

Lifelong impact of nutrition in the first thousand days after conception

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Chronic non-communicable diseases such as Type 2 diabetes, cardiovascular disease and obesity are reaching epidemic proportions worldwide, accompanied by severe impairment of quality of life and huge cost of medical care. Take the Netherlands, for example: in a population of about 17 million, about a million adults have Type 2 diabetes. Close to 4 million are on lifelong medication for hypertension. Over a million take statins every day to reduce their cholesterol levels. Almost half of the population is overweight or obese (statistics Netherlands, 2012). Those with a relatively low socioeconomic position are at increased risk. Prevention, targeting high-risk groups and individuals, is a necessity.

Prevention deals with behavioural and environmental determinants of these diseases: in particular, smoking, excessive use of alcohol, lack of physical activity and unhealthy diets. These, in turn, are heavily influenced by physical, economic and socio-cultural environments related to increased urbanisation and globalisation of markets. The World Health Organization (WHO) has estimated that about 80% of chronic non-communicable diseases can be prevented by healthier lifestyles.

The WHO also stresses the importance of a 'life course' approach to prevention, starting at conception. Especially the first 1000 days, from conception until the second birthday, are considered to have a crucial and potentially lifelong effect on the growth and development of children (Woo Baidal *et al.*, 2016). Here at the Vrije Universiteit Amsterdam we are currently involved with ongoing monitoring of the effectiveness of the Amsterdam Healthy Weight Programme, which is showing early signs of promise in reducing the incidence of childhood overweight and obesity. Its approach has potential to be replicated elsewhere, as outlined in a recent report by the Centre for Social Justice (2017) in the UK (see page 97).

Threats and opportunities before birth

It is increasingly recognised that nutrition affects the health of the child even before conception, by influencing intra-uterine growth and development. For instance, the degree to which a mother and father are overweight at conception predicts, to some extent, the likelihood of their future offspring being overweight. This partly reflects genetic susceptibility that is transferred from the parents. But studies have shown that when mothers with obesity lose weight before pregnancy, this also lowers the risk of their children being overweight.

The intra-uterine environment may affect the metabolic programming in the foetus: in an obese mother, for example, this could lead to insulin resistance, low muscle mass and reduced metabolic rate, all of which can predispose the child to future risk of obesity and Type 2 diabetes.

Some effects of intra-uterine nutrition are mediated by epigenetic effects of nutrients. Epigenetics describes the cellular processes that determine whether a certain gene will be transcribed and translated into its corresponding protein. It is a specific kind of metabolic programming, which occurs through DNA methylation. Food containing nutrients that can act as methyl donors, such as folic acid and choline, may be of particular interest in this regard. These epigenetic changes may have lifelong effects and even may have transgenerational consequences. This means that, for instance, effects of malnutrition during pregnancy not only affects the health of the offspring but also of the grandchildren. An example was recently demonstrated by the Dutch Hungerwinter project (Tobi *et al.*, 2018): more than 70 years after the Second World War, children of mothers who during their pregnancy were exposed to famine during the final stages of the German occupation still showed epigenetic changes in a number of genes relating to energy metabolism and glucose regulation. Further research is needed in this fascinating area.

In addition to the mother being overweight at conception, excessive weight gain by the mother *during* pregnancy also has adverse effects. It increases her risk of gestational diabetes and hypertension, which may lead to obstetric complications and further exacerbate the child's future risk of chronic diseases. On the other hand, lack of nutrients during pregnancy, due to the mother's malnutrition, may lead to intra-uterine growth retardation that may impair organ development with a lasting effect on the child's metabolism. The changed metabolism, in turn, may predispose toward future increased risk for Type 2 diabetes and cardiovascular diseases.

