per 100 000 per year). Nine of the top 10 countries with the highest incidence are in Europe or in populations of European origin.

Children: It is estimated that annually some 70 000 children (< 15 yrs) develop type 1 diabetes worldwide. More than a quarter of the approximately 440 000 prevalent cases (average prevalence is 0.02%) come from the South-East Asian (SEA) region and more than a fifth from the European (EUR) region. The incidence is increasing in many countries with an overall annual increase at around 3%, but more steeply in some of the low prevalence countries such as in Central and Eastern Europe, and in relative terms the increases are
greatest in young children. Boys and girls are equally affected with a male excess in the high incidence populations.  

Adults. From studies reporting up to the age of 35 years it seems that the incidence in older age groups is lower than that in the 0 – 15-year age range and it is not increasing. An increased male to female sex ratio is seen in this age group.  

Type 2 diabetes. Type 2 diabetes accounts for at least 85 - 95% of all diabetes.  

Children. There is little information on type 2 diabetes incidence and prevalence, most surveys being clinic-based or case series and not population-based. Ethnicity plays a major role in both adults and children, with higher rates in indigenous people (USA, Canada, Australia), Africans, Americans, Asians, Hispanics and Pima Indians. In Europe, type 2 diabetes still accounts for only a few per cent of all cases of diabetes (clinic-based studies). There is a female preponderance and a strong family predisposition.  

The typical age of onset of type 2 diabetes in children is around puberty coinciding with the rise in insulin resistance associated with puberty. Prevalence rates increase with age and with increasing level of obesity. 5 - 25% of obese children and adolescents have been found (OGTT) to have IGT and 2-4% silent type 2 diabetes.  

Adults. Reported estimates are to be cautiously interpreted because of limitations including different screening and diagnostic criteria, etc. Many surveys including the IDF Atlas 2006 report prevalence estimates for type 1 and type 2 diabetes combined for adults aged 20 - 79 years. As in type 1 diabetes there are large geographical differences in the prevalence among populations (about 1 - 40%). The average prevalence is approximately 5 - 6% worldwide, which translates into some 230 million people with diabetes.  

Higher rates are reported in migrant or urbanized populations (diabetogenic lifestyle factors) and lower rates in rural communities (lifestyle with high level of physical activity). The prevalence is highest in the 40 - 59-year age group and the lowest is in the 20 - 30-year age group, and there is a female predominance.  

Predictions 

Type 1 diabetes. With the present rate of increase, the incidence will double in 20 - 25 years, affecting younger and younger children.  

Type 2 diabetes. The worldwide prevalence estimate by 2025 is predicted to reach nearly 7% of the adult population.  

The continued mapping of the epidemiology of diabetes is essential for health care planning and in the fight against this major chronic disease.

METABOLIC ASPECTS 

E Standl 

Deutsche Diabetes-Union E.V., München, Germany 

The aetiology of the metabolic syndrome has not yet been fully established. For most patients, the root causes of the syndrome are thought to be poor nutrition, inadequate physical activity, and subsequent increases in body weight. Obesity is associated with insulin resistance and the syndrome’s cluster of other metabolic disorders. However, there are many interrelated factors that are thought to be important in the development of metabolic syndrome. There is a strong case for insulin resistance being the primary cause of metabolic syndrome. Insulin resistance correlates with visceral fat measured by waist circumference or waist-to-hip ratio. 

The link between insulin resistance and cardiovascular disease (CVD) is probably mediated by oxidative stress, which produces endothelial cell dysfunction, promoting vascular damage and atheroma formation. In fact, the terms metabolic syndrome and insulin resistance syndrome are largely interchangeable. Risk for CVD is particularly increased when diabetes is present in patients with the metabolic syndrome. Most men and women with type 2 diabetes and metabolic syndrome can be classified as being at high absolute risk for major cardiovascular events (30% events and more over 10 years), particularly when they have other CVD risk factors. 

The overriding goal for therapy of metabolic syndrome is therefore not only to prevent diabetes, but also to reduce cardiovascular risk. According to the American Diabetes Association and the Third Adult Treatment Panel, the starting point for treatment is therapeutic lifestyle changes. However, treatment must address the multipathological process of metabolic syndrome, with each component identified and aggressively targeted.

Invited Speakers – Diabetes in Africa 

NPHROPATHY 

A Twahir 

Parklands Medical Centre, Nephrology, Dialysis and Transplantation, Nairobi, Kenya 

The prevalence of diabetes in African communities is increasing with ageing of the population and lifestyle changes associated with rapid urbanisation and westernisation. Traditional rural communities still have very low prevalence, at most 1-2%, except in some specific high-risk groups, whereas 1-13% or more adults in urban communities have diabetes. Due to the high urban growth rate, dietary changes,
reduction in physical activity, and increasing obesity, it is estimated that the prevalence of diabetes is due to triple within the next 25 years. In addition, nephropathy occurs early in the course of diabetes and affects a high proportion of patients, probably higher than in other regions. This could partly be explained by the uncontrolled hypertension, poor metabolic control and possible ethnic predisposition.

The combination of the rising prevalence of diabetes and the high rate of long-term complications in Africans will lead to a drastic increase of the burden of diabetes on health systems of African countries. The design and implementation of appropriate strategy for early diagnosis and treatment, and population based primary prevention of diabetes in these high-risk populations is therefore a public health priority.

Greater prevalence of diabetes complications has been reported in populations of African origin compared with Caucasians. Genetic predisposition has been suggested as a possible explanation but has never been confirmed. High blood pressure and impaired metabolic control are among the main determinants of the progression of diabetes vascular complications. The prevalence of hypertension is high in populations of African ancestry and is frequently inappropriately controlled. Similarly, inadequate blood glucose control is frequently reported, due to poor compliance and/or difficult access to appropriate care, and affordability of treatment in difficult socioeconomic environment. Although genetic predisposition may not be ruled out, blood pressure and blood glucose control are major confounders.

Incipient nephropathy is reported in 32 - 57% of patients with mean known duration of diabetes of 5 - 10 years in some hospital-based studies. Overt proteinuria is reported in 5.3 - 28% of the patients, and increases with diabetes duration. Once patients develop overt nephropathy they rapidly progress to end-stage renal failure. One third of the patients admitted to most dialysis units in Africa have diabetes. Dialysis units are only available in a few African countries and even then they are not accessible to all who need them. Kidney transplantation has started in a few African countries; however, since the drugs are still very costly this mode of renal replacement therapy is restricted to only a few. A few patients are still traveling to countries overseas especially India for renal transplantation.

Thus, diabetes will represent a heavy burden on health systems in the years to come, mainly due to its high prevalence, and its acute and long-term complications. The design and implementation of a strategy for early diagnosis and appropriate population-based prevention program is therefore a public health and economic priority.

STEP BY STEP FOOTCARE PROJECT IN TANZANIA

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Background. The prevalence of foot complications is increasing among diabetic patients in Tanzania and is associated with significant morbidity and mortality, and increased healthcare costs. Data from Tanzania indicate (i) 70% of all lower limb amputations are related to underlying diabetes foot disease; (ii) 33% of diabetic inpatients with foot ulcers undergo amputation during their hospital stay; and (iii) there is a 54% mortality rate among patients with ulcers, who delay presentation to hospital. However, until recently, there has been no sustainable infrastructure for diabetic foot management in Tanzania. Compounding the problem is the lack of trained personnel and formal podiatry services in Tanzania. For all these reasons, the ‘Step by Step’ Foot Project was initiated.

Objectives. (i) To provide sustainable training of healthcare professionals in the management of the diabetic foot.
(ii) To facilitate the transfer of information and expertise from healthcare professionals who have undergone training to other healthcare professionals.
(iii) To reduce the risk of lower limb complication in persons with diabetes.
(iv) To educate people with diabetes to take better care of their feet, to detect problems earlier, and to appreciate the importance of seeking help in a timely manner when problems arise.

Methods. The Project consisted of two components:
(i) An educational training program in which a basic 3-day course was given to medical doctors and nurses followed one year later by a 3-day advanced course, held at the same venue, for the same participants; and (ii) an applied project conducted during the interim year between courses in which course participants would conduct a screening project related to the diabetic foot. Project-related activities during the interim year were evaluated after the second course. In the basic course, medical doctors and nurses were taught how to obtain a relevant history, perform physical examinations, screen for peripheral neuropathy and ischaemia, classify and stage foot ulcers, and having identified at-risk patients, how to organize and implement appropriate and timely foot care and education for these patients. In addition participants were provided diagnostic kits that included equipment necessary for foot care. The expectation was that following the course, participants would educate their patients and disseminate the acquired knowledge and skills to other health care professionals in their respective regions.
Results. A total of 15 pairs of medical doctors and nurses from 14 regions across the country participated in the Step by Step Project: the first and second courses were held in 2004 and 2005, respectively. During the interim, 11,583 patients were screened in the 14 regions; 4,322 (37%) were identified with various foot complications, including 465 (11%) with foot ulcers. Among patients with foot ulcers, 42 (9%) underwent amputation, and 17 (4%) subsequently died. Moreover, we documented marked dissemination by course participants of acquired knowledge and information to other personnel in the respective regions.

Conclusion. Institution of the “Step by Step” Foot Project resulted in improved foot ulcer management for diabetic patients in 14 regions in Tanzania and a reduction in the number of documented lower limb amputations. We also demonstrated that for diabetic patients with high-risk feet, amputation or death could be circumvented through a “Step by Step” program of education of healthcare providers and patients allied with dissemination of information to other healthcare professionals involved in patient care. In addition, early detection and treatment of diabetic foot complications through targeted screening programs, such as the one carried out in this Project, has vast potential to reduce morbidity and mortality and improve patient outcomes. More efforts are required to increase awareness of diabetes and its complications amongst healthcare workers and patients.

DIABETIC FOOT IN AFRICA
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Foot complications are a major public health problem for African diabetes patients, and are the main cause of prolonged hospital admission and an important cause of death. Most of the published data on diabetes foot complications in Africa, however, consist primarily of descriptive studies of populations from various parts of the continent. However, because of non-uniform case definitions, varying diagnostic and classification criteria, and reporting inconsistencies, z trans-continental comparisons of these patient populations have not been feasible.

Ulcers are the most common foot complication in African diabetes patients; ulcer prevalence rates range from 4% to 19%. Peripheral neuropathy (PN) rather than peripheral vascular disease is the principal underlying risk factor in the pathogenesis of diabetic foot ulcers in Africa. The prevalence rates of PN have been documented in several studies across the continent and range from 4% to 84%. Foot ulcers can progress to infection, necrosis, gangrene, loss of the limb, or death. In addition, many of the affected patients present to hospital when gangrene of the foot is already established, at which point sepsis may remain intractable to conventional supportive treatment with parenteral antimicrobials, intravenous fluids and insulin.

The gangrenous diabetic foot requires aggressive management. Data from Muhimbili National Hospital (MNH) in Tanzania suggest that surgical intervention after the onset of gangrene may be too late to significantly reduce the attributed mortality rate. MNH data also suggest that the highest mortality rates (54%) occur among patients with foot ulcers of Wagner severity score &gt;=4, who do not undergo surgery. For the African continent, mortality rates associated with gangrene vary: 9-55%. In conclusion, prevention and control programs are needed to stem the rising complications associated with the diabetic foot in Africa. Early presentation by patients and prompt surgical intervention during less severe rather than during later stages of an ulcer may improve patient outcome and reduce mortality rates.

