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The Nutrition Society Summer Conference 2023 hosted at The Hilton Liverpool, 3rd–6th July 2023

Editorial

Conference on 'nutrition at key stages of the lifecycle'

Editorial: nutrition at key stages of the lifecycle

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Nutritional requirements of individuals vary across the lifecycle, according to activity, age and gender. To optimize human health, consideration of nutritional priorities at each stage is needed. This conference brought together multidisciplinary experts in maternal and child nutrition and health, cardiometabolic and plant-based nutrition and dietitians involved in the care of vulnerable populations, plus nutritional metabolism, health and ageing. The presentations highlighted the most important nutrition research in these areas, updating knowledge and suggesting how dietary advice and policy could be adapted to incorporate research findings. With the global increase in non-communicable disease (NCD) and nutrition being considered as a key modifiable risk factor for the prevention and management of NCD, this conference was much needed.

Key words: Nutrition: Lifecycle: Health

Nutritional needs and requirements vary at different stages of the human lifecycle; what is appropriate for a fully grown adult, is not appropriate for a young child (and vice versa)[1]. This is acknowledged in the UK Dietary Reference Values (DRVs)[2], where specific ranges for energy and nutrients are suggested according to the age and gender of the population. It is acknowledged that optimum nutrition during the first 1000 d of life (from conception to a child's second birthday) is the most influential in terms of health and development for the whole of the life cycle[3]. This is particularly true regarding the prevention of obesity and non-communicable disease (NCD); for example, low birth weight, as an indicator of poor nutrition in utero, is associated with an increased lifetime incidence of CVD, stroke, and type 2 diabetes[4]. The UK continues to have one of the highest rates of low birth weight in Europe at 6·8 % in 2019[5]. Furthermore, the UK's National Health Service is struggling to cope with the burden of NCD; in 2019, 88 % of deaths in England were due to NCD[6]. The World Health Organisation states that NCDs are now the leading cause of death globally, with 71 % of premature deaths attributable to NCDs[7]. Diet is identified as a key modifiable risk factor in the prevention and management of NCD and so requires considerable attention in the planning and delivery of health promotion strategies[8].

Topics presented during the conference

The conference, 'Nutrition at Key Stages of the Life Cycle', held from 3 to 6 July 2023, was designed to explore new and developing areas of research, focussing on key stages of the life cycle. Six symposia were organised and covered nutritional issues relating to 'Pregnancy'; 'Childhood'; 'Food Chain Interventions'; 'Prevention of Cardio-metabolic Disease'; 'Nutritionally Vulnerable

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Populations' and 'Later life'. The conference was held at The Hilton Hotel, Liverpool, and attended by 262 delegates from 15 countries (including USA, Qatar, India, Chile, Ghana, UAE, Australia, and Japan).

Day one started with a plenary about nutrition and immunity, with a particular focus on lessons learned from the COVID-19 pandemic by Professor Phillip Calder (University of Southampton). The main conclusion was that living with overweight or obesity, frailty and/or insufficient zinc or vitamin D status all had a negative impact on immunity[9]. This was followed by presentations highlighting the Nutrition Society theme leads, and for the first time, there were two original communication sessions, highlighting research by/with Black, Asian, and Minority Ethnic (BAME) populations, organised by the new Nutrition Society special interest group 'Diet and Health of Ethnic Minority Groups,' (launched in July 2022). There were two oral and seven poster presentations, covering school lunches of BAME children; Diet and physical activity of UK Black pregnant women; Assessment of diet in Nigeria (using Myfood24)' and a review of Nutrition and Dietetics programmes in Ghana [OC98, OC100, OC101-OC107].

Nutrition in pregnancy

Day 2 commenced with a plenary by Rank Nutrition prize winner, Professor Kristina Pentieva (Ulster University), who gave a detailed overview of some of the health impacts and challenges regarding B vitamins during pregnancy. This included the functions of folate, vitamins B_{12}, B_6 and riboflavin, plus related gene–nutrient interactions; particularly regarding avoiding pregnancy-induced hypertension[10]. Continuing the topic of nutrition in pregnancy, Professor Sharleen O'Reilly (University College Dublin), presented her multi-centre work (Bump2Baby) using a systems approach to manage maternal obesity and gestational diabetes. She highlighted that many antenatal and post-partum health interventions, fail to meet the needs of the women involved. It is intended that her approach, where the intervention is designed with women, rather than for women, will ensure that women's needs are met in the future[11]. Next was Dr Kate Maslin (Plymouth University), who discussed the nutrition challenges of pregnancy, following weight loss surgery. Dr Maslin highlighted that women are advised to wait for two years before trying to conceive after weight loss surgery, but this often does not happen, resulting in increased challenges regarding nutritional intake for pregnancy. Women will need to have serum nutrient levels checked at each trimester and are advised to take supplements of vitamins A, D, E K, B_1 and folate, plus iron, calcium and selenium when necessary[12]. The final speaker was Dr Elinor Olander (City University, London), a psychologist, who presented her work regarding midwives offering healthy eating advice during antenatal care. Antenatal care guidelines[13] specify that all pregnant women should receive advice about healthy eating during antenatal appointments, but pregnant women report feeling unsupported by healthcare professionals, describing information as inconsistent, contradictory and too general[13,14]. This has implications for the education and continuous professional development of healthcare professionals to enable them to fulfil this key role.

