Undernutrition in childhood, adolescence or young adulthood increases risk of heart disease later

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A study of women who were children, teenagers or young adults during the Dutch famine in 1944-45 has shown that undernutrition, particularly in the adolescent years, is associated with an increased risk of coronary heart disease in later life.

The research, published online today in the European Heart Journal [1], provides the first direct evidence that acute undernutrition during the time that children are growing up can have an important impact on their future health. The authors of the accompanying editorial [2] say that it underlines the importance of policy makers and health professionals taking this into account when designing and implementing disease screening and prevention programmes.

The study authors, from the University Medical Center Utrecht and the University of Amsterdam, investigated 7845 women who were aged between 0-21 and were living in The Netherlands at a time when a combination of circumstances at the end of the Second World War resulted in severe food shortages in the west of The Netherlands; official daily rations for the general adult population dropped from 1400 calories in October 1944 to between 400-800 calories at the height of the famine from December 1944 to April 1945. After six months of starvation, The Netherlands was liberated, abruptly ending the famine.

The researchers recruited the women to the study between 1993-1997

through a breast cancer screening programme, and followed them up to the end of 2007. They divided the women into three groups: 1) unexposed – women who reported being "hardly" exposed to hunger and weight loss during the famine; 2) severely exposed – women who reported being "very much" exposed to hunger and weight loss; and 3) moderately exposed – the remaining women whose famine experience was somewhere between these two experiences.

They found that, compared with unexposed women, the risk of coronary heart disease was slightly higher overall for women who had been moderately exposed to the famine, and significantly higher among those who had been severely exposed. Women who were aged between 10-17 at the start of the famine and who had been severely exposed to it, had a statistically significant 38% increased risk of coronary heart disease in later life, whereas those who had been moderately exposed had no increased risk compared with the unexposed women. After adjusting for factors that could confound the results, such as age at start of the famine, smoking, and education (as a measure of socio-economic status), there was a 27% higher risk of coronary heart disease for the severely exposed women compared to unexposed women.

In additional analyses, they found that the risk of stroke seemed to be lower for women of all ages exposed to famine compared to those who were not exposed. In particular, women who were exposed to famine as young adults (18-21 years old), and so were not exposed during a sensitive growth period, seemed to have a lower risk of stroke compared to those who were unexposed, although this lower risk was not statistically significant.

"The Dutch famine of 1944-45 is a 'natural experiment' in history, which gave us the unique possibility to study the long-term effects of acute undernutrition during childhood, adolescence, and young adulthood in otherwise well-nourished girls and women," write the authors of the

study.

They say their findings are relevant for today. "Our findings support the notion that disturbed postnatal development, particularly in adolescence, can have important implications for adult health. The contemporary relevance of our findings is that famine and undernutrition are still a major problem worldwide; the first millennium developmental goal is to eradicate extreme hunger. Since the incidence of CVD [cardiovascular disease] is the number one cause of death globally, and rising in many parts of the world, further research into the impact of undernutrition during sensitive periods of growth and maturation is warranted."

Annet van Abeelen, the first author of the study, who is a PhD epidemiology student at the Julius Center for Health Sciences and Primary Care, University Medical Center Utrecht and at the department of Clinical Epidemiology, Biostatistics and Bioinformatics, Academic Medical Center, University of Amsterdam (The Netherlands), said that more research was needed to confirm the findings and to explore the possible mechanisms underlying the effects of famine on the risk of future heart disease.

"However, our study pinpoints the crucial role childhood plays in adult health. More knowledge in this field may lead to unique opportunities for prevention in the future," she said. "According to the developmental origins of chronic disease hypothesis, as first proposed by Professor David Barker, nutritional influences early in life may change the structure and function of the body. While these changes may be beneficial for short-term survival, they may lead to chronic diseases in later years. Our study indicates that growth that has been hampered by undernutrition in later childhood, followed by a subsequent recovery, may have metabolic consequences that contribute to an increased risk of diseases later in adulthood."

For the effects of famine on coronary heart disease the authors give several possible explanations, such as unhealthy lifestyles, changes in metabolism, or traumatic stress, but they said each of these required further research. Ms van Abeelen said that more research was also needed for the findings on stroke, especially as these results were based on only 235 stroke cases.

In an accompanying editorial, Professor Kausik Ray and colleagues at St George's University of London (London, UK), write: "These results add further weight to the suggestion that adolescence is a particularly sensitive period open to epigenetic modifications and that dietary mismatch in post-famine nutritional availability contributes to coronary disease risk."

They point out that 925 million people worldwide are undernourished according to the United Nations Food and Agriculture Organization, and that in the UK a recent report by the Association of Teachers and Lecturers found that teachers reported that three-quarters of their students arrived at school hungry, with these numbers increasing since the start of the global recession.

Mentioning studies of people who starved during the Chinese famine (1959-61) and the siege of Leningrad (1941-44), Prof Ray and colleagues write: "Taken together there appear to be consistent data showing that nutritional status in childhood may impact significantly on chronic diseases processes in later life. The findings of these recent studies could have significant practical impact on immigrant populations who try to adapt to the relatively more affluent and nutritionally rich environments, particularly those escaping from man-made and natural catastrophes. For instance, first generation Asians in the UK have a higher incidence of cardiovascular disease than Caucasian counterparts. As cardiovascular disease carries the largest economic and population burden in developed countries and is fast approaching similar

importance in developing countries, further work is now needed to better understand the mechanisms behind these associations and devise public health strategies which could have a significant impact on disease burden in years to come."

More information: [1] "Cardiovascular consequences of famine in the young". European Heart Journal. doi:10.1093/eurheartj/ehr228

[2] "Undernutrition in adolescence and risk of cardiovascular disease". European Heart Journal. doi:10.1093/eurheartj/ehr270

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