

# Fetal and infant exposure to severe Chinese famine increases the risk of adult dyslipidemia: Results from the China Health and Retirement Longitudinal Study

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## Abstract

Although studies have observed that early life famine exposure linked with hypertension, metabolic syndrome in adulthood, the association with dyslipidemia was unclear. To explore the association between fetal-stage exposed famine and risk of dyslipidemia in adults. 2,752 subjects were selected from the China Health and Retirement Longitudinal Study (CHARLS) 2011-2012 baseline survey to assess the association of fetal-stage famine exposure with dyslipidemia risk in adults aged 50 years. Dyslipidemia was diagnosed as TG/HDLc>5.0 or self-reported dyslipidemia. Birthdates of subjects were used to categorize famine exposure groups. Logistics regression model was used to examine association of famine exposure with dyslipidemia risk. We observed that the prevalence of dyslipidemia among adults in non-exposed, fetus, infant, and preschool stage-exposed cohorts were 15.7%, 23.1%, 22.0% and 18.6%, respectively. The early life famine exposure significantly increased LDL cholesterol concentrations after adjusting for age. The risks of dyslipidemia in fetal (OR 1.58; 95% CI: 1.23-2.03; P<0.001) and infant (OR 1.52; 95% CI: 1.15-2.00; P=0.003) stage exposure cohorts were significantly higher than the non-exposed cohort after adjusting for gender and current family economic status. Following gender stratification, we found that fetal (OR=1.80; 95% CI: 1.26-2.57; P=0.001), infant (OR=1.75; 95% CI: 1.17-2.62; P=0.006) and preschool (OR=1.63; 95% CI: 1.10-2.42; P=0.038) -stage exposed to severe famine aggravated the risk of dyslipidemia in female adulthood, however, various associations were not observed for male adulthood. Therefore, early-life exposure to severe Chinese famine was associated with the higher risk of dyslipidemia in female adulthood, but not in male adulthood. This gender-specific might be due to son preference hypothesis.

Dyslipidemia is an important risk factor of coronary heart disease (CHD), which is one of the leading causes of death in developing and developed counties [1]. Based on the Chinese national data, the prevalence of dyslipidemia was 26.7% among workers aged 18–59 years in 2012 [2], and was 33.5% among Chinese aged greater than 45-years-old [3], which was higher than those among American population (29.3%) aged 45 to 84 years [4]. The emerging pandemic was partially caused by population growth,

rapidly aging and changes of diet and lifestyle [2, 3, 5]. However, recent studies indicated that the early life famine exposure also might increase the later susceptibility to some common chronic diseases [6], including metabolic syndrome [7], diabetes [8], and fatty liver disease [9].

The early origins of disease hypothesize that adaptability change for early-life (fetal, infant and early-child stage) severe malnutrition could result in bodily changes. Although these adaptability changes could contribute to early-life survival, they may elevate the risk of some common metabolic diseases in later life [10, 11]. Many animal model studies had supported the hypothesis in the past decades, but direct human evidence is rare due to ethical limitations. However, historical famine provided us a unique environment to examine the effect of early-life severe famine exposure on adverse health outcomes in adulthood [12]. Over the last few decades, many studies focused on the Dutch famine, and found that the infant stage exposure to famine increased the risks of hypertension [13], cardiovascular disease [14], diabetes [15], and other diseases [16] in adulthood. However, the studies focused on dyslipidemia were extremely limited and results were contradictory. According to our knowledge, just two studies based on European explored the association between early-life famine exposure and dyslipidemia [17, 18]. One Dutch famine study reported that only female prenatal malnutrition was associated with the elevated total cholesterol and triglycerides concentrations, but not with dyslipidemia [17]. However, the other study from Israel found positive association between early-life famine exposure and dyslipidemia [18].

Because of the radical collectivization movement and inclement climate conditions, almost the entire Mainland China suffered from extreme food shortage during 1959–1961 [19, 20]. Different from the Dutch famine, the Chinese famine was more severe, lasted for a longer period and far-reaching, leading to about 30 million premature deaths [21]. In addition, food supplies recovered slowly after the Chinese famine due to low social economic condition [22]. Apart from the result in large-scale premature deaths, the Chinese famine also exhibited a severe adverse effect on the later health of the survivors. For example, several studies have found that in severe

famine affected areas, individuals who exposure to the Chinese famine in early life significantly increased the risks of adult diabetes [8], metabolic syndrome [7], which did not happen in less severe affected areas. Our recent study had demonstrated that the infant stage exposure to the severe Chinese famine substantially elevated the risk of hypertension in later life [23]. However, the association between Chinese famine exposure in early life and the dyslipidemia in adulthood has not been reported yet.

In the current study, the China Health and Retirement Longitudinal Study (CHARLS) 2011–2012 baseline databases were used to explore whether different stages and severity of famine exposure in early-life were associated with the dyslipidemia in adulthood, and to examine the

gender difference.

### **Biography**

Zhiyong Zou has received his Doctor of Medicine degree in Nutrition and Food Health from Peking University. Presently, he is working as a Lecturer at the Institute of Child and Adolescent Health, Peking University Health Science Center. His research interests are famine exposed and the risk of cardiovascular disease in adulthood; the population intervention of obesity and hypertension in school students. He had participated in Chinese national survey on students' constitution and health in 2014 as a Member of National Research group and as Co-Investigator to finish the final report of Chinese students' common diseases and health risk behavior surveillance in 2016.