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The first two years after birth are crucial too

After birth, nutrition continues to be important for the child's mental, physical and social growth and development (van Eijdsden *et al.*, 2015; Pietrobelli *et al.*, 2017). Exclusive breastfeeding for at least four to six months is considered to provide optimal nutrition, and partial breastfeeding is to be encouraged up to one or two years of life. The quality of weaning foods after six months should secure optimal nutrition: not only optimal supply of nutrients, such as essential fatty acids, and adequate intakes of proteins, vitamins and minerals, but also the avoidance of foods rich in free sugars. In particular, sugary drinks seem to contribute to excessive consumption of calories, mainly because they do not affect appetite regulation effectively. This is a crucial stage for development of taste preferences and lasting attitudes towards certain foods. The texture of foods is also important in this phase, when the child is learning to chew and swallow fibre-rich and hard foods.



△ Photo: AAGG

Excessive weight gain of the child in the first year of life may indicate an increased risk of later being overweight or obese. Routine monitoring of linear growth and weight is important to identify high-risk patterns of growth, and may prompt early interventions to prevent weight problems later. It is not only dietary habits that are important. Lack of physical activity, chronic sleep deprivation and frequent use of antibiotics may contribute to the risk of obesity.

The effect of antibiotics points towards a potentially important role of the gut microbiome, the composition of which is largely determined by nutrition. Fibre-rich products are considered to have beneficial effects on the diversity of bacteria in the intestine. Pre- and probiotics may have a positive effect on children's growth and development. This area of research is quickly developing and may lead to effective preventive interventions against chronic diseases in the future.

Joint efforts for a healthy start

Although many details of the underlying mechanisms have still to be unravelled, it is already clear that nutrition in the first 1000 days is of prime importance for children's future health and well-being. Assuring optimal nutrition during this critical phase of life should be a priority in public health policy and in the practices of midwifery and youth healthcare.

Learning from the Amsterdam Healthy Weight Programme

Extracts edited and abridged by *Early Childhood Matters* from *Off the Scales: Tackling England's childhood obesity crisis*, report published by the Centre for Social Justice, December 2017

Between 2013 and 2017, childhood obesity and overweight rates in Amsterdam went down by 12% for all children and by 18% among the most deprived children. The *Amsterdamse Aanpak Gezond Gewicht* (AAGG), ('Amsterdam Healthy Weight Programme'), demands attention because two of the main factors that have made it successful so far are transferable and replicable to other countries. These two factors are political leadership, and the adoption of a whole-systems, collective approach.

The lessons to be learned are not in what specific interventions were introduced, since they were based on what was appropriate and feasible in Amsterdam and its target neighbourhoods. Rather, the key lessons are in how the programme was introduced, how it was politically led and how a whole-systems approach was successfully implemented.

In 2012, Amsterdam City Council's Alderman and Deputy Mayor, Eric van der Burg, brought the municipality's political leaders together to commit to doing something bold and mission-led. In 2013, the AAGG was launched with the aim of supporting children and parents to be healthier by engaging with them alongside professionals and organisations that work with children or significantly influence their lifestyles. In contrast to a treatment-based approach, AAGG focuses on integrated, cross-sector and cross-departmental actions involving politicians, local authorities, schools, medical professionals, planning bodies, sports organisations, communities and neighbourhoods, charities, and the business sector.

The key principles of the programme are political leadership, focus on social impact, whole-systems, targeted learning development based on consistent monitoring, and value in professionals and professional training. Interventions take place during the first 1000 days (from conception to 2 years old), in schools (from preschool to secondary), in neighbourhoods (including targeting efforts and monitoring success), and in the creation of a healthy environment (including urban design and regulation of the food and drinks industry, such as restricting unhealthy marketing to children).

There was an understanding that the majority of families with obese or overweight children were often multi-problem families with multi-complex

needs, and so addressing the issue of childhood obesity was about more than just getting children to eat better and exercise more. It was about tackling the complex social issues behind unhealthy behaviours, such as mental health issues, poverty and lack of education.

