DOI 10.1111/pedi.12449

WILEY ISPAD International Society for Pediatric and Adolescent Diabetes

INVITED ABSTRACTS

Exercise: part of diabetes treatment or only for the fittest? – JDRF?

INV1
Sports nutrition

F. Annan[1]

[1]*Alder Hey Children's Hospital, Liverpool, United Kingdom*

Nutrition is an integral part of the management of Type 1 Diabetes. For the active child and young person with T1D good nutrition is a key factor in both optimising glycaemic control during exercise and maximising sports performance. The IOC consensus statement on training the elite child athlete recommends "a strong support system to ensure a balanced lifestyle including proper nutrition, adequate sleep, academic development, psychological well-being and opportunities for socialisation". This recommendation applies to children with Type 1 Diabetes.

Sports nutrition advice for child athletes with Type 1 Diabetes is adapted from evidence for sports nutrition in adults and glycaemic management in children.

Requirements for nutrition for performance and recovery will be reviewed with a focus on the roles of carbohydrate, protein and fluid. The review will cover nutrition before, during and after exercise, based on the type and duration of exercise being undertaken and insulin adjustment strategies used.

Key references for this presentation include:

IM Mountjoy, N Armstrong, L Bizzini, et al.OC consensus statement: "training the elite child athlete" Br J Sports Med 2008;42:3 163–164

Thomas DT, Erdman KA, Burke LM. Position of the Academy of Nutrition and Dietetics, Dietitians of Canada, and the American College of Sports Medicine: Nutrition and Athletic Performance. J Acad Nutr Diet. 2016 Mar;116(3):501–28.

Desbrow B, McCormack J, Burke LM, Cox GR, Fallon K, Hislop M, et al. Sports Dietitians Australia position statement: sports nutrition for the adolescent athlete. Int J Sport Nutr Exerc Metab. 2014 Oct;24(5):570–84.

Rare monogenetic diabetes

INV2
Berardinelli-Seip syndrome and other lipodystrophies: diagnosis and treatment

C. Vigouroux[1]

[1]*Saint-Antoine Research Center, Inserm U938, Paris, France*

Berardinelli-Seip syndrome, also named Congenital Generalized Lipodystrophy (CGL), is a rare and severe monogenic syndrome of insulin resistance, transmitted as an autosomal recessive trait, mainly in consanguineous families. Inactivating mutations in four genes, causing the clinically related CGL type 1 to 4, impair the cellular pathways of adipocyte differentiation through different mechanisms, leading to the association of fat loss, insulin resistance, severe dyslipidemia and fatty liver disease, further complicated with diabetes. Early diagnosis, mainly based on clinical signs, is needed for adequate care, family screening and genetic counseling. Recombinant leptin therapy, which addresses one of the endocrine defects related to fat loss, is effective for the prevention and the treatment of metabolic complications. However, its restricted availibity outside North America and Japan limits its utilization for routine care.

Beside CGL, other rare lipodystrophic syndromes, with lipoatrophy being generalized or partial, genetically-determined or acquired, cover a broad spectrum of clinical phenotypes including multisystem pediatric or adult diseases. Accelerated ageing syndromes, DNA repair abnormalities, auto-immune or inflammatory diseases can also result in limited fat storage in adipose tissue and its metabolic consequences. These recently described diseases further reveal that each aggression against differentiation, regulation and/or maintenance of adipose tissue, or dysregulation of triglyceride storage within adipocyte lipid droplets, has major consequences for whole-body metabolic homeostasis.

Obesity and Insulin resistance

INV3
Metabolic Markers of Beta Cell Failure in Youth Insulin Resistance: Do They Conform to Standards?