Nutrition in childhood

During the afternoon of day two, symposium two moved the focus to childhood nutrition, a time in the life span that can have considerable influence on long-term health and where timely interventions can support the development of positive behaviours in children. Dr Michelle Miller (University of Warwick) presented topical research exploring the causal relationship between sleep and obesity in children. She highlighted the importance of sleep and showed evidence that short durations of sleep are associated with detrimental effects on metabolic, endocrine, immune functions and homeostatic pathways, leading to much greater risks for obesity and obesity-related disorders of hypertension, type 2 diabetes mellitus and CVD. She proceeded to emphasise effective strategies that parents/guardians can use for improving the quality of not just children's sleep but for everyone[15,16]. Professor Jayne Woodside (Queen's University, Belfast) presented her work around the GENIUS school food network, which aims to build a network of researchers and non-academic stakeholders working within the UK and school food systems to build research capacity. School food provision has the potential to reduce the risk of obesity and NCD, and the network aims to build a community that works to provide a more health-promoting food and nutrition system in UK schools[17,18]. Our final speaker in symposium two, was Dr Lisa Newson (Liverpool John Moores University), a health psychologist who spoke passionately about how those involved in childhood weight management interventions need to have a broader approach and give more consideration to the effects of psychosocial issues. These include childhood stress and the negative effects of low self-esteem on emotions, mental health and eating behaviours, which are associated with weight discrimination and stigma[19]. A more holistic approach, that addresses psychosocial and emotional needs, may positively influence engagement with and long-term sustainability of health behaviour change interventions[19,20].

The potential health impacts of food chain interventions

A parallel session during the afternoon of day two focussed on opportunities within food supply chains to impact both public and planetary health. Professor Nicola Lowe (University of Central Lancashire) opened this symposium with an important reminder about the global prevalence of 'hidden hunger' micro-nutrient deficiencies[21], with a particular focus on zinc deficiency in Pakistan (which affects 22 % of the adult population[22], with prevalence rates as high as 68 % in adolescent girls in some rural communities[23]). Professor Lowe outlined the

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potential role of food fortification and biofortification programmes to address this type of public health challenge (plus the strengths and weaknesses of these approaches), including the use of the Zincol-2016 zinc biofortified wheat variety and its potential role in flours used in making widely consumed breads. Professor Lowe reminded us that for the scale-up of successful biofortification and food fortification programmes, there is a need for (a) evidence of efficacy, (b) consumer acceptability and (c) strong stakeholder and policy-maker support. Professor Lowe outlined how the 'BiZiFED2 trial' had been the first effectiveness study to demonstrate the impact of consuming biofortified wheat on dietary zinc intake and health outcomes in adolescent girls in Pakistan[24], as well as outlining additional work linked to consumer and farmer acceptability of biofortified wheat and the performance of Zincol-2016 under different agronomic management practices.

Dr Leo Stevenson (Liverpool Hope University), followed with a review of work undertaken over the last 10 years focused on hot take-away foods from independent food businesses. Dr Stevenson reminded us of some of the reasons behind increasing levels of consumption[25] and the potential contribution to cardio-metabolic disease risk and increased weight gain from these types of energy-dense foods (typically high in salt, fat and SFA)[26]. Dr Stevenson outlined the importance of interventions in small independent businesses, which are currently exempt from regulations requiring calorie information on menus[27] and often provide foods with meals that have a nutritional composition that compares less favourably with 'ready to eat' meals from major supermarkets[28]. Dr Stevenson outlined the experience of working with small independent take-away food businesses around 'reformulation,' including the achievable level of nutritional improvement (meeting both food business and consumer expectations).

Professor Charlotte Hardman (Liverpool University) finished the symposium with an engaging discussion about the potential for 'Rurbanisation' (the ruralisation of urban areas through increased food growing) to act as an intervention to improve diet and wellbeing, particularly in communities experiencing significant food insecurity. Professor Hardman presented findings from the 'Rurban Revolution' project, which included findings indicating that more spaces in UK towns and cities used for food growing could increase the production of fruit and vegetables and help meet the dietary needs of local populations[29]. Findings also concurred with wider evidence indicating that growing food in urban areas can have extended benefits for individuals via developing skills, social connections and wellbeing[30]. Professor Hardman concluded with some interesting thoughts about psychological mechanisms that might explain the effects of urban food growing on diet and wellbeing.

