A Life-course Approach to Healthy and Active Ageing

Policy Briefing - Reducing the Risk of Obesity and Type 2 Diabetes

Executive Summary

This document presents policy recommendations aimed at reducing the risk of type 2 diabetes (T2D) and obesity. These diseases are increasing at a significant rate globally, impacting on long-term health and placing pressures on healthcare budgets and wider society. The risks of developing these diseases increase with age and their prevalence is also linked to health inequalities, showing higher rates in lower socioeconomic strata. To address this public health crisis, it is well-recognised that we need to invest in both preventative and treatment measures whilst at the same time considering health inequalities and their origins.

This was the aim of the DynaHEALTH project, an EU funded consortium which undertook a programme of research to investigate a life-course strategy to reducing the risks of obesity and the related onset of T2D. The approach was unique as it examined the risks of T2D in both a biological and psychosocial context, throughout the life-course. The project contributed significantly to a growing body of evidence suggesting that early intervention is critical in reducing the risks of obesity and T2D. Early action provides an opportunity for intervention in the life-course at a point before many additional risk factors come into play, and prior to the development of additional social inequalities in later life.

The results from the project support the key policy recommendation that **reducing childhood obesity, reduces the incidence of obesity in later life and the associated risks of T2D.** The recommendations developed by DynaHEALTH, which are detailed in this document focus specifically on a developmental window in pre-school age. There are several initiatives and policy recommendations already in place addressing childhood obesity, however, **18 months to 5 years appears to be under-represented as a target age range for interventions**. The policy recommendations are provided in this briefing along with the supporting potential economic impacts of early interventions.

We are currently facing a major public health challenge brought about by the alarming increase in the prevalence of obesity and type 2 diabetes.

The risk of developing type 2 diabetes (T2D) is closely associated with obesity, which is also now recognised as a chronic disease. Europe is experiencing spiralling healthcare costs to treat T2D and other non-communicable diseases (NCDs) linked to obesity, such as cardiovascular disease and cancer. Furthermore, people with obesity are also at a higher risk of contracting infections. Emerging, but not yet conclusive evidence, links obesity to a higher mortality rate in the current Covid-19 pandemic[1].

Figure 1. Prevalence and estimated healthcare costs of diabetes in Europe (figures include type 1 and type 2 diabetes, around 90% people with diabetes have type 2)[2].

The burden of obesity, T2D and other NCDs is compounded by an ageing population and socioeconomic inequalities.

Our risk of developing obesity and T2D increases with age. Patients with obesity or T2D also then have a higher risk of other NCDs such as cardiovascular disease and dementia, adding further to the burden of unhealthy ageing on healthcare systems and society. It is also well-established that rates of obesity are higher in lower socioeconomic strata, further widening health inequalities. Across European Union Member States, women and men in the lowest income group are, respectively, 90% and 50% more likely to have obesity, compared to those on the highest incomes[3].

Unfortunately, there is no single 'magic bullet' to treat obesity and T2D, but it is well-recognised that we need to invest in both preventative and treatment measures whilst at the same time considering health inequalities and their origins. This is supported by the World Health Organization's Global Action Plan for the Prevention and Control of NCDs 2013-2020[4], recommending an inclusive and life-course approach.

The prevalence of childhood obesity is increasing.

Early life is a critical stage of development in the life-course and an important area of focus for the prevention of long-term health issues. Currently the prevalence of childhood obesity is increasing. In the EU about 23% of boys and 21% of girls are measuring as overweight (including those with obesity) across age-groups[5].

European policymakers have already recognised the need to protect the youngest and most vulnerable from the early onset of NCDs through developing the EU Action Plan on Childhood Obesity 2014-2020[6], and Mid Term Evaluation[7], aiming to halt the rise in overweight and obesity by 2020.

This policy briefing is aimed at a broad representation of policy makers at a European, national and regional level. It has been developed on the principle of 'prevention at the earliest age possible', addressing the growing problem of obesity in children**. Reducing childhood obesity reduces the incidence of obesity in later life and associated risks of T2D.**

DynaHEALTH: A life-course strategy to reducing the risks of obesity and the onset of T2D.