MACROVASCULAR COMPLICATIONS
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Diabetes is increasing in the world. By 2025, it is estimated that over 300 million individuals will have diabetes, with most of the expected increase occurring in developing countries. Cardiovascular complications are now the leading cause of diabetes related morbidity and mortality in advanced economies. The macrovascular complications of diabetes include coronary artery disease, stroke and peripheral arterial disease. These conditions are generally similar in subjects with and without diabetes. The main difference with respect to diabetes status is their increased frequency in diabetes. Furthermore, atherosclerotic disease develops at a younger age in diabetes, particularly if renal disease also occurs. Atypical presentation such as atypical angina and congestive heart failure, are however, more common in individuals with diabetes. Moreover, mortality from first or subsequent myocardial infarctions is higher in subjects with diabetes than those without.

Diabetes is associated with a two to fivefold risk of peripheral artery disease and stroke. Subjects with type 2 diabetes, often as part of the metabolic syndrome, also have other cardiovascular risk factors including abdominal obesity, hypertension, dyslipidaemia, a prothrombotic state and insulin resistance. Independent of these risk factors, diabetes is also a major risk factor for macrovascular disease.

Sub-Saharan countries are undergoing health transition with rise in chronic diseases consequen
to explore the role that traditional healers play in diabetes care, which makes the clinical rhetoric of ‘compliance’ to diabetes care stringent, frustrated and often fruitless in Cameroon today in order to suggest an approach that will help health care providers cope with the pressure from traditional medicine (TM).

**Methods.** This study was conducted as an extended comparative ethnography, in Yaoundé and Bafut in Cameroon from 2001 to 2003. TH, people with diabetes and their families were the main participants. The method entailed participant observation involving observations, conversations, interviews, case studies and focus group discussions. Ethnomethodological analysis was used to produce the ethnographic accounts.

**Results.** The very terminology of ‘traditional healers’ after all, asserts a familiar dichotomy of modern biomedicine versus unmodern, traditional healing practices. The constant tussle between the claims of biomedicine and traditional medicine enacted in the lives of those diagnosed as diabetic forms the heart of the rhetoric about diabetes care in Cameroon. When symptoms and episodes of diabetes are revealed, and because biomedicine proposes control, there will always be relatives and neighbours to urge the possibility of dealing with the problem instantly. Even where diabetes is fully acknowledged as a condition requiring biomedical treatment, additional questions are habitually asked, and explanations offered by TH. Whatever the diagnosis taken by such a healer, a damaged social relationship is likely to be identified as the ultimate cause, exemplified through the harmful intervention of either an ancestor or more commonly, a witch.

TH in Cameroon implies a misleading uniformity of technique and therapeutic practice. Yet some form of divination is common to many of the varieties of indigenous healing practice: even a common distinction between herbalist and diviner obscures the fact that herbal treatments often go hand in hand with some form of divination. Many of those contacted in this research identified themselves as herbal specialists claiming to use herbs to cure diabetes. These distance themselves from the psychic or mystical powers which divination is assumed to rely upon. Their technique appeals to the more educated clientele. This category advocates a partnership with biomedicine. Yet whatever the approach to diagnosis taken by such a healer, a damaged social relationship is likely to be identified as the ultimate cause of diabetes, exemplified through the harmful intervention of either an ancestor or a witch. Without rituals to restore ancestral protection, or nullify the threat from witchcraft, there can be no final restoration to health, no ‘cure’. In this respect, diabetes is like many other diseases, one of numerous possible vehicles for manifesting damaged relationships, and equally as amenable to restorative treatment.
Discussion. The plurality of traditional healing practices has a long history, but in part at least the current diversity owes something to the engagement of certain practitioners with the influence of biomedicine. Certain traditional healers are not set in their ways, and may indeed have a part to play within a ‘modern’ system of public health in Cameroon. Yet relevant as it is to explore these ambiguities around modernity, the undeniable fact is that biomedicine and indigenous medicine remain in a state of tension that seems highly likely to persist far into the future. Whatever the strictures of health care providers, people will carry on alternating between the two frameworks of knowledge and practice. And they will do so because the promise of the TH has been and still is inherently appealing to most Cameroonians. So TH should be educated on their limits to caring for diabetes.

CONTINUOUS SC GLUCOSE MONITORING
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Several clinical trials and observations proved self-monitoring of blood glucose (SMBG) to be one of the prerequisites for achieving good metabolic control in people with type 1 or type 2 diabetes mellitus requiring insulin therapy. A prospective study demonstrated a significant positive correlation between the number of SMBGs per day and HbA1c (1). The same was demonstrated in a pediatric population with T1DM (2). Recently, more SMBGs per day were associated with a decrease in HbA1c in a randomized, controlled trial (3). It was therefore anticipated that continuous glucose monitoring would even further improve metabolic control of people with diabetes and allow them more freedom and flexibility.

Continuous glucose monitoring (CGM) was successfully used in clinical trials already fifteen years ago (4), however relative technical complexity prevented a more routine use. The use of modern CGM with the capacity of sensing for 72 consecutive hours and the possibility of a retrospective analysis of the glucose data improved metabolic control in randomized trials in adolescents with T1D (5), adults with T1D and T2D (6), and in follow-up studies in pregnant women with T1D (7). The next step were CGM devices with on-screen real-time glucose values, performing at acceptable accuracy and feasibility (8) and demonstrating positive effect on day-to-day management of diabetes (9). Finally, a randomized controlled trial with a real-time CGM device demonstrated a significant decrease of HbA1c in poorly controlled patients with T1D without a concomitant increase of hypoglycemia or weight gain (10).

A robust amount of clinical data and evidence places the monitoring of glycemia in the very center of diabetes management. More knowledge about blood glucose excursions clearly means better metabolic control. Real-time continuous glucose monitoring offers to people with diabetes a new clinically effective possibility, which nonetheless has to be further investigated, technically improved and will, hopefully, become more accessible also to those with less economic privileges.


STRATEGIES FOR HELPING A PERSON TOWARDS SELF-MANAGEMENT
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The person with diabetes must do over 95% of the management of diabetes on their own. As health care providers it is our responsibility to see that the person has the knowledge, ability and motivation to self-manage diabetes. We have to be able to “let go” and trust and encourage our patients to take on the management of the disease. This does not mean we send them off on their own, but that we provide initial and ongoing support and advice so that the patient can make appropriate choices as the need arises.

There are barriers to moving to a system where self-management is the norm. Barriers can be addressed in three areas, professional, patient and system barriers. Professional barriers are often around communication skills, attitude and approach to the educational component of diabetes care. For some health care professionals moving to patient self-management may mean redefining the approach they take with patients. No longer is it an exercise of telling people as much information as you can in one session because “the patient may not come back again”. But rather finding out what the patient wants to know and where he feels he is having the most difficulty. Too often in the past the health care provider has had an agenda and feels that in the time allotted the agenda items must be addressed no matter what. It has been shown that by providing patients the opportunity to set the agenda by asking questions or stating where they are past the health care provider has had an agenda and feels that in the time allotted the agenda items must be addressed no matter what. It has been shown that by providing patients the opportunity to set the agenda by asking questions or stating where they are.

For patients, some barriers may be access to knowledgeable health care professionals or lack of self-efficacy or belief that they can take charge of their own disease. Patients who have been given a choice and have had a say in goal setting are more likely to
self-manage and strive to meet goals that are their own. The health care professional has to recognize and address the patient barriers if self-management is going to work.

The health care system may also create barriers to self-management. Accessibility to knowledgeable health care providers, adequate time with providers for initial assessment and education and follow up are some of the possible barriers. As well a system that has strict requirements on what should be covered/done on each visit may lead to less than ideal individualisation of the education and care.

Health care professionals working in the diabetes field have the responsibility to address the barriers and help patients move to self-management of diabetes so that people with diabetes will be able to live full and productive lives.

NUTRITION AND DIABETES MANAGEMENT IN MALI

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Introduction

A 24-hour diet recall over 80 diabetics allowed us to observe that diets implemented in Mali are especially restrictive with a very low compliance. Accurate research activities on foods that were found out the most consumed by diabetics in the diet recall will permit to best adapt recommendations.

Methods

Stage 1:

11 participants without diabetes or under medical treatment were randomly selected. Each person was tested (fasting for 13 hours) twice during a week for each cereal.

Initially participants ingested 100g of white bread (50g of carbohydrate), as a reference: GI=100. Following this, each participant ate a quantity of each cereal equal to 50g of carbohydrates.

The first measure of glycemia at T=0 before the ingestion of the food (white bread or cereal). After ingestion blood glucose measurements, using the glucose oxidase method from capillary blood taken from the finger (Accu-Chek Active Roche), were taken at T = 15, 30, 45, 60, 75, 90, 105 and 120 min.

5 different cereals were tested (preparation method in Mali):
- Fonio (couscous)
- Millet (couscous, Tô)
- Maize (couscous, Tô)
- Rice (white)
- Sorghum (couscous, Tô)

Tô is a flour paste.

The area under the glycemic response curve was calculated using the FAO/WHO geometric mean. Results were compared using variance and a Student t-Test (P<0.01).

Stage 2:

10 participants without diabetes or under medical treatment were randomly selected. Each person was tested (fasting for 13 hours) twice during a week for each sauce. They ate a quantity of each cereal (rice) equal to 50g of carbohydrates with 12 cl of sauces.

5 different sauces were tested (preparation method in Mali):
- Arachide
- Saga saga
- Gombo
- Nadji
- Fakoye

Blood collections and test follow the same methodology than the one at the stage 1.

Results

Phase 1:

- Millet couscous (127,577 ± 19,796 ; 53,59 ± 7,13)
- Fonio couscous (135,584 ± 25,365 ; 56,95 ± 8,73)
- Sorghum couscous (144,855 ± 22,578 ; 60,84 ± 6,24)
- Maize couscous (153,475 ± 26,601 ; 64,47 ± 9,15)
- White rice (158,086 ± 26,840 ; 66,40 ± 7,00)
- Millet Tô (165,168 ± 26,793 ; 69,38 ± 5,55)
- Sorghum Tô (175,793 ± 35,231 ; 73,84 ± 11,64)
- Maize Tô (182,794 ± 30,503 ; 76,78 ± 8,28)

Phase 2:

- Fakoye (108,037±22,489)
- Arachide (159,819±28,518)
- Saga saga (95,878±33,803)
- Gombo (126,060±20,702)
- Nadji (113,609±35,535)
Conclusion

These results enable hypotheses to be formed:

• Foods with low GI such as millet and fonio couscous seem to be better indicated for diabetic patients.

• All the types of tô must be less consumed in order to avoid an important rise of the glycaemia.

• No cereals are misadvised, it is necessary to take into account the eaten quantity which should be less important for Tô compared to couscous to limit the post prandial hyperglycaemia.

• With the problems of cost, methods of preparation it does not seem necessary to ask the patients to focus their cereal food on the fonio and converted rice. They remain interesting in a varied and balanced food.

• Except the sauce ‘arachide’ the sauces tested do not present a notable influence on the post prandial glycaemia of the patients.

• The sauce ‘arachide’ presents a large problem because it is consumed massively. It involves a rise of the post prandial glycaemia and in more its composition containing groundnut paste seems aberrant for the diabetic patients (by complete diet represents an ultra glucidic base and an ultra proteolipidic sauce).