S. Arslanian[1]

[1]*University of Pittsburgh, Children's Hospital of Pittsburgh of UPMC, Pediatrics, Pittsburgh, United States*

Youth prediabetes and type 2 diabetes have emerged as major consequences of childhood obesity imposing a serious public health burden. The traditional and widely accepted standards to either diagnose type 2 diabetes or capture heightened risk for future type 2 diabetes, i.e. pre diabetes, are the fasting and 2-hr glucose concentrations during an oral glucose tolerance test (OGTT). Considering that insulin resistance, impaired β-cell function and impaired incretin effect constitute

the pathophysiological mechanisms of youth prediabetes and type 2 diabetes, there is increasing interest to identify simple biomarkers that can detect impairment in β-cell function presaging type 2 diabetes. Among these are the fasting, the 1-hr, and the 2-hr glucose concentrations during the OGTT which signal impaired β-cell function, measured by the clamp-derived disposition index (β-cell function relative to insulin sensitivity), and proclaim risk of progression to type 2 diabetes. Additionally however, recent cross-sectional studies demonstrate that the shape of the OGTT-glucose response curve can differentiate type 2 diabetes risk in adults, but data are limited in pediatrics. This presentation will discuss the nontraditional metabolic biomarkers that herald β-cell failure and risk of type 2 diabetes in obese youth.

Pandemic and Potential solutions: Improving Diabetes in emerging economies

INV4
Pandemic and potential solutions: improving diabetes in emerging economies - China

J. Fu[1]

[1]*Children's Hospital of Zhejiang University School of Medicine, Hangzhou, China*

It has brought an increasing amount of attention to childhood diabetes and the impact on economic development. The cost for diabetes-related health expenditure in China is >500 billion dollars in 2015.

The incidence is increasing in China, particularly in children < 15 years. We conducted a nationwide study from China's 14 medical centers for15 years including 4 million patients. T1DM has occurrence rate of 89.6% of all diabetes.China ranks No.4 in the number of children with T1DM (<15 years).The overall annualincidence increase isestimated around 3% globally. But there are strong geographic difference, with 3 times higher in well developed areas in China such as Beijing, Shanghai. According to the retrospective study the mean age at diagnosis decreased significantly to 11.21 years in 2013. A steep rise in diabetes incidence was observed in the under 5 year's age group.

China is struggling with the growing challenge of childhood obesity and rapid increase in type 2 diabetes. The prevalence of obesity and overweight increased 3-fold in 10 years.The prevalence of overweight was 11.0 % and obesity 8.9 % in our multicenter study, aged 7–16 years old. The prevalence of childhood T2DM in China doubled from 4.1/100,000 in the first 5 years to 10.0/100,000 in the recent 5 years.

Withthe growing increase in diabetes, we are trying to improve the awareness of society to childhood diabetes.Chinese professionalsconducted the project *MANAGEMENT PROGRAM FOR CHILDREN WITH DIABETES IN CHINA*,which has established32 pediatric diabetes centers in 26 cities in Chinafrom Nov. 2011 to Mar. 1, 2015. We organized78 diabetescamps to deliver knowledge of diabetes care and set up a network for communication. Over 1300 children and 2600 parents benefit.Meanwhile,Spring Bud Plan-Chinese children diabetes cooperative group was initiated involving 48 pediatric diabetic centers. Outpatient management of diabetes and 3C diabetic management is seeing its advantage.

Obesity and Insulin resistance

INV5
Endocrine-metabolic consequences of low and high weight at birth

L. Ibañez[1]

[1]*University of Barcelona, Barcelona, Spain*

Infants born small-for-gestational-age (SGA) are at higher risk for adult diseases, including diabetes and hypertension. Longitudinal studies have disclosed that those risks may be modulated by early nutrition, so that breast-feeding confers a relatively low risk and protein-enriched formula-feeding is followed by a relatively high risk. In early infancy, the catch-up of SGA infants is characterized by a recovery of lean versus fat mass; in late infancy, SGA-breastfed infants combine a low adiposity and a high insulin sensitivity with normal IGF-I and HMW adiponectin levels; in contrast, SGA infants fed enriched formulas normalize their body composition by gaining more fat; this normalization is accompanied by a fall in HMW adiponectinemia and by elevated IGF-I levels, and thus, by a less favorable cardio-metabolic profile. Eventually, catch-up SGA children tend to become hyperinsulinemic, and to display more hepatic fat and a thicker carotida by the age of 3–6 yr; the development of overweight amplifies these abnormalities and increases further the risk for an early and rapidly progressive puberty, and a shorter adult stature.