The DynaHEALTH consortium was awarded 5.9 million Euros through the EU's research and innovation programme (Horizon 2020), bringing together a critical mass of experts from a range of disciplines. The aim of the DynaHEALTH project was to investigate a life-course strategy to reducing the risks of obesity and the onset of T2D. The research approach was unique as it examined the risks of T2D in both a biological and psychosocial context, throughout the life-course. The consortium had access to 20 cohorts, with data from 1.3 million individuals from pre-conception to 85 years old across eight European

countries. The project contributed significantly to a growing body of evidence suggesting that early intervention is critical in reducing the risks of obesity and T2D. This provides an opportunity for intervention in the life-course at a point before many additional risk factors come into play, and prior to the development of additional social inequalities in later life.

Evidence has shown that early life is a critical period of intervention to reduce the risks of obesity and T2D.

To illustrate this point, observational research demonstrated that the risks relating to obesity and T2D began to accumulate in pre-school children from around 4 to 5 years old, and for T2D specifically there is strong evidence from age 7 onwards. This was further supported by robust evidence of the associated causal mechanisms from the work of DynaHEALTH[8,9].

A missed opportunity to intervene?

Focusing on early life as a target for interventions, including the timing and role of critical periods in a child's development during pregnancy and infancy, are well studied. However, the DynaHEALTH consortium went on to identify that there seems to be a potential 'missed opportunity' for interventions between 18 months and 5 years of age, i.e. before additional risks begin to accumulate.

It is during this pre-school age range that children across Europe are most likely to fall into a gap between local postnatal healthcare and monitoring which begins at school.

The policy considerations presented in this document therefore focus mainly on this window of opportunity supported by:

- The point at which **Adiposity Rebound** (AR) is observed can occur during this age range. The trajectory of AR is characterised by changing Body Mass Index (BMI) during the growth of the child (Figure 2). The age at which AR occurs is an established indicator of a child's risk of obesity in later childhood and adulthood;

- This opportunity to intervene early is an important starting point to activate interventions to normalise BMI in later childhood. Studies showed that for T2D in adulthood, risk of developing the disease began to accumulate in childhood. Those who were already with overweight and obesity by age 7 years had a much higher risk for T2D than if they had a normal weight at this age. We also showed that if weight was normalised before adolescence, then the risk was reduced to a level comparable to individuals who had maintained a normal weight during childhood[8].

What is Adiposity Rebound and why is it significant?

BMI (kg per m^2), is a measure of an individual's body mass relative to height. Measuring a child's BMI is one method we can use to predict his or her risk of obesity and associated diseases in later life. It is a simple ratio taking into account weight and height measurements. The BMI of a child changes considerably due to a sequential developmental process affecting skeletal growth (height) and body growth (weight) over time. We can observe these changes through plotting the natural trajectory of a child's BMI from birth until pre-pubertal age. As described by the model based on boys and girls followed during the DynaHEALTH project, we can first observe a distinct **Adiposity Peak** (Figure 2) in BMI by the age of nine months, corresponding to the time when the infant starts to become active by crawling, standing and then walking. Following this peak, the BMI of the child declines substantially until we then observe a point at which BMI starts increasing again at an almost steady rate until it stabilises in adulthood. The age at which this point is observed is called **Adiposity Rebound** which occurs at an average age of 5 to 7 years old.