TB, HIV/AIDS AND DIABETES IN AFRICA
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In 2003, the World Health Organization (WHO) issued guidelines for implementing collaborative TB and HIV programme activities in view of the dramatic spread of the HIV epidemic throughout sub-Saharan Africa in the past decades, accompanied by up to fourfold increase in TB numbers. Also in 2003, the WHO and UNAIDS launched the ‘3 million (mio) by 2005’ strategy, aiming at providing lifelong antiretroviral (ARV) treatment to 3 mio people living with HIV/AIDS in poor countries by the end of 2005. The core principles included urgency, equity and sustainability, and acting now was stressed.

Still in 2003, the IDF, with major support by the World Diabetes Foundation WDF, issued the 2nd edition of the Diabetes Atlas, where diabetes (DM) numbers for Africa were estimated at 7.1 mio, and impaired glucose tolerance IGT at 21.4 mio, in total 28.5 mio; and it was stressed that the time has come to act now!

When comparing HIV/AIDS and IGT/DM for Africa, numbers are near to 30 mio for both, while about 30% of Africa’s populations are infected with TB. To combat TB, HIV and DM in a continent with limited financial and human resources calls for integration.

But besides the well-known interaction between TB and HIV, and abovementioned resource constraints, and competition for them, are there other arguments for further integration of diagnosis, treatment and prevention? For TB and DM interaction is known since the 1930s in the Americas and confirmed in Congo in 2003. DM may increase the risk of (re-)activating TB fourfold, and the clinical course may be modified, as with HIV. Even multidrug resistant TB may be more prevalent in DM patients, as has been documented in India. For HIV and DM the link may only be of public health significance for Africa after the implementation of the ‘3 by 5’ ARV campaign: In 2003, it was noticed in the US that ARV therapy accelerated the risk of cardiovascular diseases by inducing dyslipidaemia, IGT and even DM. The mechanism behind may be in line with type 2 DM: mitochondrial dysfunction.

Further arguments for attempting to integrate the diagnosis and treatment of these 3 major public health problems requiring long-lasting, costly, compliant therapy, and even more importantly integrated prevention, will be given. Act by integration and collaboration now!

NON-INVASIVE TECHNIQUES - WHAT’S COMING

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The benefits of strict glycaemic control on microvascular complications of both type 1 and type 2 diabetes have been well established – and likewise a similar impact upon macrovascular disease has been suggested. During the last 3 decades self-monitoring of blood glucose has been used extensively by diabetic patients in order to improve glycaemic control. Frequent spot measurements of blood glucose leading to mean daily blood glucose estimations, together with measurements of HbA1c have for decades been the cornerstone in the clinical handling of these patients. However, composite or average markers often conceal details that make the difference between success and failure in clinical medicine (as well as in many other aspects of life). For example, HbA1c measurements alone cannot identify whether fasting glucose levels or postprandial glucose excursions are too high. Self-monitoring of glucose is helpful overcoming some of the limitations in HbA1c measurements, but frequent monitoring is inconvenient and expensive. The development of reliable and inexpensive means for continuous glucose monitoring – with the options of the patient for on-line information is highly needed.

Since 2001 so-called minimal invasive systems for continuous measurements of tissue glucose have
been available, and since 2006 the first systems have been put on the market, which offers the patient the opportunity of on-line reading of glucose values. It is likely, that such systems will improve glycaemic control, and thus have a beneficial clinical impact — but this will depend on a number of different factors: The cost and the reliability of these systems are obvious factors of importance. Also, the convenience of the systems will highly influence the daily use. In this context the development of non-invasive systems will be a major leap forward.

Many different physical and chemical methods for non-invasive monitoring of glucose have tested — and some are in clinical development. So far, none of the systems have proven accurate and robust enough to be utilized in clinical practice. An overview of the different possibilities for non-invasive glucose monitoring and a status over some of the technical developments will be given.

THE ROLE OF TRADITIONAL HEALERS IN DIABETES CARE IN BENIN

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Background. Traditional medicine is a secular way of healing in black Africa. In Benin, promotion of traditional medicine was declared as one of the main axes of the health program of the government in 1972. Since this time, a wide development of the activities of traditional healers was observed.

Objective. To determine the frequency of traditional healers intervention in diabetes care in Benin.

Method. It is a cross sectional survey based on questionnaires addressed to diabetic patients on the one hand and to traditional healers on the other.

Results. In diabetic patients investigated (n=102), 84.3% declared to have turned to traditional medicine during their disease. Only 8.1% have had traditional medicine as first resort. In 8.1% of patients traditional medicine was the actual therapeutic way at the moment of investigation. Fifty seven per cent of patients who have taken traditional treatment took it simultaneously with anti-diabetic drugs. In all patients traditional treatment was based on phytotherapy using leaves, bark or root of various plants. Only 29% of patients got their prescription from a traditional healer. In 61.7% of patients, the treatment was started just on the recommendation of an other patient. In 59.3% of patients, traditional treatment was taken in hope to be definitely cured of their diabetes and in 26.7% of cases, they were said that no specific diet was to be observed with the treatment. For 68% of diabetic patients, the traditional treatment was effective for their diabetes when 32% didn’t find it effective.

As regards traditional healers, 61% of 187 subjects investigated declared to care of diabetic patients. For 57% of them starting the treatment depends on a biological diagnosis made in a health center by blood or urine analysis. For the majority of them (94%) specific diets recommendation must be associated with the treatment. Ninety per cent of traditional healers considered patients definitely cured by their treatment and for 55% of them no relapse is possible.

Conclusion. Traditional healers take an important place in diabetes care in Benin. The effectiveness of traditional medicine can not be evaluated with precision since patients often combine oral anti-diabetic drugs with traditional therapeutics. With growing of the cost of diabetes care promotion of traditional medicine can constitute an alternative for developing countries.

RELATIONSHIP BETWEEN CIRCULATING SERUM ADIPONECTIN LEVELS AND INSULIN SENSITIVITY IN AFRICAN SUBJECTS

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Methods. There is evidence of ethnic differences in metabolic characteristics, but levels and correlates of the adipose tissue-specific hormone adiponectin are not known in Sub Saharan Africa (SSA). We studied serum adiponectin and its putative correlates in this population. Seventy (70) consenting healthy non-diabetic volunteers (33M/37F) aged 24-69 yr with BMI 20-42 kg/m², and living in Yaoundé, Cameroon were conveniently sampled. Subjects had a stable weight over 3 months prior to inclusion. Waist circumference and total body fat were measured, and a venous blood sample collected after a 10- to 12-h overnight fast for measurement of plasma glucose, serum insulin and adiponectin. Before analyses, we validated fasting insulin sensitivity indices including fasting insulinaemia, HOMA-IR, QUICKI and glucose-to-insulin ratio against 80mU/m²/min 120-min euglycaemic hyperinsulinaemic clamp in a representative sub sample of 16 subjects. HOMA-IR was the best correlated index to the clamp derived M-value (r = -0.76; p=0.004).

Results and discussion. Males had lower adiponectin levels than females (8.8 ± 4.3 vs. 11.8 ± 5.5). There was no significant correlation between adiponectin and total body fat (r = -0.03; NS) or BMI (r = -0.16; NS), whereas adiponectin was inversely correlated with waist circumference (r = -0.39; p=0.001). Adiponectin correlated negatively with insulin resistance (r = -0.35; p=0.01). In a regression analysis using fasting adiponectin concentration as the dependent variable, and age, HOMA-IR, waist circumference, and fat mass as predictors, waist circumference (β = -3.30; p=0.002), fat mass
Adiponectin correlates in this study. The prevalence of diabetes mellitus was independent predictors of adiponectin. When considering gender, these relations persisted in males and females with the exception of waist circumference which was not an independent predictor of adiponectin in females.

Conclusion. Adiponectin correlates in this study population are comparable to those observed in Europe and the US. The metabolic significance of waist circumference may be less marked in SSA women.

EXPERIENCE FROM NIGERIA

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Introduction. The prevalence of diabetes mellitus in Nigeria is on the increase. DMFS is a major medical, social and economic problem to the patient, the healthcare provider and the public in general in Nigeria. It is associated with social deprivation and lots of negative cultural beliefs, thus a major cause of morbidity and mortality in Nigerian diabetics.

Discussion. The prevalence rates of DMFS vary in different regions of the country from 3%-9.5%, accounting for 14% to 16% of all diabetic hospitalizations. Recently a study in Lagos reported that 41.5% of diabetic patients have foot at risk. DMFS accounts for the majority of the non-traumatic amputations performed in various centres in Nigeria with mortality rates varying between 30% and 33%.

Principal risk factors of DMFS include peripheral neuropathy, peripheral vascular disease, bony deformities, and limited joint mobility as well as previous foot ulcers and amputations. Other well recognized risk factors such as ignorance, being middle aged or elderly, poor glycaemic control and presence of microvascular complications are common in our environment.

Neuropathy, which predisposes to foot ulceration, is very common among Nigerian diabetics with a prevalence ranging between 76%-84%. Studies have reported neuropathy at time of diagnosis of diabetes and as primary presentation of diabetes in 22.5% and 2.5% respectively. Initiating factors to foot ulceration in the presence of neuropathy usually vary from mild trauma like bad pedicure habits, thorn pricks to puncture wounds or burns.

Peripheral vascular diseases (PVD), though accounts for 15% of foot ulcers, has not been commonly found in Africans. Foot infections with very serious consequences and often due to mixed flora, account for about 17% of cutaneous/subcutaneous infective lesions in patients with DM in Nigerian series. In the Nigerian scenario walking unshod, Tinea pedis, being middle aged or elderly, and poor glycaemic control are well known risk factors.

The morbidity and mortality associated with DMFS are very high and these have been attributed to poverty, late presentation due to a number of reasons, cultural beliefs, patronage of the alternative health practitioners, delayed referrals to tertiary centers, delayed acceptance of amputations, overwhelming sepsis, lack of education on foot care and inadequate knowledge and skills of the health care providers. DMFS also carries a very high economic burden. Limited resources are available for healthcare in Nigeria. The percentage of gross national product spent on health is about 1%. The mean direct cost of DMFS per patient per admission is about 90,000 Naira or 700 USD, which amounts to just over 50% of annual income of minimum wage earners in Nigeria. The situation in Nigeria is a cash and carry situation, thus the economic cost of DMFS is of immense magnitude to the patient and his relations, hence, the socio-economic standing of patients with DMFS has a direct bearing on disease outcome.

Conclusion. Although the situation of DMFS in Nigeria appears alarming, there is hope if we take proactive steps to change the present picture. There is need for policy makers to understand the threat posed by diabetes mellitus and its devastating complications such as DMFS. We need to devote more resources to fund education of patients with diabetes and their families. We need to institute preventive foot care and educational programmes that will work effectively in primary, secondary, and tertiary health care settings, throughout Nigeria. The establishment of multi disciplinary foot care clinics in tertiary centres will go a long way in achieving primary, secondary and tertiary diabetic foot prevention. We must not wait until the present situation reaches catastrophic proportions. The time to act is now.

DIABETES EDUCATION TRAINING MANUAL

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The purpose for this manual is to fill a need in the IDF African Region. It has many modules to train diabetes educators using the distinctive features of each region. It was developed by members of the Diabetes Associations representing the various geographical regions and the different languages spoken South of the Sahara.

In the African Region, the profession of Diabetes Educator exists for the most part only in South Africa. Training of those giving diabetes education elsewhere is carried out on an individual basis, most often independent of others and not known by the others. With the poor ratio of doctors to patients,
The aim of this study was to assess the knowledge and attitudes of diabetic Muslim patients in Kenya about fasting during the month of Ramadan. The study was conducted by administering a standard, structured questionnaire. Basic patient data including height, weight and blood sugars were also collected.