Breastfed, large-for-gestational-age (LGA) infants from non-diabetic mothers are more adipose as newborns, despite having lower levels of myostatin -a myokine inhibiting the differentiation of myoblasts-, and longer telomeres. By the end of early infancy, these infants become relatively lean and develop a favorable endocrine-metabolic profile including high insulin sensitivity. By age 2 years, LGA subjects become relatively "muscular" -by gaining more lean mass- and tall; this pattern of body composition may subsequently protect these individuals against metabolic complications of overweight and explain their lower risk for diabetes as adults.

Emerging diabetes therapeutics (ADA symposium)

INV6
New approaches for islet immune-isolation and delivery

D.G. Anderson[1]

[1]*Massachusetts Institute of Technology, Cambridge, United States*

The fibrotic reaction to implanted biomaterials is a fundamental challenge to the development of immuno-isolation devices. Here we describe our work developing new biomaterials and devices for the purposes of enabling islet transplantation. In particular we describe the development of a large library of synthetic hydrogel materials, and the characterization of their biocompatibility in vivo. Data will be presented on the nature of the immune response to these and conventional biomaterials. Several lead materials have been identified with significantly improved biocompatibility in rodents and primates. When formulated into microcapsules these materials allow for long-term islet survival and function in rodents and primates.

INV7
Neurodevelopment and KATP channels: evolution and new pharmacologic approach

K. Busiah[1]

[1]*Necker-Enfants Malades Hospital - Assistance Publique Hôpitaux de Paris, Paris, France*

ATP-sensitive potassium (K_{ATP}) channels are cell metabolic sensors that couple cell metabolic status to electric activity, thus regulating many cellular functions. Structurally, K_{ATP} channels are four identical inwardly rectifying potassium channel subunits (Kirx) forming the pore, associated to four identical high-affinity sulphonylurea receptor subunits (SURx). In the brain, as in the pancreatic β-cells, the Kir6.2/SUR1 channel is the dominant K_{ATP} isoform. In pancreatic β-cells, K_{ATP} channels modulate insulin secretion in response to fluctuations in plasma glucose level, thus regulating glucose homeostasis. In the brain, their functions and the pathways they control are partly understood. Neonatal diabetes mellitus (NDM) is due to gain-of-function mutations in K_{ATP} channel subunits and is associated with neurodevelopmental disorders ranging from developmental delay and epilepsy (DEND) or intermediate DEND syndrome to developmental coordination disorder associated or not with hypotonia or attention deficit. Sulfonylurea treatment acts through closure of the K_{ATP} channels, which enables insulin secretion from the β-cell and modest but measureable improvements in neurodevelopmental outcomes. However, sulfonylurea drugs have limited ability to cross the blood–brain barrier in animal models. Early treatment with sulfonylureas improves visuomotor performance in patients with permanent NDM. Rapid identification of mutations and switching to sulfonylurea treatment at a younger age might provide further benefit with regard to neurodevelopmental outcomes. Our group developed a suspension of glibenclamide that is more suitable for use in pediatric patients as its dosage can be adjusted to patients needs with great precision. Pharmacokinetic studies reported it to be better absorbed than glibenclamide tablets and metabolic studies reported same efficiency as tablets in infants and young children affected with NDM (ClinicalTrial.gov NCT02375828).

Epidemiology and Economic Burden on healthcare system by childhood DM

INV8
Is the incidence of type 1 diabetes in children and adolescents really increasing?

E. Mayer-Davis[1]

[1]*University of North Carolina at Chapel Hill, Department of Nutrition, Chapel Hill, United States*

Type 1 diabetes (T1D) diagnosed in youth presents a substantial clinical and public health burden due to both the challenges of daily disease management and the risk for serious acute and chronic complications. Previous reports documented that the incidence of T1D has increased worldwide over the past three decades. Data from Australia demonstrated a 5-year cyclical variation in T1D incidence in youth from 2000–2011 in both sexes and in all age groups studied. In Finland - with the world's highest reported incidence of T1D - analyses suggested a stabilization of the incidence of T1D from 2005–2011. Similar findings indicating a plateau in incidence were reported from Norway. On the other hand, data recently reported form the SEARCH for Diabetes in Youth study in the United States showed that a linear trend of increasing incidence of T1D from 2002–2012 was the best fit to the data, rather than a non-linear function. In this presentation, we will present data from around the world and will consider potential reasons for variable results across studies and countries on the topic of whether the incidence of T1D is increasing over time. These results are important indicators of the potential impact of T1D on the lives of young individuals, on the health care system and on society in general. Variation in incidence trends may generate new directions for research on the environmental or behavioral triggers of T1D diabetes in youth that may change over time, and that therefore may be important in eventual efforts for prevention.