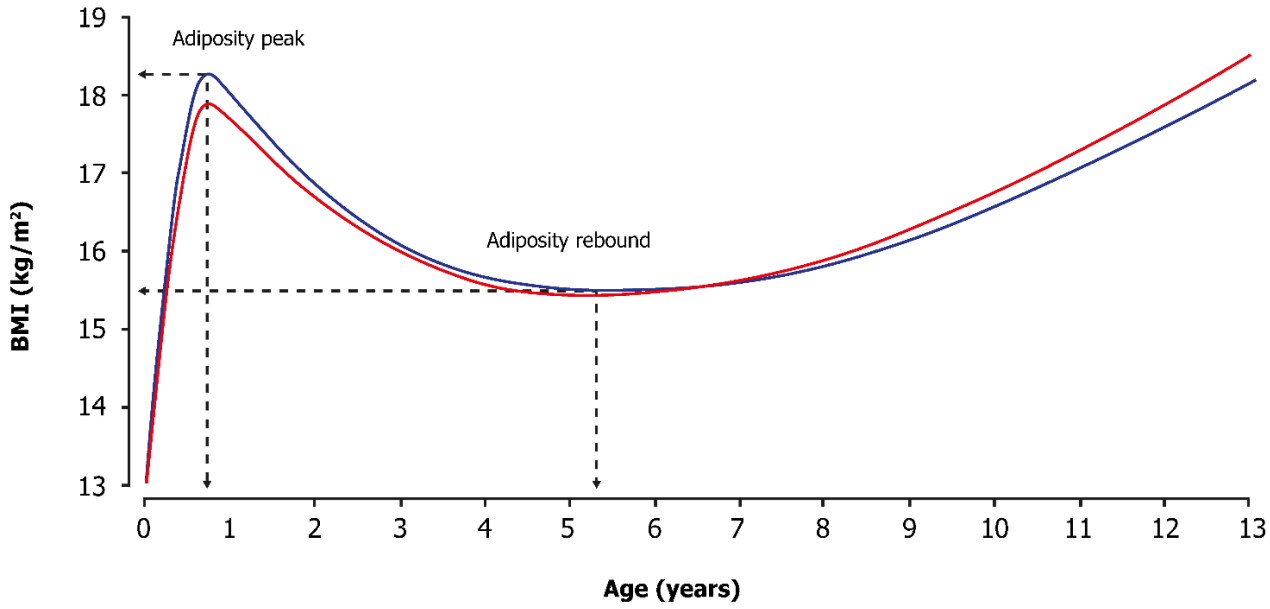

Figure 2. Age and BMI at Adiposity Peak and Adiposity Rebound. The growth curves for males are in blue and for females in red. Curves are based on the Northern Finland Birth Cohort (NFBC) 1986 data[9].

The BMI trajectory and point of AR can only be seen by frequently measuring and tracking the child's weight **and** height during this developmental window. Tracking the changes in BMI at regular intervals from birth enable an accurate and early prediction of the age at which AR will occur in a child.

An earlier than average age at which AR is observed, is associated with an increased risk of obesity in later life. The youngest AR observed in DynaHEALTH was around the age of 2.5 years old. The significance of AR is also supported by an observation that an earlier than average AR was seen in children from mothers with type 1 diabetes and they are also at an increased risk of developing overweight[10].

DynaHEALTH research also quantified the likelihood of obesity based on the age of AR. Data from the 1966 Northern Finland Birth Cohort (NFBC) linked the age of AR to the likelihood of obesity at the age of 31 years[11].

- Early age at AR (3.5 to 5 years): Males were 1.9 times more likely to have obesity and females were 2.2 times more likely to have obesity at 31 years, compared to those with an AR from 5 years old onwards.
- For very early age at AR (before 3.5 years), this likelihood increases to 3.4 for males and 4.1 for females respectively, again when compared to those with an AR from 5 years old onwards.

The prediction provides an early opportunity to identify individuals with an increased risk of obesity and developing cardiometabolic disease in later life. It is also an optimal time-frame for prevention and intervention measures.

In conclusion, there are several initiatives and policy recommendations already in place addressing childhood obesity e.g. in the first 1,000 days of life. However, 18 months to 5 years appears to be under-represented as a target age range for interventions. This is despite the well-established link between delaying AR and reduced risk of childhood obesity.

What are the recommendations for policymakers?

To address this window of opportunity, the following recommendations have been developed for policy makers based mainly on findings from the DynaHEALTH project, founded on robust scientific evidence. They build on current consensus within the scientific community and peer-reviewed papers published by the consortium members. They also take into consideration the 'whole systems approach' to tackling childhood obesity and the wider context of health inequalities. The recommendations presented are aimed at healthcare professionals and local healthcare systems, and conveys messages to politicians about health inequality being a major influencing factor.