Results. 89% of the patients interviewed noted that they had fasted previously. 75% of the patients sampled responded that they were aware that Islam does provide an exemption for diabetics from fasting and of these 89.3% of them fasted. Of the 25% of patients who were not aware that Islam does provide an exemption from fasting 89% still fasted. The results were suggestive that awareness of the safety of fasting didn’t influence whether one fasted or not. (P=0.3490). From the study, it was observed that statistically significant differences in awareness on the safety of fasting amongst the educated and uneducated persons existed (p=0.0411). However there was no statistical difference in medical seeking behaviour between the educated and the uneducated (p=0.8856).

Of the 72% of patients who fasted without medical advice, 61% had increased carbohydrate and fat ingestion during Ramadan as compared to 52% of patients who had fasted with medical advice (p=0.0615). The average blood sugar of persons who fasted with medical advice was 10.47 mmols while those who fasted without medical advice had an average of 11.42 mmols. When patients were divided into two groups namely blood sugars greater than 4 and less than 10 mmols (acceptable glycemic control) and less than 4 or greater than 10 mmols (poor glycemia) differences where noted between glycemic control of those who sought doctor’s advice and those who didn’t seek doctor’s advice (p value 0.0088)

Conclusions. Many diabetic muslims are aware that Islam does provide an exemption from fasting but still fast without seeking medical advice. Diabetics who are educated on fasting and fast with doctors advice have better glycemic control. In order to optimize care during Ramadan, patients must be well educated on the risks of fasting without medical advice and various other important factors such as diet and exercise during Ramadan. Pre-Ramadan education on fasting should be included in the curriculum for all newly diagnosed diabetic muslims.

POSTPRANDIAL VERSUS MEAN BG LEVEL – WHAT’S IMPORTANT

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To achieve optimal glycemic control both fasting and postprandial hyperglycemia must be reduced to as close to normal as is safely possible. Both contribute to HbA1c values, although postprandial hyperglycemia makes a larger contribution to HbA1c than does fasting hyperglycemia as HbA1c approaches target values, i.e. below 7.0%. Moreover postprandial hyperglycemia is usually the rate-limiting factor in...
achieving HbA1c values in the normal or near-normal range. Thus it has been shown that people with HbA1c values of 7.0-7.5% have similar fasting plasma glucose levels as those with HbA1c values 6.5-7.0% but differ in having greater postprandial glucose levels. Finally, postprandial hyperglycemia such as is found in people with impaired glucose tolerance has, for the most part, been demonstrated to increase the risk of cardiovascular disease whereas this has not been the case for people with isolated impaired fasting glucose concentrations. The main issue is whether to treat fasting or postprandial hyperglycemia first or to treat both simultaneously. From personal experience, I recommend treating fasting hyperglycemia first and then, if needed, treating postprandial hyperglycemia. The rationale for this approach is that virtually all drugs which lower fasting plasma glucose levels will also lower postprandial glucose levels although not necessarily postprandial glucose excursions, e.g. sulfonylureas, metformin, thiazolidinediones, basal insulin, meglitinides and exenatide. Such treatment may be sufficient to achieve optimal glycemic control. The alternative approach—targeting postprandial hyperglycemia first—in most cases will not result in satisfactory overnight glucose control and later attempts to do so will require readjustment of doses of drugs targeting postprandial hyperglycemia in order to avoid hypoglycemia.

DETERMINANTS OF INSULIN RESISTANCE: A SOUTH AFRICAN PERSPECTIVE
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Obesity is a significant and growing health problem worldwide, particularly in developing countries. In South Africa (SA), 56.6% of women are overweight or obese compared to 29.2% of men. Black African women living in urban areas have a significantly higher prevalence (62%) of overweight and obesity than black males (28%) and white females (53%). A series of studies on small numbers of obese SA women found that obese black women matched for BMI, but with ~25% less visceral adipose tissue (VAT) than the white women had relative insulinopenia yet were more insulin resistant and had greater rates of lipolysis. More recent similarly powered studies, in which the women were matched for VAT have not corroborated these findings. Moreover, in over 220 apparently healthy lean and obese black SA women, <3% had IGT, and only 12% had the metabolic syndrome, despite > 62% being classified as centrally obese. As such, we have described a group of ‘metabolically healthy, but obese’ women (based on HOMA-IR) that is characterized by a preferential distribution of fat in the periphery and less VAT. One of the factors that underlie the association between centralisation of fat and insulin resistance, may be altered exposure to glucocorticoids. We recently found that reduced glucocorticoid action in superficial subcutaneous adipose depot, although not associated with total body fatness, conferred protection against the accumulation of VAT, and was associated with a reduction in insulin resistance and blood pressure in pre-menopausal SA women. The mechanisms underlying these effects are not clear and might be mediated directly via glucocorticoid action, or indirectly via glucocorticoid-regulated adipokines, such as adiponectin, PPAR&gamma;6543; leptin and the various cytokines (TNFa, interleukin (IL)-6, IL-9, IL-18). Two recent independent studies in SA have shown that circulating IL-18 levels, independent of total adiposity, VAT and age, are associated with insulin resistance. However, IL-18 only accounted for a small proportion of the variance in insulin resistance in these studies. Further research is required to examine the role of other inflammatory and anti-inflammatory adipokines in the development of insulin resistance, as well as the interactions with socio-cultural and environmental factors in the diverse South African population.

Hba1c – Standardization and Relationship to BG Levels and Complications
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By measuring HbA1c in blood, the long-term glycemic control of an individual patient with diabetes mellitus (DM) can be determined retrospectively. HbA1c is the result of the level of glycation of hemoglobin in the past two to three months, which in turn is determined by the long term mean blood glucose concentration. Due to the fact that all currently used reference methods are rather non-specific, a new reference method which specifically measures glycated N-terminal residue of the &alpha;2-globin chain of hemoglobin has been developed by the International Federation of Clinical Chemistry (IFCC) working group on HbA1c standardization. The high specificity of the reference method results in lower HbA1c values in patient samples since the non-specific components measured as HbA1c in routine methods are not measured by this reference method. In order to avoid confusion which may develop following the introduction of a new reference value, the ADA/EASD/IDF Working Group of the HbA1c Assay has recently suggested expressing the HbA1c as mean blood glucose (MBG).

Objectives. The main objective is to establish the relationship between the mean blood glucose (MBG) and the HbA1c as determined by the DCCT (HbA1c-DCCT) as well as by the IFCC method (IFCC-HbA1c). The ultimate goal is to implement the calculated MBG as the means of expressing HbA1c results and use the IFCC-HbA1c to standardize HbA1c assays.
Trial design. Measurement of the IFCC-HbA1c and DCCT-HbA1c will take place at baseline and at all monthly visits. Continuous glucose monitoring during 48 hours with a glucose sensor (CGMS) will be done at the end of the run in and at 4, 8 and 12 weeks thereafter. All participants will also perform 7-point self-monitoring of blood glucose on at least three days per week during the study.

Trial population. Type 1 and type 2 diabetic subjects (males or females, 18-70 years) with stable glycemic control and non-diabetic volunteers will be included in all participating centers (7 in US; 3 in Europe; 1 in India and 1 in Cameroon). Approximately one-third of the type 1 and type 2 diabetic volunteers will have a baseline DCCT-HbA1c between 4-6.5%, one-third will have a baseline DCCT-HbA1c between 6.6-8.5%, and one-third will be above 8.5%.

Assessments. A 48-hours glucose profile will be measured at baseline and monthly for 3 months with a CGMS device. For calibration purposes and for the assessment of the relationship between blood glucose profiles and HbA1c, patients will perform 8 point self glucose monitoring for the two days of CGMS monitoring. Patients will also perform 7-point self glucose monitoring 3 days a week for the duration of the study, from week 0 to week 16. Following baseline measurements, HbA1c [DCCT-HbA1c method] and secondary IFCC HbA1c [reference method] will be measured at 4 week intervals for 16 weeks thereafter. The statistical analysis will consist of the Bland Altman method to compare the correlation and the accuracy and reproducibility between the DCCT-HbA1c and IFCC-HbA1c method. The linear regression method will be used to examine the relationship between the MBG during different periods and the DCCT-HbA1c as well as the MBG and the IFCC-HbA1c.

Results. At the IDF meeting we will be able to present the preliminary data of the first approximately 100 patients with type 1 diabetes. The final data of the total study population, including those of the type 2 diabetes patients, will be presented in 2007. We strongly suggest to maintain the DCCT aligned HbA1c values until the data of this study will be available.

THE IMPACT OF AFRICAN CULTURE ON DIABETES EDUCATION

A Jalang’o
Kenyatta National Hospital, Diabetes Clinic, Nairobi, Kenya

Introduction. Kenya is a land of contrasts, home to over 42 ethnic communities. This rich diversity is comparable to other African nations, a setting of various intriguing cultural practices. Each ethnic community has its own set of practices and codes of conduct that govern everyday life, their culture. In the wake of emerging chronic illnesses e.g. Diabetes Mellitus, culture has a significant role to play. Culture is a pre-conditioning force that has bearing on one’s perception and can therefore influence their choices and lifestyle. It is an integrated pattern of human knowledge, belief, and behavior that is both a result of and integral to the human capacity for learning and transmitting knowledge to succeeding generations. Culture consists of language, ideas, beliefs, customs, taboos, codes, institutions, tools, techniques, art, rituals, ceremonies, and symbols. Each society has its own particular culture, or socio-cultural system. Variation among cultures is attributable to such factors as differing physical habitats and resources; the range of possibilities inherent in areas such as language, rituals, and social organization; and historical phenomena such as the development of links with other cultures. Attitudes, values, ideals, and beliefs are greatly influenced by the culture. The presentation is from observations in my clinical practice.

Summary. Diabetes Education is the hallmark of all Diabetes care activities, it involves imparting of knowledge and self care skills to optimize outcomes in people with Diabetes. It empowers people to make choices that ensure the best possible outcomes with Diabetes. In Kenya this variation in culture is much appreciated in healthcare, however it has both its pros and cons. It has a significant bearing on the approach, and reception to Diabetes Education, and policies that govern healthcare systems. It determines the support systems that can be promotive to Diabetes care. Notwithstanding is the clash between modern versus traditional culture.

The language used in Education in most centres will largely depend on the major ethnic group in the area. A good number of Kenyans do not yet have a good grasp of the two official languages, Kishwahili and English, so this consideration has to take place. Language goes beyond the spoken word to include gestures and facial expression which depending on the community involved can mean different things and hence have a bearing on impact of education. Most patients in Kenya prefer the narrative style of Education.

Attitudes, taboos and belief also impact on education and as such have to be addressed to make any headway e.g. some tribes believe honey is a medicine so its use may continue even with Diabetes, or others who believe any chronic illness is a curse or witchcraft and hence seek alternative care. The sex and even ethnicity of the educator may also have a bearing in some communities who believe women cannot instruct men, or who prefer their own person.

Culture will not only determine the impact of education as a process but also its outcomes, as certain practices are promotive while other detrimental.
The intricacies of culture require that Educators are diverse, and culturally competent to be able to handle a variety of people. The attitude of Educator determines how they influence Diabetes Education. Education resources also need to be ethno-sensitive to achieve the intended purpose.