Nutrition for the prevention of CVD across the life span

Day three of the conference started with a plenary from Dr Michael Schmidt from the USA (Sovaris Aerospace), who fascinated us with his research on space travel with the NASA Twins Study[31]. The study contains the most robust multi-scale omics investigation of the molecular changes in a human during nearly one year in space. He showed how specific analytes (or analyte clusters) might one day serve as novel biomarkers for use in spaceflight or on Earth[31].

Symposium four focused on 'Nutrition for the prevention of CVD across the life span,' with three speakers presenting key areas of research on the importance of nutrition in the primary and secondary prevention of CVD. Professor Bruce Griffin (University of Surrey), started the symposium with an enthusiastic presentation regarding the importance of serum low-density lipoprotein cholesterol (LDL-C) as a causal risk factor for CVD[32]. He presented evidence showing from the RISSCI-1 and 2 (Reading, Imperial, Surrey, Saturated fat Cholesterol Intervention) studies that investigated the responsiveness of LDL-C to dietary saturated fat reduction[33]. The RISSCI-1 study showed variation in LDL-C from –40 % to 20 % and that cholesterol intestinal absorption increased, and genes associated with lipid metabolism were upregulated[34,35], whereas RISSCI-2 has given deeper insights regarding the potential drivers of this variation, including the postprandial trace-labelling of dietary fat (U-^{13}C palmitate) and plasma metabolomics. Professor Griffin's work offered valuable evidence that supports current dietary guidelines for the reduction and replacement of dietary saturated fat, which would make a substantial contribution to public health.

Dr Ian Davies (Liverpool John Moores University), followed proposing that higher protein (HP) diets, particularly when combined with resistance training (RT), could improve current cardiac rehabilitation (CR). He presented studies showing the variable impact of HP diets on cardiometabolic health and that the consensus from meta-analyses favour plant-based protein[36–39]. He highlighted the potential benefits of HP diets when combined with RT in older populations[40], and how this translates to CR regarding indices of muscle health, but he pointed out the lack of published data on this combination in individuals living with CVD. He showed the feasibility and acceptance of high protein diets in those living with CVD, via his work on the PRiMER study, which combines a HP/Mediterranean-style diet with RT in CR[41,42]. Dr Davies finished by stating that caution, in relation to the microbiome and existing kidney disease, should be considered before application and suggested further research regarding efficacy, mechanisms of action, and safety in specific CR populations is needed.

Dr Wendy Hall (King's College, London) finished the symposium focusing on the growing concern of CVD in women, with millions affected in the UK[43]. She emphasised that several risk factors, including high blood pressure, obesity, diabetes, and raised triglycerides, pose an even greater threat to women than men[44]. Additionally, the presentation highlighted the unique female-specific risk factors, such as early menarche, pregnancy complications, and menopause and that long-chain *n*–3 PUFA (LC *n*–3 PUFAs) are particularly

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relevant regarding CVD risk in women with inadequate dietary intake. Dr Hall discussed the results of the REDUCE-IT trial stating no sex differences regarding LC *n*–3 PUFA, but that women were underrepresented. Dr Hall stressed the importance of increased consumption LC *n*–3 PUFAs, especially during the menopausal transition when triglyceride levels rise and efficiency in converting short-chain *n*–3 PUFA to the cardio-protective LC *n*–3 PUFA is lost,[45,46] and concluded the need for more research on optimal LC *n*–3 PUFA intake across a woman's lifespan in the context of CVD prevention.

Challenges for nutritionally vulnerable populations

In parallel to symposium four, on day three there was a symposium focused on 'Challenges for nutritionally vulnerable populations' (symposium five), with three speakers presenting key areas of research on the importance of carefully planned diet and nutrition advice for vulnerable groups. The three expert speakers tackled this issue from interesting perspectives.

The first talk was by Dr Sarah Bath (University of Surry), who gave an excellent insight into whether we are missing vital micronutrients when switching to plant-based diets for sustainability and health. Dr Bath discussed the potential absence of iodine, calcium, vitamins B_2 and B_{12} in diets that exclude animal food. She further explained how milk and dairy products provide 51 % and 33 % of the iodine intake of UK children (4–10 years) and adults respectively and outlined findings from her own research showing that unfortified plant-based milk-alternative drinks have an iodine concentration that is just 2 % of that of cows' milk[47]. Dr Bath concluded that it is important to consider all nutrients that may be at risk in a plant-based diet and that appropriate consideration is given to this in nutrition guidelines and advice given by healthcare professionals.