Policies should recognise the life-course origin of disease and therefore the need to intervene early:

- At an individual level, starting interventions aimed at the age-range 3 to 5 years in children identified with an early AR could have an impact on their health outcomes in later life through reducing the likelihood of childhood obesity;
- Also, delaying AR by 6 months through population-level interventions is attainable and is likely to achieve a sizeable reduction in the prevalence of childhood obesity and obesity in later life[9,12]
- It is essential to measure and assess the variation of BMI through the age period we are targeting. Just one or two single measurements of BMI cannot simply be used as an indicator of the risk of obesity. We need to inform healthcare professionals, carers and parents on the significance of the AR trajectory and regular measurements of weight and height from birth onwards;

- BMI is easy and cost effective to monitor, especially in high-risk populations, anywhere in the world, and could easily be implemented alongside existing healthcare programmes, or even by parents and carers, supported by new healthcare apps.

 # Interventions should be designed to take psychosocial, as well as biological factors into account, to build a context-based and more personalised approach to an individual's disease risk in later life:

- Health policies should take into account the multiple risk factors associated with the origins of obesity, i.e. there is no one single cause of the disease and an individual's overall risk is a composite of different factors and exposures which accumulate through the life-course. This includes genetics, biological mechanisms such as satiety and fat deposition, lifestyle, socio-economic circumstances and stress;
- We can predict at risk individuals via their genetic variants. Many studies have already identified more than 500 common genetic polymorphisms associated with BMI in the European population, with cost effective testing available. In the future, a genetic risk score can be calculated and used to identify individuals with a high risk of obesity and diagnose possible biological causes. This risk score can also be used to predict the age and BMI at AR;
- However, there is a need for much more precision in determining the other risk factors associated with obesity such as psychological, psychosocial and bio-psychosocial, which is an area for further research;
- Despite this knowledge gap, we still have an opportunity to develop a personalised approach to prevention, starting with identifying those individuals at high risk and then optimum points through the life-course, such as before and around AR, where interventions can be targeted.

 # Wider societal engagement to break the vicious cycle:

- There is an opportunity to promote social interventions and stimulate innovation within communities to break this vicious cycle. This starts with wider participation and engagement with parents, grandparents and other carers, especially within hard to reach groups;
- A wider engagement across society can promote and stimulate novel ways of detection and prevention and test innovative interventions. There is an opportunity to engage with, and mobilise, the resources of all actors, including

healthcare systems, schools, and food companies. Interventions must avoid stigmatisation and use readily available diagnostics where possible.

Economic impacts

The long-term impacts of policies reducing obesity in children are hard to quantify. Economists from the DynaHEALTH consortium used a micro-simulation model to estimate the long-term benefits of reducing obesity in children[13,14]. The model used a well-established childhood nutritional intervention, shown to affect obesity, as an example – the CHOP Study[15] and a cohort of people aged 50-51 in 2015 from the Survey of Health, Ageing and Retirement in Europe (SHARE)[16].

The model examined the long-term effects of the intervention on several health measures (BMI, prevalence of diabetes and prevalence of hypertension) and Quality-Adjusted Life Years (QALYs). The study included the following nine countries: Austria, Belgium, Denmark, France, Germany, Italy, Spain, Sweden and Switzerland, and the results showed a rich heterogeneity across of the countries.

The model started from a baseline scenario and used the intervention impacts from the high and low protein treatment groups to forecast the evolution of BMI for different types of nutrition in childhood (Figure 3).