Diabetes Registries: Comparing outcomes to improve care

INV9
Nordic countries / USA & Australia registries

J. Svensson[1]

[1]*Herlev University Hospital, Copenhagen, Herlev, Denmark*

Objectives: There is an increasing use of benchmarking within and between countries. Resources are used to collect data and present data. Is it purely an academic exercise or do our patients benefits from benchmarking? The purpose of this lecture is to describe the Nordic and American and Australian benchmarking, to highlight results regarding improved outcome for children with diabetes and discuss why and how benchmarking works.
Methods: Literature review of studies from the Nordic National registers, America and Australia including long-time follow-up and feedback to participating center including center specific results before and after.
Results: There are numerous registers and collaborating net-works worldwide with the purpose of improving outcome for children with diabetes. There are substantial differences among countries and centers not easily explained by the treatment or population characteristics. Some differences between centres may be nullified by the opposite results from other centres hiding valuable information. Several studies have shown improved HbA1c and reduction in hypoglycemic events, though some studies show limited improvement. Only items with a high accuracy and completeness can be addressed for interpretation and more soft variables such as good communications skills and beliefs are difficult to measure. Beneficial outcome may be due to exchange of guidelines, exchange of good clinical practice or the direct comparison of results changing our beliefs of what is possible. The mindset of the healthcare providers (or patients) may be as important as treatment including target settings.
Conclusions: Benchmarking and national registers is often associated with improved care the challenge is to translate it into specific guidelines and identify factors responsible for improved outcome. Our own mindset and convictions may be challenge by the best results seen in centers comparable to our own.

The state of art on Diabetes Complications

INV10
Effects of type 1 diabetes on cognition and the brain

A.M. Arbelaez[1]

[1]*Washington University, Saint Louis, United States*

The human brain undergoes dynamic changes in brain structure and metabolic demand throughout childhood. Glycemic extremes, such as hypoglycemia and hyperglycemia, occur more frequently in children and adolescents with T1DM. Thus, brain developmental trajectories are altered depending on the age and severity at which these extremes are experienced. Studies utilizing various neuroimaging techniques have shown that glycemic extremes can differentially affect the developing brain. Severe hypoglycemia has been associated with smaller gray matter volumes in superior temporal regions, whereas exposure to hyperglycemia has been associated with smaller gray matter volume in the medial parietal area, greater gray matter volume in the right prefrontal region. There are only a few of cognitive studies with large sample size that examine glycemic control variables in a reliable manner. Some studies in adults and children have documented an association between severe hypoglycemia and lower cognitive outcomes compared to controls or those without severe hypoglycemia. Moreover, cross-sectional studies of youth suggest that exposure to chronic hyperglycemia may lead to subtle differences in cognitive and academic function. Recent data suggest that this association can be detected quite early in young children and youth with recent onset diabetes. However, longitudinal prospective studies over a wide range of glycemic extremes are needed to better determine the effects of glycemic extremes in the brain.

Motivational Interviewing to engage adolescents with Diabetes

INV11
Motivational interviewing to engage adolescents with diabetes

D. Christie[1]

[1]*UCLH, London, United Kingdom*

For young people trying to keep diabetes under control the behaviours can appear simple e.g.; following a healthy diet, regular self-monitoring and exercise. However clinicians and parents are often frustrated by the gap between the “ideal” and ’reality’. Young people have conflicting motivations and pressures; a change in behaviour feels too big, the rewards too distant, the personal or financial costs too high or maybe it was never their idea to change in the first place. Attention has turned to the potential of Motivational Interviewing in the paediatric setting, particularly with the adolescent age group. Motivational Interviewing is a directive person-centred therapeutic style that invites individuals to explore ambivalence and find solutions that fit for them if they identify the situation as a problem. Early trials support the use of MI in type one diabetes in adolescents, either as a stand-alone treatment or as an adjunct to other treatments where it can be a method of engaging patients in the programmes thus enabling the programmes to be more effective. The presentation describes the core principles and key skills of motivational interviewing and offers clinical examples with young people and parents living with diabetes.