Following this Prof. François Mariotti (Agro Paris Tech), presented his topical research highlighting the health benefits and risks of plant-based food analogues, focussing on meat alternatives. He revealed that plant-based meat alternatives were becoming an increasingly popular choice in diets across Europe. While some health benefits are reported, particularly increased intake of dietary fibre and reduced intake of SFA, there are concerns about the absence of key micronutrients. His research has found that while plant-based meat substitutes can compensate for the reduced provision of some key micronutrients found in meat (e.g. vitamin B_6, potassium, bioavailable iron); they currently do not compensate for bioavailable zinc and vitamin B_{12}. He concluded that choosing the right ingredients for meat alternatives could improve the nutritional intake of people following a plant-based diet[48].

Finally, Dr Roz Fallaize (University of Hertfordshire), concluded the symposium by presenting her extremely interesting work supporting nutritionally vulnerable homeless people. She began by highlighting the worryingly high figures of homelessness in the UK and how the situation is worsening due to the current cost of living crisis. Her research has focussed on dietary intake, nutritional status, and mental health of homeless people[49]. Key findings included higher intakes of salt, alcohol and SFA; plus, lower intakes of dietary fibre, vitamin C and fruit, compared to housed people. Smoking and substance misuse were also high in the homeless group[49]. Not surprisingly, homeless people have much lower life expectancy than the general UK population, and more needs to be done to tackle this significant health inequality.

Nutrition in later life

The final day of the conference concluded with a plenary and symposium regarding the topic of 'Nutrition in Later Life'. This is of vital importance given the aging population in the UK, the multidimensional impact of senescence on both the lifespan and healthspan, and emerging evidence highlighting the influence of nutrition. The four expert speakers tackled this issue from very different perspectives. The session commenced with a plenary by Professor Mario Siervo (Curtin University, Western Australia), who discussed the detection of sarcopenic obesity and the importance of nutrition. He initially highlighted the lack of standardised protocols for the diagnosis of the condition which has resulted in elevated levels of heterogeneity in the evidence reporting its prevalence[50]. Professor Siervo then described his efforts to address this by contributing to the development of the Sarcopenic Obesity Global Leadership Initiative which aims to reach expert consensus and enable the condition to be defined as a distinct phenotype[50]. In addition, he evaluated common nutritional strategies that are frequently used for the prevention and management of sarcopenic obesity.

Next was Dr Oliver Witard (King's College London), who gave an excellent insight into the role of omega-3 fatty acids in skeletal muscle protein turnover in older adults. More specifically, Dr Witard explained how supplementation with omega-3 fatty acids may reduce anabolic resistance and lead to increased muscle mass and strength in older adults[51,52]. Although the underpinning mechanisms have yet to be elucidated this nonetheless suggests that nutritional recommendations should place a greater emphasis on omega-3 consumption[52].

Dr Paul Morgan also focused on muscle and assessed the evidence regarding protein supplementation for the maintenance of muscle mass. Dr Morgan (Manchester Metropolitan University), showed how there is a growing body of evidence suggesting that recommendations for dietary protein intake should be increased for older adults to ensure skeletal muscle health[53]. Dr Morgan's presentation also demonstrated how the nuances of dietary protein intake should be considered for older adults, such as its postprandial impact on skeletal muscle metabolism[54,55].

Finally, Dr David Weinkove (University of Durham) concluded the symposium by explaining how his findings regarding nutrient metabolism in the nematode worm '*C. elegans*,' might be translatable to humans. More specifically, Dr Weinkove mentioned how *E. coli* provides

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C. elegans with folate; however, the microbe also limits the worm's lifespan[56]. Interestingly, Dr Weinkove made the unexpected discovery that inhibiting the production of folate by *E. coli* resulted in an extension of lifespan of *C. elegans*; not because of decreased folate supply, but rather a change in bacterial metabolism and/or behaviour that was beneficial to the worm[57]. Therefore, this may provide a potential target to slow animal aging with no detrimental effect.

Summary

The talks throughout the conference, although varied, offered delegates much to consider regarding the role of numerous nutritional strategies that might be used to improve the health of populations across the whole lifespan. This included approaches to optimise nutrition and weight gain during pregnancy and childhood, ensuring that individuals have the best start in life. Considerations of protein, fat, and carbohydrate to both prevent and manage cardiometabolic disease. Strategies to improve the nutrient intake of more vulnerable populations, including the homeless and people following a plant-based diet. Finally, novel nutritional considerations to negate the various effects of aging. Each of the talks created a great deal of debate as evidenced by the numerous thoughtful questions that ensued and were an excellent indication of interest and engagement throughout the conference.

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Author contributions

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Conflict of interest

There are no conflicts of interest.

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