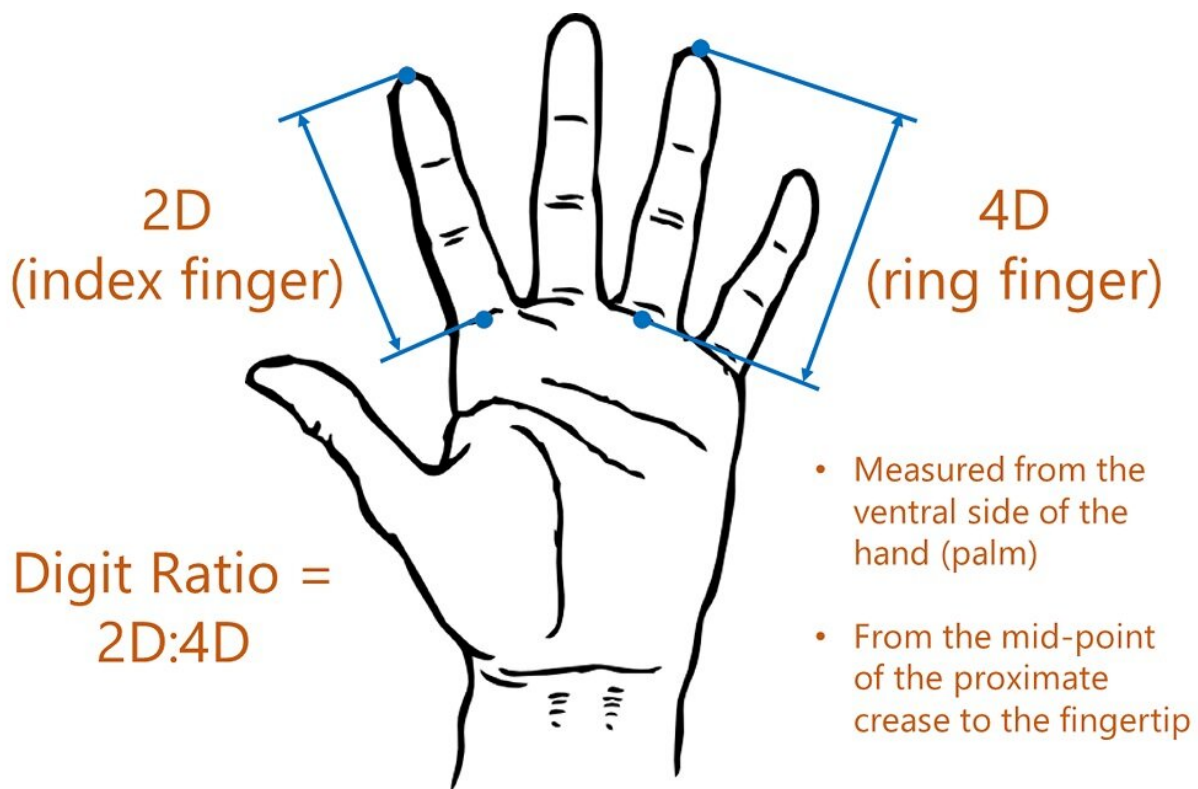


# Children's finger length points to mothers' income level

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Low-income mothers feminize their children in the womb by adjusting their hormones, whereas high-income mothers masculinize their children, a major study based on finger length, led by a Swansea University expert, has found. The study was based on the relationship between the length of a person's index and ring fingers, known as the 2D:4D ratio. What is significant about the new report is that the team examined the ratio in relation to parental income. Credit: John Manning, Swansea University

Low-income mothers feminize their children in the womb by adjusting their hormones, whereas high-income mothers masculinize their children, a major study based on finger length, led by a Swansea University expert, has found.

The phenomenon is an unconscious evolutionary response aimed at boosting their offspring's chances of successful reproduction.

It helps, in part, explain associations between [low income](#), low levels of testosterone before birth, and major causes of mortality such as cardiovascular disease.

The study was based on the relationship between the length of a person's index and ring fingers, known as the 2-D:4-D ratio. A longer ring finger is a marker of higher levels of testosterone, whereas a longer index finger is a marker of higher levels of estrogen. Generally, men have longer ring fingers, whereas women have longer index fingers.

The 2-D:4-D ratio is a widely-debated measure that has been the subject of over 1000 studies, but what is significant about the new report is that the team examined the ratio in relation to parental [income](#).

Led by Professor John Manning of Swansea University, with colleagues in Austria and Jamaica, the team tested a hypothesis about evolutionary influences on the mother and her [children](#). This suggests that for higher-income mothers, sons have higher reproductive success compared to daughters. For lower-income mothers, in contrast, daughters will be more reproductively successful. Known as the Trivers-Willard hypothesis, its senior author, Professor Robert Trivers, was also involved in this new study.

The team used data from over 250,000 people from around 200 countries, who were taking part in an online BBC survey. Participants

were asked to measure their index and ring fingers and given instructions on how to do this accurately. They were also asked to indicate their parents' income level.

The results showed:

- Children of parents of above-average income had a low 2-D:4-D ratio, with longer [ring fingers](#), which indicates high testosterone and low estrogen before birth, hallmarks of a more masculinized fetus
- Conversely, the children of parents of below-average income had a high 2-D:4-D ratio with longer index fingers, which indicates lower testosterone and higher estrogen before birth, markers of a more feminized fetus
- These effects were present for both men and women

Professor John Manning of Swansea University's A-STEM research team in sport science, lead researcher on the study, said:

"Our results show that mothers with high income may secrete high levels of testosterone relative to estrogen early in pregnancy, thereby masculinizing their male and female children. In contrast, women with low income may secrete low levels of testosterone, which will feminize their male and female children.

This is an evolutionary response, which mothers will not be aware of, let alone able to control. It is geared towards giving their offspring the best chance of reproductive success.

For high-income mothers, the advantages of high testosterone for their sons are likely to outweigh its disadvantages for their daughters. For low-income [mothers](#), the fitness gain from feminized daughters is likely to outweigh the fitness loss for feminized sons.

This pattern is consistent with the Trivers-Willard hypothesis."

Professor Manning explained how the findings could shed light on susceptibility to disease:

"These patterns suggest important effects on public health which are linked to poverty.

Low [testosterone](#) and high estrogen in male fetuses may predispose those men, as adults, to diseases linked to poverty such as heart attacks, strokes, and high blood pressure.

It is well known that poverty is closely associated with poorer health. What our research indicates is that this link can be replicated across generations".

**More information:** J.T. Manning et al, Parental income inequality and children's digit ratio (2D:4D): a 'Trivers-Willard' effect on prenatal androgenization?, *Journal of Biosocial Science* (2021). [DOI: 10.1017/S0021932021000043](#)

Provided by Swansea University

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