Christie, D., Martin, C. (Eds.), (2012). Psychosocial Aspects of Diabetes: Children, Adolescents and Their Families London: Radcliffe.

Christie, D., Channon, S.(2014).

Using motivational interviewing to engage adolescents and young adults with diabetes *Practical Diabetes*, 31 (6), 252–256. doi:10.1002/pdi.1878

Is Diabetes an Emotional Burden in adolescents and young adults with T1DM?

INV12

I wish they understood how much of an impact it has on everyone in the family': parents' views of living with type 1 diabetes in the family

C. Hendrieckx[1]

[1]*Deakin University, The Australian Centre for Behavioural Research in Diabetes, Geelong, Australia*

This presentation will share findings of the Diabetes MILES Youth Study, the first large-scale, Australian survey of parents and adolescents focused on the psychological aspects of diabetes.

Youth (aged 10 to 19 years) and their parents were invited to complete an online survey about their experiences of living with type 1 diabetes, their emotional well-being, family relationships and support. Parents completed questions about their own general emotional well-being as well as diabetes-specific measures (parental diabetes-related distress, fear of hypoglycaemia and hyperglycaemia); about their child's diabetes management, history of hypoglycaemia and DKA, diabetes-specific self-efficacy and responsibilities.

In total, 826 parents or carers (mean age 46 ± 6years, 88% mothers) of an adolescent with type 1 diabetes took part in the study. Overall, few parents reported severe anxiety symptoms (8%) or had impaired emotional well-being (12%). However, one in four parents experienced high levels of distress related to their child's diabetes. Looking more closely to their concerns, it was clear that parents experienced both fear of hyperglycaemia (and its long-term consequences) as well as fear of hypoglycaemia. Parents were often concerned about their child's diabetes management being ´off track´ and many felt they acted as 'diabetes police'. In general, respondents scored high on the diabetes self-efficacy scale, but they felt least confident in having the conversation with their child about the realities of long-term complications. These findings indicate that the difficulties parents face in keeping the child's glucose levels within targets affect their psychological well-being and family relationships.

The Diabetes MILES Youth survey provided an opportunity for parents' voices to be heard, as illustrated by this parent: *'Thank you for providing the opportunity to detail what I experience on a daily basis.'*

INV13

We're all in this together - reducing the burden, an issue for the whole family and the diabetes team

E. Northam[1]

[1]*Murdoch Childrens Research Institute, Cell Biology, Melbourne, Australia*

Recent advances in insulin delivery systems, as well as new and improved insulins hold great promise for improved outcomes for youth with TIDM. Yet the emotional burden of the disease remains stubbornly high and there is evidence that human behaviour continues to undermine the translation of treatment advances into better outcomes for patients. Media driven reports of an imminent "cure" create uncertainty and disappointment for families, while the demands of implementing promising new technologies may exceed the financial, cognitive and emotional resources of many individuals and actually increase stress and a sense of failure. As Acerini (2016) points out, evidence that "high tech" = "high quality" = better metabolic outcomes is lacking. Hope is essential, but misguided hope will engender resentment and undermine trust. Most clinicians are acutely aware of the important role that emotional factors play in diabetes management, but the desire for a prescriptive template for reducing stress and promoting psychological wellbeing in their patients, while understandable, may be unrealistic. It is most unlikely that "one size will ever fit all". This presentation will review what we currently know and what we still need to learn about the psychology of diabetes management. Pitfalls, predicaments and cautionary tales will be noted, and some suggestions for a way forward will be offered.

Acerinit C. The rise of new technology in diabetes care. Not all that is new is necessarily better. *Pediatric Diabetes* 2016; doi:10.11111pedi.12366