Conclusion Health Education systems in Kenya have the opportunity to adjust to the intricacies of culture. We are just facing up to the challenges of rising Diabetes incidences, and these considerations can be put in place before it is too late. Education processes have to address cultural competency to ensure integrated cost effective care.

FUNDING DIABETES INITIATIVES IN AFRICA
A Kapur
World Diabetes Foundation, Kgs. Lyngby, Denmark

Funding Diabetes Initiatives in Africa –The WDF Model

The World Diabetes Foundation (WDF) aims to address and potentially limit the epidemic of diabetes by raising the issue of diabetes on the global health care agenda as well as funding sustainable projects on awareness, primary prevention, building healthcare capacity, and improving access to care in the poorest countries. The World Diabetes Foundation acts as a catalyst to build sustainable relations between different stakeholders ensuring the individual project initiatives live on even after the specific project funding has ceased.

Building Partnerships To Help The Neediest

WDF directs its funds to areas and people with the greatest burden and most need: namely for diabetes projects in the developing countries. The strategy is to act as a catalyst - help others do more - making a much greater impact than the Foundation’s size would suggest. The WDF seeks and builds partnerships with established organizations in the areas of health, diabetes and development aid to build on existing structures and resources. Through these partnerships we aim to raise global awareness of diabetes and help find the resources to address and potentially limit the epidemic. WDF has established project related partnerships with organizations like WHO, IDF, DANIDA, DanChurch Aid, The Insulin Foundation, Humanitäre CubaHilfe, Fundación para la Diabetes, local diabetes associations and Ministries of Health in various countries, leading diabetes research institutions and WHO collaborating centers.

Established in 2002 as an independent trust WDF is governed by a board of six experts in the field of diabetes, access to health and development assistance. Only two of them represent Novo Nordisk.

The foundation already supports 72 projects. These projects in the coming 3-4 years will potentially influence the diabetes treatment of 26,000,000 people directly in the developing countries. Although established through a commitment of 500 million Danish Kroners over ten years by Novo Nordisk A/S (which guarantees continued resources for the Foundation’s work), “WDF raises funds from other sources as well to support specific projects ensuring a multiplier effect; the current project portfolio is worth 80 million USD of which the WDF will contribute only 22 million USD. Thus for every dollar the foundation spends it is able to attract three dollars in cash or kind from other sources.

1/3rd of the current project portfolio is directed at Sub Saharan Africa and covers 12 countries in addition to two large regional projects that cover whole of Sub Saharan Africa. WDF supports a global collaboration project between the WHO and IDF entitled Diabetes Action Now. There are a number of projects with the International Diabetes Federation (IDF) to build capacity and raise awareness of diabetes. The Memorandum of Understanding that was signed with The Danish International Development Assistance (DANIDA) in 2002, materialized into collaboration on three Projects.

Experience shows that not all projects will fare as planned and hoped for often due to factors beyond the control of project management and WDF. These factors include - the political and personal commitment to the activities, transfer of trained staff, changes in policy or unrest in the country in question. These and other such factors will affect and hamper implementation and sustainability of our projects despite our comprehensive efforts to pre-qualify projects before granting support. In order to minimize chances of failure and maximize the likelihood of success and sustainability, we ensure strong local commitment to the activities; we work with highly competent organizations and project leaders; we focus on close dialogue in our partnerships and we support our partners to address problems and to drive positive project processes further. More importantly we closely monitor progress. For further information visit www.worlddiabetesfoundation.org

BURDEN OF COMPLICATIONS
J Koning
University of the Free State, Internal Medicine, Bloemfontein, South Africa

Diabetes mellitus is a chronic disease that affects the lives of millions of people worldwide. It causes serious microvascular complications (retinopathy, neuropathy and nephropathy) and macrovascular complications (coronary artery disease, carotid artery stenosis and peripheral vascular disease). In 1966 Seftel established that diabetic retinopathy and nephropathy are common in black patients with diabetes incidences, and these considerations can be put in place before it is too late. Education processes have to address cultural competency to ensure integrated cost effective care.

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Diabetic nephropathy is a progressive, abstracts.indd   134 transitions are associated with many changes in heart disease. Epidemiological and demographic was found to be a major contributor to ischaemic diabetic patients. In studies conducted in Ghana heart disease is present in 4.8% of newly-diagnosed presenting with coronary events and ischaemic diabetes is present in more than one third of patients. Data available for African populations show that the diabetic patients had coronary artery disease, heart disease. In a Sudanese study (1995), 28% of sub-Saharan Africa, with diabetes mellitus emerging as a major underlying risk factor in the pathogenesis of foot ulcers in patients with diabetes. The foot complications frequently progress to sepsis or gangrene, resulting in prolonged hospitalization and significant mortality. In a review article by Abbas it was found that the rate of foot complications varies significantly from country to country, with the rates for foot amputation varying between 0.3 and 45%. Historically the prevalence of large vessel disease in Africans with diabetes has been low, despite the high prevalence of hypertension. In Sub-Saharan Africa peripheral neuropathy is the main underlying risk factor in the sub-Saharan African population, including the increasing prevalence of cardiovascular risk factors such as smoking, obesity and dyslipidaemia. In recent studies from Botswana (2006) and Ethiopia (2006), hypercholesterolaemia was found in 33.5 and 47.3% and hypertriglyceridaemia in 38.9 and 41.8% of patients respectively. In a South African study (2005) Vezi reported that 90.3% of black diabetic patients had diabetic dyslipidaemia.

**DIABETES PRACTICE GUIDELINES**

**N S Levitt**

**SEMDSA and University of Cape Town, Medicine, Cape Town, South Africa**

Sub-Saharan Africa is one of three regions globally with the greatest projected increase in diabetes prevalence between 1995 and 2010. It is also a region characterized by multiple disease burdens which compete for limited health resource allocation. Assessments of diabetes healthcare in Africa indicate that this is sub-optimal, both in terms of coverage and quality, the latter even within urban areas. In this context and based on evidence that implementation of clinical guidelines improves care, IDF Africa formed a task force to develop practice guidelines for diabetes management for the region. The task force included a representative from each of the sub-regions. The consensus guidelines are directed at management of type 2 diabetes at the primary level, where the majority of people with diabetes receive their care. The guidelines address key clinical questions that face health workers daily as well as the organization of diabetes care and monitoring the quality of such care. Having consulted widely and after receiving input from clinicians throughout the region, the task force finally revised the guidelines after review by an international panel of experts. The next major challenge is implementation of the guidelines. This has been planned to take place in close collaboration with national departments of health in order to improve their uptake and thus health care delivery for diabetes in the region.

**PREVALENCE OF MICROALBUMINURIA IN PEOPLE WITH DIABETES IN DAR ES SALAAM, TANZANIA**

**J Lutale**

**Muhimbili University College of Health Sciences and University of Bergen Institu, Department of Internal Medicine and Divison of Haraldsplass Deaconal Hospital, Dar es Salaam and Bergen, Tanzania and Norway**

Background. Diabetic nephropathy is a progressive, irreversible glomerular disease and it accounts for a significant morbidity and mortality among diabetic patients. It is the leading cause of end stage renal failure in developed countries. In Caucasians the...
prevalence of diabetic nephropathy in Type 1 patients ranges from 7 to 30%, while among Type 2 it has been estimated to range from 3 to 16%.

In the early 1980s a threshold level of albumin excretion rate which was later termed microalbuminuria was described, a level above which the risk of progression to clinical proteinuria is increased. Several studies thereafter have shown that, microalbuminuria is indeed a marker for diabetic nephropathy with a positive predictive value of 80%. This is a reversible stage and lifestyle modification and appropriate medical treatment can prevent the development of severe renal damage.

The prevalence and risk factors of microalbuminuria are not fully described among black African diabetic patients. Available information shows a wide range of prevalences of microalbuminuria among diabetic patients being between 7 to 53%.

Some studies indicate a racial difference in the prevalence of microalbuminuria and diabetic nephropathy. For instance African American diabetic patients have been reported to suffer more kidney disease than the Caucasian Americans.

A study aimed at determining the prevalence of microalbuminuria among African diabetes patients in Dar es Salaam, Tanzania was done in 2003. It also aimed at relating microalbuminuria to socio-demographic features as well as clinical parameters.

Methods. Cross sectional study on 91 Type 1 and 153 Type 2 diabetic patients. Two overnight urine samples per patient were analysed. Albumin concentration was measured by an automated immunoturbidimetry assay. Average AER was used and were categorised as normalalbuminuria (AER< 20ug/min), microalbuminuria (AER 20-200ug/min), and macroalbuminuria (AER>200ug/min). Information obtained also included age, sex, BMI, BP, serum total cholesterol, high-density and low-density lipoprotein cholesterol, triglycerides, serum creatinine, and HbA1c. Electrocardiography and indirect ophthalmoscopy were also done.

Results. Overall prevalence of microalbuminuria was 10.7% and macroalbuminuria 4.9%. In Type 1 patients prevalence of microalbuminuria was 12% and macroalbuminuria 1% and among Type 2 patients prevalences were 9.8% and 7.2% respectively. Type 2 patients with abnormal AER had significantly longer diabetes duration 7.5 (0.2-24 yrs) than those with normal AER 3 (0-25 yrs), p<0.001. SBP and DBP among Type 2 patients with abnormal AER were significantly higher than in those with normal AER (p<0.001). No significant differences in BMI, glycaemic control, and cholesterol levels was found among patients with normal compared with those with elevated AER either in Type 1 or Type 2 patients. A stepwise multivariate regression analysis revealed AER (ln AER) as the dependent variable to be predicted by diabetes duration OR(95%CI) 0.09 (0.056-0.125), p<0.0001 and SBP OR(95%CI) 0.011(0.003-0.018), p< 0.004.

Conclusions. The prevalences of microalbuminuria and macroalbuminuria among Type 2 patients in our study are relatively low when compared with most findings from sub-Saharan Africa. These discrepancies are hard to explain, differences in design, setting methods for urine collection and microalbumin assays can partly account for it.

When comparing with prevalences among the Caucasian patients, the prevalence of microalbuminuria (12.1%) in our Type 1 patients was relatively higher than prevalences found among Caucasian Type 1 patients with similar diabetes duration. On the other hand, prevalences of microalbuminuria among our Type 2 patients (9.8%) appears to be comparable to prevalences in Caucasian Type 2 patients (8-32%). Abnormal AER was significantly related to diabetes duration and SBP.

**TYPE 1 DIABETES – COMPLICATIONS AND SOCIOECONOMIC BURDEN IN DAR ES SALAAM, TANZANIA**

E Majaliwa

Muhimbili National Hospital, Paediatric and Child Health, Dar es Salaam, Tanzania

The natural history of type 1 DM is the development of serious complications. They include hypoglycemia, hyperglycemia, DKA, retinopathy, nephropathy, neuropathy, and growth impairment. These impose a burden to the patient and his/her family.

Objective. To determine the complications of type 1 diabetes in children aged 5-17 years and socio-economic burden encountered by the families of children with diabetes in Dar es Salaam. Study design Cross sectional descriptive study. Study setting The Diabetes clinic at Muhimbili National Hospital, Dar es Salaam, Tanzania from June 2005 to February 2006.

Subjects. Ninety nine children aged 5-17 years were recruited into the study.

Methodology. All type 1 diabetic children who met the inclusion criteria were recruited. A clinical assessment was carried out and blood samples were collected for RBG, HbA1c, renal and lipid profile.