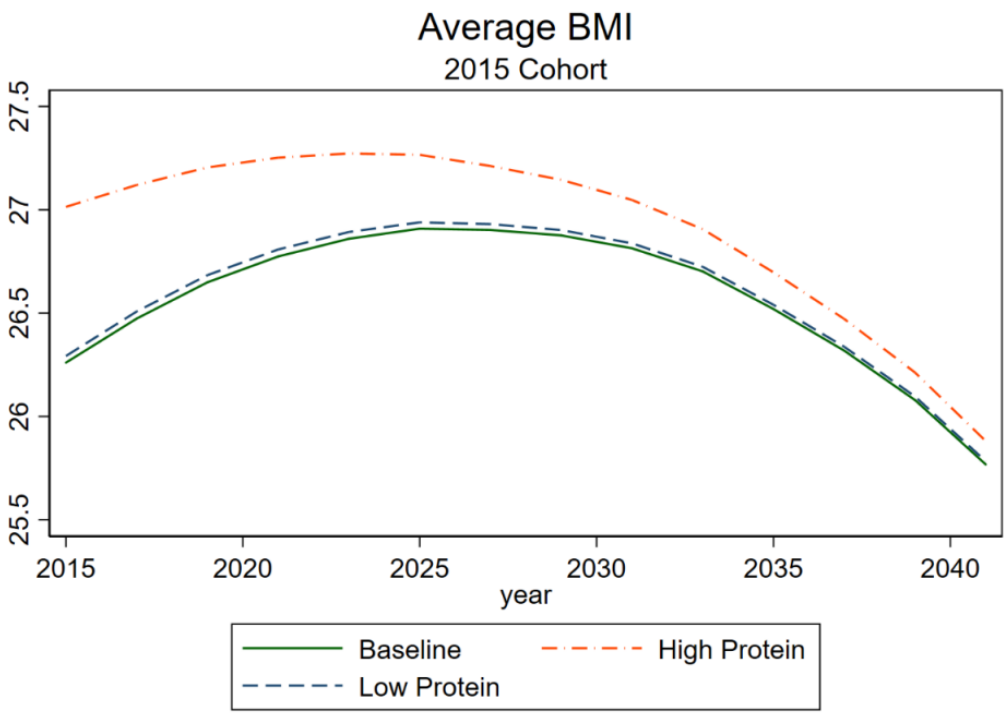

Figure 3. Evolution over time of the average BMI, pooled across countries.

Although small (around 1%), the differences between the predicted BMI in the two intervention scenarios (high and low protein) are sufficient to induce significant differences in the prevalence of two major chronic conditions that have BMI as an important risk factor (diabetes and hypertension). The results also showed the intervention had an impact on QALYs. The value of this translated into the following costs to healthcare systems across the nine countries involved in the simulation:

- The high protein intake scenario from the CHOP study during lactation, inducing an early AR in children, demonstrated a healthcare cost of 48 billion Euro;
- If the effect of the high protein treatment was amplified by 50%, then the cost would increase to 300 billion Euro;
- Reducing the effects by 50% limited the cost to less than 21 billion Euro.

This demonstrates the potential impacts of the intervention on personal and societal costs through the life-course. These savings could be re-invested in healthcare systems to support healthy ageing policies.*

Wider impacts

Although the policy recommendations above are aimed at local and national healthcare professionals and policymakers, more fundamental issues should be addressed at a political level to support these interventions. This is strongly supported by the United Nation's 2030 Agenda for Sustainable Development, Goal 3 - Ensure healthy lives and promote well-being for all, at all ages:

- All children should have **equal rights** to access to a **clean and safe environment** which favours a healthy diet and outdoor physical activity;
- All children should have **equal rights** to access **education** allowing them to choose a **healthy lifestyle**;
- EU member states should recognise that childhood obesity, if not prevented or treated, can **quadruple the risk of T2D** by the age of 50.

* For further information about the findings from the CHOP Study visit http://www.metabolic-programming.org/obesity/.

Acknowledgements

Funding

The DynaHEALTH project received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 633595.

Full information about the project can be found in Sebert S, Lowry E et al. Cohort Profile: The DynaHEALTH consortium – a European consortium for a life-course bio-psychosocial model of healthy ageing of glucose homeostasis. International Journal of Epidemiology, 2019 Aug. 48(4):1051–1051. doi:10.1093/ije/dyz056.

Cohort-specific funding is acknowledged in Supplement 2 of the above paper, available as supplementary data online:
https://academic.oup.com/ije/article/48/4/1051/5443287#140006148

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