The initial commitment to reduce childhood obesity did not include any funding commitments. This was a deliberate move by Alderman van der Burg, who believed the key to success was first to identify, draw upon and pool existing resources from across the various departments and sectors. Focus began on joining up existing services by identifying community-, school-, local government- and neighbourhood-led projects that already existed. The one initial cost was for the departments to each employ a programme or project manager who was paid for by the participating departments. By not putting a price on the project at the beginning, time for the joining up and mapping of existing services and opportunities was allowed. Funding down the line was then provided based on evidence, including identifiable gaps in support. A key feature of the AAGG is the joining-up of existing programmes and interventions, and the introduction of interventions to fill the gaps.

To build an effective long-term plan independent of political cycles, a cross-departmental team, put together by the programme manager, developed a 20-year plan and model. Science and learning institutes play a key role. The programme's guiding principle is 'learning by doing, doing by learning'. The Vrije Universiteit Amsterdam is developing external monitoring tools to ensure independent monitoring of results. The programme and approach has constantly changed since it was introduced, which is considered to be a good thing, because it is an iterative process where interventions are constantly improved or changed for the better, and new interventions are introduced along the way where necessary.

AAGG intervention examples: the first 1000 days

The programme recognises the importance of the first 1000 days (from conception to 2 years old), including maternal health during pregnancy for the health of a child. Support is provided in three main ways:

- 1 **Information** All parents of unborn children and children from birth to 4 years in Amsterdam receive information about healthy nutrition at all ages of their child's life.
- 2 **Connected care** All pregnant women and young parents have regular appointments with medical professionals (midwives, youth health care nurses, etc.). These professionals agree on the way to work together, share necessary information and use the same information for parents. Special focus lies in the detection of (a higher risk of) overweight and obesity before the age of 2 years.

3 Healthy communities During pregnancy and early childhood, the informal network and community surrounding parents is incredibly important and powerful. Key persons within these networks are trained about healthy lifestyle and invited to organise activities.

Specific examples of interventions in the first 1000 days include:

- growth app – in this popular information app, information about healthy lifestyles for pregnant women is included
- referral by medical professionals to customise coaching programmes for future parents
- screening infants for risk of obesity, with extra support provided to at-risk families
- nurses provide two years of support to teenagers and more deprived mothers
- development of a new pregnancy course for more deprived women
- greater access to fitness programmes and information for young children
- prenatal home visits
- ‘Healthy Weight Pact’ strategy, which involves midwives
- research involving teenagers, which examines how expectant mothers can be best supported inside and outside of the doctor’s office.

References

- Centre for Social Justice. (2017). *Off the Scales: Tackling England’s childhood obesity crisis*. London: Centre for Social Justice. Available at: <https://www.centreforsocialjustice.org.uk/core/wp-content/uploads/2017/12/CSJ-Off-The-Scales-Obesity-Report.pdf> (accessed March 2018).
- Pietrobelli, A., Agosti, M. and the MeNu Group. (2017). Nutrition in the first 1000 days: ten practices to minimize obesity emerging from published science. *International Journal of Environmental Research and Public Health* 14(12): 1491.
- Statistics Netherlands (CBS). (2012, online). More people overweight. Available at: <https://www.cbs.nl/en-gb/news/2012/27/more-people-overweight> (accessed February 2018).
- Tobi, E.W., Slieker, R.C., Luijk, R., Dekkers, K.F., Stein, A.D., Xu, K.M. *et al.* (2018). DNA methylation as a mediator of the association between prenatal adversity and risk factors for metabolic disease in adulthood. *Science Advances* 4(1): eaao4364.
- Van Eijsden, M., Meijers, C.M., Jansen, J.E., de Kroon, M.L. and Vrijkkotte, T.G. (2015). Cultural variation in early feeding pattern and maternal perceptions of infant growth. *British Journal of Nutrition* 114(3): 481–8, doi: 10.1017/S0007114515000951.
- Woo Baidal, J.A., Locks, L.M., Cheng, E.R., Blake-Lamb, T.L., Perkins, M.E. and Taveras, E.M. (2016). Risk factors for childhood obesity in the first 1,000 days: a systematic review. *American Journal of Preventive Medicine* 50(6), 761–79.