Results. Fifty-seven (56.4%) were females and 42 (45.92%) were males. Mean age was 13.34±3.56. One child (1.1%) had adequate glycaemic control, 56 (56.6%) had moderate glycaemic control and 42 (42.4%) had poor glycaemic control. DKA and hypoglycemia presented in 89 (89.80%) and 55 (55.67%) respectively. The common chronic complication found was linear growth impairment 67 (67.7%), followed by neuropathy 28 (28.3%) and nephropathy 30 (30.61%). Retinopathy was found in 22 children (22.68%). Poor glycaemic
control was associated with irregular clinic visits and failure to adhere to insulin regimen. About 62% of the children missed insulin doses at least twice in six months. Of these, 54.5% missed insulin because they could not afford to buy. Among children with poor glycaemic control 71.4% had growth impairment. About 63% of children who had diabetes of less than one year duration had a smaller frequency of growth impairment compared to 70% who had diabetes for more than five years. Most families with children attending the diabetic clinic had significant socio-economic burden in terms of the cost for caring for their children. Children with acute complications (hypoglycemia 73% and DKA 92.1%) had an increased frequency of outpatient visits to the diabetes clinic than those with chronic complications. Most of the children who had chronic complications visited the clinic 1-3 times in 6 months. The reasons for this difference may be, acute complications usually have severe symptoms that need immediate attention. On the other hand, chronic complications are asymptomatic. Children and parents are either unaware or if aware major barrier to clinic visits may be the costs. On average, one clinic visit costs a patient about 17,600 Tanzanian shillings, and the mean cost of taking care of a diabetic patient per month is about Tanzanian shillings 35,548. Parents thus do not feel an obligation to take the child regularly to the clinic unless there is an acute problem.

Conclusions and recommendations. DKA and hypoglycemia were the commonest acute complications found in this study. These complications were also commonly associated with irregular clinic attendance for follow-up visits, non-adherence to insulin regimens and poor glycaemic control. Families with insulin regimens and poor glycaemic control. Families with children suffering from diabetes do experience significant socio-economic burden. Children with type 1 diabetes should have regular clinic follow-up visits so as to promote education and adherence to treatment and in so doing ensure good glycaemic control and ultimately reduce the incidence of acute complications as well as long-term sequelae of diabetes mellitus. Children should also be given access to free or subsidized treatment in particular glucose monitoring and insulin supply.

WHAT ROLE DO ADIPOCYTES PLAY IN AFRICAN SUBJECTS?

J C Mbanya
University of Yaoundé, Department of Internal Medicine Endocrine Unit, Yaoundé, Cameroon

Adipose tissue has been recognized as a hormonally active system involved in glucose homeostasis and energy metabolism. Adiponectin, an adipose tissuespecific protein, displays a close link with insulin resistance and obesity. Low levels of this protein have been shown to predict a high incidence rate of insulin resistance. Central (abdominal) adiposity, as measured by waist circumference, has been shown by several studies to correlate inversely with adiponectin levels and positively with insulin resistance. But one study carried out on adult Cameroonians (a sub-Saharan African population) failed to show this inverse relationship in women.

This raised the question of the role of adipocytes in this group of individuals. This presentation will discuss the results from current studies.

DIABETES EDUCATION PROGRAM IN KENYA

E Muchemi
Kenya Diabetes Management and Information Centre DMI, Nairobi, Kenya

Introduction
• DMI Centre founded in May 1999
• a registered not-for-profit medical charitable organization
• became operational in October 1999.

Aims and objectives of the Centre
• To develop a comprehensive educational programme
• To evolve and promote an education facility.

Why Education?
PREVENTION IS ALWAYS BETTER THAN CURE AND KNOWLEDGE IS POWER.

Reports from IDF and WHO on global trends on diabetes projected sharp rise in diabetes. Prevalence from 110m in 1994 to over 330m in 2025. Two thirds rise in developing countries of Africa and Asia.

What does the diabetes education focus on?
Raising public awareness on:
• Primary prevention
• Secondary prevention
• Risk factors
• Role of nutrition and exercise in diabetes.

What is being done? Activities to achieve objectives
• Retraining of professional health care providers in all public hospitals
• 12 training centres in 8 provinces headed by a co-ordinator
• Initial hospital training of 1 or 2 clinicians, 3 nurses, 1 nutritionist & 3 lay educators
• Training since programme started: 96 Clinicians, 239 Nurses, 61 Nutritionists, 146 Paramedics, 1 050 Lay Educators
• Training & Educating young diabetics living with the condition as educators – 74 trained
• Supply of diagnostics – these are used in the diabetes clinics and reduces time-wrap
• After training each hospital gets 3 glucometers and 150 testing strips
• Developing and printing education materials
  • Printed in main language understood by 90% of population
  • Approved by the Ministry of Health
  • Translated into 8 main local dialects with a national coverage of 65%
  • The 8 local dialects are in high prevalence areas.

**Monthly Public Education Forums**

Run for a day and have an average of 300-400 people in any venue.

**Medical Camps**

• Part of education programme and encourages random check ups
• Source of data and aids in determining prevalence in different areas. January – July, in attendance 19,750, 11,000 screened, 487 diabetics, 332 old diabetics, 94 new, 331 IGT (>8.5mmols but <10.2mmols).

**Major constraints**

• Few numbers of diabetes educators
• Limited personnel to run clinics – most time only 2
• Infrastructure – limited space
• Inadequate equipment – bp machines, weighing scales
• Limited funds to improve on the above
• Testing is still mainly done in laboratories
• The MoH has not yet finalised the National Diabetes Policy document.

**Achievements**

• More health institutions raising alarm on the burden of diabetes
• 22 health facilities monitoring patients at the diabetes clinic
• Reported increased numbers monitoring sugars regularly
• More health facilities running a diabetes clinic
• More patients coming for education.

**Conclusion**

With other committed partnerships like WDF, the Kenyan dream of achieving effective diabetes education will indeed be a reality.

**EXPERIENCE FROM CAMEROON**

A E A Ndip  
*Manchester Royal Infirmary, Department of Diabetes and Medicine, Manchester, UK*

**Introduction.** Foot problems are a common manifestation of diabetes and occur in 15% of diabetic patients during their lifetime. They are a frequent cause of hospitalisations and disability with one in five admissions in diabetic patients being directly related to foot ulcerations. Where prevention fails, effective management remains the mainstream approach. In this study, we aimed to look at the clinical features of diabetic foot ulcers and their management in a health care developing country setting.

**Methods.** We reviewed preliminary data from the foot care component of the CAMBoD project (Cameroon burden of Diabetes), a large country wide diabetes survey and capacity building, involving the four main ecological zones in Cameroon. This project had a training component in which a doctor with special interest in diabetic foot problems had to educate staff on the importance and management of this complication. This was pictorially based with workshops for demonstration. One of these sentinel sites was later examined in greater detail for clinical features and management at the time of implementation. Consecutive patients presenting with foot ulcers were recruited and went through a history taking and general examination with particular podiatric assessment.

**Results.** Our preliminary analysis shows that in the whole country and prior to the implementation of the CAMBoD project, there were no specialised diabetic foot care services. There were no trained podiatrists/chiropodists and diabetic foot care is offered by untrained nursing staff. Foot problems are still the Cinderella of diabetic complications. Medical staff knowledge on the diabetic foot was generally inadequate and marked by an array of misconceptions as to causality, treatment and prognosis.
After the implementation of this project, there has been heightened awareness in foot complications and foot clinics have been integrated in diabetic care. Foot care is now offered by trained staff with a dedicated interest in this complication.

As far as clinical presentation is concerned, ulcers were of higher grades (University of Texas wound classification) and mostly neuropathic and of enormous sizes. Infection was quite common with polymicrobial flora. Atypically a sizeable proportion of dorsal ulcers were found and trauma (shoe or other external injury) was the predominant trigger. All too often, the ultimate course was marked by amputation and/or excessively long in patient stays. Care was usually either delayed or inappropriate. The multidisciplinary foot care team approach is almost inexistent. Physicians still do not carry out routine foot check during consultations. Healthcare and hence foot care being generally unaffordable, admitted patients do not have full ancillary investigations and care is based on the clinicians’ ‘uninformed’ impressions.

Just like the foot, the hand was frequently involved in ulceration (the tropical diabetic hand syndrome). Traditional medicine and self care are usually the first option diabetic patients recourse to, when they develop an ulcer and this treatment modality is usually ineffective.

**Conclusion.** Foot problems have sinister implications for diabetic patients in our setting. They present with poor prognostic features in a context of ill-structured care thus underpinning prevention as a cornerstone to curbing the burden of this complication.

**EXPERIENCE FROM SENEGAL**

M Ndour-Mbaye  
National Diabetes Centre Marc SANKALE, Dakar, Senegal

The diabetic foot in Senegal, as in all parts of the world, is associated with a high risk of amputation, an important cause of both functional impairment and disability (7% before the implementation of an effective education program). In addition, these amputations occur in working individuals between the ages of 55-65 and their financial impact is substantial particularly when the low income of these patients is taken into account (3300$ without taking prosthesis into consideration). Clinically, infectious complications are by far the most frequent (97% of cases) and occur in isolation or on the background of underlying vascular/neurological complications.

Prevention as well as the correct treatment of diabetic foot ulcers is the primary aim of the diabetic treatment centre Marc SANKALE, however it frequently encounters a multitude of problems: cultural and religious reasons are often found to explain the late presentation and the advanced state of foot ulcers (walking barefoot, poor footwear, traditional healing techniques, and perilous aesthetic foot treatments).

Other problems are closely related to the infrastructure of the healthcare system: insufficient treatment facilities for diabetes and diabetic foot ulcers, the lack of specialised podiatry services as well as the geographic spread and distance of these facilities making an interdisciplinary approach often difficult. And in addition to the above, financial difficulties have to be taken into account such as poor resource allocation to healthcare in general and more specifically diabetology.

Thus, all these reasons justify the necessity of a comprehensive diabetes prevention program that is tailored to these cultural and financial needs. The APEDIA (Action Populaire d’Éducation des Diabétiques), since its implementation in 1980, has effectively reduced the amputation rate for infectious gangrene from 7% to below 2%. Furthermore, the inauguration of the first podiatry service as well as the creation of a dedicated interdisciplinary diabetic foot team should further reduce the frequency of amputations. In the long-term it will be crucial to decentralise the treatment of diabetics, to perform diabetic foot awareness campaigns and hence to encourage early detection and the implementation of correct treatment plans.

**CAMEROON BURDEN OF DIABETES PROJECT**

G F Ngufor  
Cameroon Burden of Diabetes Research Project, Faculty of Medicine and Biomedical Sciences, Yaoundé, Cameroon

**Introduction.** Type 2 Diabetes Mellitus has become a disease of developing countries. This change of trend will impact on government health budgets aggravating the already constricted resource availability if something is not done. Cameroon, a sub Saharan African country with a population of approximately 16 million inhabitants sought to curb the rising prevalence of non communicable diseases in general and diabetes in particular, by putting in place a specific National Diabetes Programme. This paper describes how this programme was put in place in Cameroon.

**Objective.** To use evidence-based information to influence the Cameroon government’s Health Sector Reform through the development of a National Diabetes Programme.

**Methodology.** Using standardized methods and the WHO Steps approach over 10,000 subjects were surveyed at baseline in 4 ecologic zones of Cameroon.
**Results.** The burden of diabetes was established at 6% prevalence in the urban population. Eighty percent (80%) of diagnosed diabetics were unaware of their condition. Risk factors and complications were also quantified. Surveillance, control and prevention programmes including the opening of a national obesity centre and specialized clinics for diabetes care were initiated in collaboration with the Ministry of Public Health following the baseline survey and in response to the results of the survey in the four ecologic zones. Data systematically collected from the field were exploited by the health policymakers to develop a non communicable disease programme because high blood pressure was also found to be very prevalent in the population.

**Conclusion.** The first phase of the Cameroon Burden of Diabetes project sponsored by the World Diabetes Foundation provided support to the health sector reform in Cameroon and set the pace for the implementation of a non communicable disease prevention programme.

**GLYCAEMIC CONTROL IN TYPE 1 DIABETES**

**E W Njenga**  
*Diabetes Management and Information Centre, Nairobi, Kenya*

**Objective.** In type 1 diabetics hypoglycaemia and wide glucose excursions continue to be of major concern. Improvement in glycaemic control is associated in improved morbidity and also reduction in long-term complications and treatment costs. In this study, we looked at the use of data obtained from CGMS in improving glycaemic control in type 1 diabetics.

**Research design and methods.** A total of 10 insulin-requiring patients with type 1 diabetes in Kenya were enrolled in this study. Prior to the onset of the study basic demographic data and baseline HbA1c were taken and thereafter the subjects wore a transcutaneous, 3-day, continuous glucose-sensing system for three consecutive days (72-hr period). Device accuracy was assessed by comparing continuous glucose values to paired self-monitoring of blood glucose (SMBG) meter readings. Data collected from CGMS readings were analyzed for hypoglycaemic tendencies, glucose excursion and blood glucose variances during various times of the day. Results were discussed with the patient and various management strategies such as change in insulin type/dose adjustments, regular exercise, nutritional counseling were undertaken. The subjects thereafter were followed up for three months and had a repeat HbA1c and CGMS monitoring was done. Basic demographic data were also collected and a comparison of various parameters from the two CGMS readings was done.

**Results.** A review of the data collected noted that CGMS when used as a tool to initiate various management strategies including exercise, nutrition and treatment adjustments lead to improvement in HbA1c and overall glycaemic control. From the patients enrolled an average drop in HbA1c of 0.93% was noted with an increase in BMI by only 0.14. The overall time within glycaemic limits of 4 to 9 mmols increased by 15.3% coupled with a subsequent decrease in 14.8% of overall time the patients had sugars above 9 mmols. A decrease in the average blood sugar was noted by 1.7 mmols amongst the patients following the use of CGMS to initiate treatment strategy changes.

**Conclusion.** Current routine glucose monitoring may not be able to adequately identify glycaemic excursions noted in type 1 diabetics. Continuous glucose monitoring can be used as a useful tool in type 1 diabetics to analyze blood sugar trends and initiate various management strategies in order to improve overall glycaemic control.

**DIABETIC KETOACIDOSIS**

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**Background.** Diabetic ketoacidosis is the most common hyperglycaemic emergency in patients with diabetes mellitus, especially type 1 diabetes. It carries very high mortality in sub-Saharan Africa, both in the treated patients and those who are presenting to hospital with diabetes for the first time.

**Objective.** To review the risk factors and management approaches in diabetes ketoacidosis in published literature and to discuss them in the context of why a significant proportion of patients who develop diabetic ketoacidosis in sub-Saharan Africa (SSA) still have high mortality.

**Data source.** Literature review of relevant published literature from both Africa and the rest of the world.

**Data synthesis.** The main causes or precipitants of DKA in patients in SSA are newly diagnosed diabetes, missed insulin doses and infections. The major underlying mechanism is insulin deficiency. Treated patients miss insulin doses for various reasons, for example, inaccessibility occasioned by unaffordability of insulin and/or its unavailability in hospitals, missed clinics, perceived ill-health and alternative therapies like herbs, prayers and rituals. Infections also occur quite often, but are not overt, like urinary tract, tuberculosis and pneumonia. Due to widespread poverty of individuals and nations alike, the healthcare systems are scarce and the few available centers are unable to adequately maintain a reliable system.
of insulin supply and exhaustively investigate their hospitalized patients for diagnosis and monitoring of treatment. Consequently, there is little guarantee of successful treatment outcomes. Poor people may also have sub-optimal nutrition, caused or worsened by diabetes, more so, at first presentation to hospital. Intensive insulin therapy in such individuals mimics ‘re-feeding syndrome’, an acute anabolic state whose outcome may be unfavourable during the period of treatment of diabetic ketoacidosis.

Conclusions. Although mortality and morbidity from diabetic ketoacidosis remains high in sub-Saharan Africa, improved healthcare systems and reliable insulin supply can reverse the trend, at least, to a large extent. Individuals and populations need empowerment through education, nutrition and poverty eradication to improve self-care for health and successful living with diabetes.

INTEGRATING THE TEAM APPROACH INTO DIABETES CARE

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The global epidemic of diabetes has resulted in a pressing need to change current health care service delivery models to cope with the growing number of people affected by this disease. One strategy is to develop a collaborative team approach when providing diabetes care. This model draws on the strengths of a wide range of diabetes health care professions including doctors, nurses, dietitians and other allied health professionals. It is underpinned by the philosophy that non medical health professionals can deliver much of the first-line intervention in diabetes care. The nature of clinical assessments required by most people with diabetes is relatively narrow in scope. With appropriate training, non medical team members can assess individuals referred for management of both acute and chronic issues of diabetes and perform the battery of complication assessment procedures. In addition, in most countries, a team of medical and non medical health care professionals would be much less expensive than one using medical staff alone. Moreover, non medical team members are often able to spend longer with patients to enable them to acquire the necessary skills to self manage their disease. This approach also releases precious medical manpower from routine day to day clinical activities so that their time can be spent dealing with the more complex medical issues. The success of this model hinges on blurring of traditional professional boundaries, continuing education for all team members and assignment of staff to permanent diabetes positions. Tantamount to this success is the support of both medical staff and health authorities.

IMPROVED ACCESS TO DIABETES CARE IN TANZANIA

K Ramaiya

Tanzania Diabetes Association c/o Hindu Mandal Hospital Room 104, Dar es Salaam, Tanzania

Most of the diabetes care services in developing countries have been established through unsystematic, needs-based efforts. This is because the limited resources of these countries have to be divided between fighting poverty, implementing education strategies, providing housing and appropriate sanitation, as well as the social, economic and health burden of fighting HIV/AIDS, Tuberculosis and Malaria.

However, as the burden of diabetes and its complications increases with modernisation, economic well-being and westernised lifestyle, these resource limited countries are unable to provide even minimum care in some instances, let alone secondary and tertiary care.

The economic cost of diabetes and its complications cannot be met by most of the individuals and families in these countries whose incomes are insufficient to purchase insulin, oral hypoglycaemic agents and other supplies for management of diabetes.

This presentation will discuss a pragmatic approach to the problem: the multi-sectoral participation of the government, pharmaceutical industry, national diabetes associations and other non-government organisations, healthcare providers and patients who can all play a role in providing high quality and appropriate care that helps people with diabetes maintain the best possible quality of life.

EXPERIENCE FROM ETHIOPIA

A Reja

Ethiopian Diabetes Association, Addis Ababa, Ethiopia

Ethiopia, with a population of 74 million is the second most populous country in sub-Saharan Africa. 86% of the population lives in rural areas. The health status of the Ethiopian population is very low. Although communicable diseases and malnutrition dominate the picture, diabetes is becoming an important public health problem in Ethiopia. In Ethiopia, WHO estimates the number of cases at 769,000 in 2000 and is expected to grow to 1,820,000 by 2030. Although the numbers in Ethiopia are quasi guesstimates, patient attendance rates for diabetes at major hospitals have shown a marked rise in the past three decades. The high cost of medications, interruption in supply, shortage of trained personnel, illiteracy and lack of awareness of patients on diabetes all add up to the difficulties of providing diabetes care of an acceptable quality. As a result, there is a high rate
of chronic complications and premature death. In recent years, foot problems among Ethiopian diabetes patients are increasing, albeit published data are scanty. Diabetic foot problems are usually managed by physicians at general medical or surgical outpatient clinics. Some are managed at general diabetes clinics. There are no special foot clinics neither are there podiatrists. Diabetic patients usually neglect foot ulcers and physicians do not give them due attention. Thus, the outcome of diabetic foot ulcers in the majority of our patients is quite bad. In a recent study, we have found that among 196 patients, only 11% had the habit of daily inspection of their feet. More than 80% of foot ulcer patients had poor glycemic control. Median duration of symptoms before presentation was 21 days (range 1-90 days) and the median duration of diabetes mellitus was 13 years (range 0-33 years). More than two thirds had type 2 diabetes mellitus. Among 109 patients with identified antecedent risk factors for their foot problem, ill fitting or new shoes attributed in 48 (44%). Neuro-ischaemic ulcers were seen in 113 (58%) of the cases and neuropathic ulcer in 63 (32%). Ulcer with cellulitis or gangrene was the most common mode of presentation seen in 92 (47%) of the patients. 92 patients (47%) had amputations. Reamputation was necessary in 24 (26%) of these cases. Less than 40% of the total cases had regular follow up either at a clinic or hospital. Diabetes was diagnosed for the first time in 7 cases (4%) on presentation with foot ulcer. The overall mortality rate was 21% and sepsis was the most identified cause.

Lack of regular patient follow up and diabetes education on foot care, poor glycemic control, delay in patient presentation and surgical intervention as well as patients’ refusal to undergo surgical interventions have played a major role in the high mortality seen in this particular study.

We recommend that diabetic education on foot care, establishment of special foot clinics at least at major diabetes clinics, emphasis on metabolic control of diabetes, early presentation and surgical intervention when appropriate have to be highlighted in the management of diabetic patients.

**AFRICAN TRADITIONAL HEALERS: BRIDGING THE GAP**

**M B Sangare**

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Le diabète s’inscrit dans le cadre de l’épidémie croissante des maladies non transmissibles qui commencent à imposer une double charge de morbidité aux pays les plus pauvres. Confrontés aux problèmes du VIH/SIDA, du paludisme et de la tuberculose, ces pays doivent aussi se préparer à faire face à la charge accrue des maladies liées au changement du mode de vie et au vieillissement de la population. L’OMS estime que le nombre de cas de diabète dans les pays en développement devrait plus que doubler au cours des 30 prochaines années, passant de 115 millions en 2000 à 284 millions en 2030. En Guinée, les enquêtes épidémiologiques relatives au diabète sont encore à leur début. La prévalence est globalement importante et variée selon les régions naturelles, les centres urbains ou ruraux, les sexes, les catégories professionnelles...

Des enquêtes ethnomédicales menées auprès des tradithérapeutes, des herboristes et des malades, à l’échelle nationale ont permis de contacter 158 tradithérapeutes, de recenser 86 recettes constituées de 212 plantes. Les recettes les plus citées ont été sélectionnées et parmi celles-ci 3 ont fait l’objet d’évaluation thérapeutique sous les auspices des traditionnelles en terme d’efficacité et de tolérance. La présente étude confirme l’usage significatif des drogues végétales dans le traitement du diabète en Guinée et met en relief les limites de la médecine traditionnelle en terme de diagnostic et de baisse significative et durable du taux de la glycémie chez des diabétiques non insulino dépendants.

**RETINOPATHY**

**B Seyoum**

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Retinopathy is a common cause of blindness in patients with diabetes. In Africa however the problem of blindness due to diabetes is overshadowed by the presence of the prevalent and common nutritional deficiency diseases and eye infections such as vitamin A deficiency, trachoma, onchocerciasis and other conditions. In Africa besides the existing long standing preventable diseases, the infrastructure to diagnose and treat diabetic retinopathy is still not well developed.

The prevalence of retinopathy in Africans with diabetes is 25-50%, which is similar to that of other countries. However, the most striking is the duration of diabetes in African patients is much lower when compared to that of the developed countries. In a study seen in Ethiopia the overall prevalence of retinopathy was 38% and the mean duration was 9 years. Similar study from Japan reported the same level of retinopathy in patients with mean duration of diabetes of 19 years. Thus retinopathy occurs much earlier in African patients with diabetes. The main reason for the high prevalence of retinopathy in the early stage of diabetes is poor control and inadequate diagnostic and therapeutic infrastructure in Africa. The manpower to diagnose and treat diabetic...
retinopathy is most undeveloped in most African countries. As a result it is common to see young patients with diabetes become blind as a result of diabetic retinopathy.

Much effort is needed by governmental and nongovernmental organizations to improve the diagnostic and therapeutic capabilities at all levels of care and improve the manpower and infrastructure to help reduce the burden of retinopathy in African patients with diabetes mellitus.

INSULIN AVAILABILITY AND IMPROVING DIABETES CARE IN MOZAMBIQUE

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Control of type 1 diabetes has been proposed as a tracer condition to access the quality of the health care system in a country. In sub Saharan African countries access to insulin has been described as a problem. We describe the problem of insulin availability in Mozambique health system as an example case.

Mozambique has a total population of about 19 million people (2006) and the prevalence of type 1 diabetes is unknown. Using the IDF methodology on incidence and life expectancy, a total number of 1 254 type 1 diabetic patients are expected in the country.

A RAPIA study was conducted in Mozambique during 2003 in 3 different provinces. This study showed that diabetes type 1 is under diagnosed in the country, mainly outside the capital. The supply of insulin in the public sector has been inadequate with long periods of insulin shortages, which obliges the diabetic patients to buy insulin in the private sector, where it is 50 times more expensive. Nevertheless the total amount of money used by the government to buy insulin (10% of government expenditure on medicines) exceeded several times the needs. The reason for this discrepancy is a lack of a surveillance system for NCDs. Insulin requirements by the health units are done on an Ad-Hoc basis with a consequent accumulation of vials in places with low use and shortages in other places. As a consequence the public supply system tends to react to emergencies rather than forecast needs on surveillance system data. Another factor that creates long periods of shortage of drug is the system used for importation. Insulin is bought through big tenders together with several other drugs including psychotropic drugs which increases delivery time from the opening of the tender to the supply of the drug along the country. The delivery time can be as long as 18 months. Even when the drug is available, there is an insensibility of the health worker to the vital need of insulin for the patients. Stock outs at the provincial level are frequent even when, at a central level, insulin exists. Table 1 presents quantities and costs of different type of insulin imported by public health system during 2003 to 2006.

<table>
<thead>
<tr>
<th>Insulin</th>
<th>Year</th>
<th>Quantity</th>
<th>Price (USD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rápido</td>
<td>2003</td>
<td>0</td>
<td>9,000</td>
</tr>
<tr>
<td></td>
<td>2004</td>
<td>0</td>
<td>5,000</td>
</tr>
<tr>
<td></td>
<td>2005</td>
<td>9,000</td>
<td>14,000</td>
</tr>
<tr>
<td></td>
<td>2006</td>
<td>5,000</td>
<td>78,199</td>
</tr>
<tr>
<td>Intermédia</td>
<td>2003</td>
<td>12,000</td>
<td>51,000</td>
</tr>
<tr>
<td></td>
<td>2004</td>
<td>0</td>
<td>4,000</td>
</tr>
<tr>
<td></td>
<td>2005</td>
<td>0</td>
<td>67,000</td>
</tr>
<tr>
<td></td>
<td>2006</td>
<td>0</td>
<td>366,42</td>
</tr>
<tr>
<td>Mista</td>
<td>2003</td>
<td>0</td>
<td>2,500</td>
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<td>2004</td>
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<td>2,500</td>
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<td></td>
<td>2005</td>
<td>0</td>
<td>14,16</td>
</tr>
<tr>
<td></td>
<td>2006</td>
<td>0</td>
<td>94,567</td>
</tr>
<tr>
<td>Retarded</td>
<td>2003</td>
<td>0</td>
<td>7,000</td>
</tr>
<tr>
<td></td>
<td>2004</td>
<td>10,000</td>
<td>17,000</td>
</tr>
<tr>
<td></td>
<td>2005</td>
<td>0</td>
<td>94,567</td>
</tr>
</tbody>
</table>

The training of health workers on diabetes diagnosis and management is insufficient. Diagnostic facilities are not available outside the provincial capitals. The availability of urine glucose strips, ketone strips and glucometer are estimated to be 18%, 8% and 21% respectively on the health facilities. There are no guidelines for diabetes control and most health workers are afraid to use insulin safely.

Improvements in insulin availability and establishment of a diagnosis and management of type 1 diabetes need an holistic approach. Therefore, a NCD surveillance system needs to be on place. A specific and more flexible system of insulin importation and supply management should be developed. Primary health care diabetes guidelines and further training of health workers are necessary to increase the knowledge and the awareness of the disease. Some of these recommendations are already partially implemented, for example, support diabetes association in an effort to expand services to its members including supply of urine and glycemia strips, glucometers, etc., and the preparation of a standard guidelines procedures for management of diabetes patient is on going.

INSULIN SENSITIVITY INDICES: COMPARISON WITH THE HYPERINSULINAEMIC EUGLYCAEMIC CLAMP TECHNIQUE IN AFRICAN SUBJECTS

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The measurement of insulin sensitivity is of paramount importance for a better understanding of the pathogenesis of diabetes and related metabolic disorders. The gold standard method for the assessment of whole body insulin sensitivity remains the euglycaemic hyperinsulinaemic clamp. This technique is labour intensive, time consuming and expensive and therefore applies mostly for clinical...
research purposes. Several surrogates are proposed for the use in population studies. However these indices have mainly been validated in Caucasian and Asian populations.

In order to provide scientific evidence to support the use of one or more of these indices in populations of African descent, we have conducted the validation of the most frequently used fasting insulin sensitivity surrogates in 120 individuals of African origin of whom 40 were living in France and 80 in Cameroon. These indices were compared with the euglycaemic clamp for correlation and concordance in classifying individuals in four categories of insulin sensitivity. We performed a 120-min euglycaemic clamp at 80mU/m²/min insulin infusion rate to achieve supraphysiological levels of insulin in volunteers and derived insulin sensitivity from the glucose infusion rate at steady state and adjusted it to fat free mass. We also determined fasting glucose and insulin levels in order to derive the insulin sensitivity indices. The insulin sensitivity indices used for validation were the Homeostasis Model Assessment (HOMA), the Quantitative Insulin Sensitivity Check Index (QUICKI), the fasting Glucose-to-Insulin ratio (G/I) and the fasting Insulin level.

Fasting insulin (r= -0.70; p=0.01 for adjusted M-value), HOMAIR (r = -0.76; p<0.01 for adjusted M-value) and QUICKI (r= 0.67; p=0.01 for adjusted M-value) showed good correlations with the clamp-derived insulin sensitivity index. HOMAIR was found to be the best correlating index with the clamp-derived index in our study population. No significant correlation was found between M-value and G/I (r= 0.50; p=0.06 for adjusted M-value). Of note is the absence of concordance between the classification of subjects in four quartiles of insulin sensitivity by the clamp method and the fasting insulin sensitivity methods indicating the inability of these indices to be used to classify individuals.

We therefore conclude that most fasting insulin sensitivity indices can be used for epidemiological purposes in populations of sub-Saharan African origin, but not for clinical/individual classification purposes.

PRACTICAL TIPS FOR MANAGING HOME EMERGENCIES

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Hypoglycaemia and sick days pose special problems in diabetes and inappropriate management often results in critical illness and hospitalisation. Teaching individuals how to deal with these special circumstances is an integral part of their learning how to manage diabetes. However the advice is often not implemented by the individual at the time of illness due to lack of confidence or forgetting the advice that was given. Furthermore, health professionals often mistakenly treat all people with diabetes the same, rather than differentiating between Type 1 and Type 2 diabetes, which results in inappropriate advice being given. In addition, the management of acute emergencies in people with Type 1 diabetes will differ according to whether the individual is treated with subcutaneous injections or an insulin pump. Similarly, the management of those with Type 2 diabetes will also differ according to their mode of treatment.

This session will review the practical management of dealing with illness and hypoglycaemia as they relate to Type 1 (including those on pump therapy) and Type 2 diabetes. Specific issues for sick days include prevention, recognition and management of ketosis, ketoacidosis and hyperosmolar coma, when to seek help and when hospitalisation is necessary. The management of hypoglycaemia with regard to use of glucagon and adjustment of medication will also be reviewed.

THE ROLE OF TRADITIONAL HEALERS IN DIABETES CARE – THE TOGOLESE EXPERIENCE

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Method. This review has required consultation of different registers (Hospitals, Association Togolaise du Diabète (ATD) center), reports (ethnobotanical expedition, meetings, publications), interviews (Traditional Practitioners (TP), diabetics, doctors, educators, researchers).

Results. The main actors implicated in the field of Traditional medicine and diabetes care are: health ministry, faculty of sciences, ATD, doctors, traditional practitioners, diabetics, media. More than 50 medicinal plants (MP) are used to treat diabetes, alone or in association with antidiabetics. The main are Phyllanthus amarus, Momordica charantia, Catharantus roseus, Vernonina colorata, Azadirachta indica, Nauclea latifolia, Sclerocarya bireara. More than 30% of diabetics attending ATD center, are treated by MP. Up to 50% of diabetics combine MP and antidiabetics according a crossed itinerary. In a case-study, a significant decrease of the average fasting glycaemia from 3.03 g/l to 1.67 g/l (P<0.0001) has been observed after one month, in a group of 71 type 2 diabetics treated by MP and followed at the consultation of diabetology in CHU Tokoin. Collaboration between doctors and TP exists in 20% of cases due to a mutual mistrust. Only 20% of TP who declare healing diabetes have produced laboratory results attesting the normalisation of the glycaemia of their patients; in 1 case, the glycaemia had decreased from ‘2.4g/l to 1.02g/l’ in 15 days.
Discussion. Two aspects of traditional medicine are to be taken into consideration: common medicinal plants, and remedies of TP. The first one is available for all, cheap, well known, and generally non toxic at the concentrations currently used; some of them are secularly used in malaria treatment. Medicinal plants are also used to heal foot ulcers and prevent foot amputation. Most of them have been studied scientifically and their hypoglycemic activities demonstrated. These plants are the same found in other countries in Africa specially in west Africa. Remedies of TP are based on MP, remain secret and often non assessed. Most of current antidiabetics are not affordable for the majority of diabetics, poorly available, partially efficient and present some side effects. There are many quacks among TP, attracted by easy money, they use the media for their publicity. They are dangerous for the population and cause some premature deaths. Many diabetics turn to TM; in 50% of cases, it was to try to find better treatment, and for 28.57%, because of a lack of means. Traditional medicine without quacks has an undeniable role in the reduction of morbidity and mortality rates in Africa; studies, assessment and promotion by an international committee can ensure the real success.