Folic Acid and Neural Tube Defects

What do millers actually prevent?

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on Flour Fortification

Smarter Futures

With thanks to Graham Fieggen (Red Cross War Memorial Children’s Hospital), Lieven Bauwens (IF) and Sarah Zimmerman (FFI)
Neural Tube Defects: what are they?

- NTD’s occur when the neural tube of a fetus fails to close properly thus impairing the central nervous system.
- Spina bifida is one of the most common birth defects.
- Often preventable
- Initial management has a profound effect on survival and the disabilities that they may suffer.
- Hope and support make this a manageable condition, which culminates in a productive and meaningful life for many...
Normal embryology: Closure of the neural tube

This process is complete within the first month post-conception;

This has clear implications for the concept of prevention
Important points to remember about neural tube closure

- Occurs by **day 28 post conception**, **before a woman even knows that she is pregnant**. This is critical for understanding strategies for prevention!

- Abnormalities cause conditions like spina bifida and hydrocephalus
The most common NTD is spina bifida in which the baby’s spine does not form correctly.

In mild cases, permanent loss of some sensation or movement occurs.

Severe cases include paralysis and varying degrees of loss of bowel and bladder control.

Children born with spina bifida will undergo a lifetime of surgeries and face many health issues.

Spina bifida cannot be cured.
Long term issues

- **Neurosurgical**
  - **Hydrocephalus** - A hydrodynamic disorder of Cerebral Spinal Fluid circulation leading to an increase in intracranial pressure
  - **Tethered spinal cord** – may lead later to:
    - Gait deterioration, progressive motor deterioration
    - Delayed toilet training or secondary Incontinence
    - Scoliosis
    - Back pain

- **Orthopaedic**
  - Feet, ankles, knees, hips...
  - Spinal deformity

- **Urological**

- **Cognitive**
Anencephaly

- Another NTD is anencephaly in which the brain does not form properly.

- Pregnancies affected by anencephaly are often miscarried.

- Babies born with anencephaly die shortly after birth.
NTD’s are only the ears of the hippo....

Other adverse health outcomes:

**Certainly:** Folic Acid deficiency and related anemia

**Probably:** stroke, heart disease

**Possibly:** Low birth weight, pre-term birth, cancer, other birth defects, cleft palate ...

Recurrence?
Prevalence of NTDs, 2001

Rates per 1000 births: data from March of Dimes
Until 25 years ago we did not know that NTD’s can be prevented...

- Folic acid is a B vitamin that our bodies need to make new cells.

- In 1991, a study done in the United Kingdom showed that 400 microgram of folic acid daily taken from 8 weeks before conception till 12 weeks into the pregnancy can help reduce the risk of NTD’s by up to 70%.

- This important discovery made it possible to prevent these debilitating birth defects.

- Pregnant women all over the world are given iron and folic acid tablets during pregnancy, mostly in the 3d trimester.

- That is too late for preventing NTD’s.
Supplements have limitations:

- Cost and inconsistent use
- Minority of women use folic acid supplements at the correct time for preventing NTDs (even when the pregnancy is a planned one) – important relation with socio-economic background
Dietary Diversification:

- It is virtually impossible to obtain enough folic acid through natural foods, even in high-earning and educated populations.

- Women who plan to become pregnant need 400ug of folic acid daily.

- To obtain this naturally they would need to eat 44 ripe tomatoes, 14 cups of broccoli or four slices of fried beef liver every day.
Flour Fortification with folic acid is the best solution

- Effective, simple and inexpensive
- Requires no change in dietary patterns or individual decision
- Non-discriminating
- The discovery that folic acid can prevent NTD’s led Oman to start fortification of flour with folic acid in 1996, soon followed by the US and Canada.
- The impact was immediate!

Reduction in NTD’s in Oman
Eight studies from Argentina, Canada, Chile, South Africa, and the United States:

- **31% to 78% reduced risk** of neural tube defects after fortifying flour with folic acid
- **Overall reduction of 46%**
Today 81 countries worldwide are fortifying flour with folic acid and iron.

To request data, e-mail info@ffinetwork.org
Summary

- An estimated **300,000 neural tube defects (NTDs)** occur every year globally.

- Fortifying flour with folic acid is an effective way to prevent NTDs.

- Countries that made fortification mandatory have experienced between 31 and 78% reductions in NTD prevalence.

- Globally an estimated **38,417** birth defects were prevented in 2012 where flour was fortified with folic acid. That is an average of **105 a day**.

- Countries can avert millions of dollars in healthcare expenditures when spina bifida is prevented.

- Millers are **key partners** in preventing Neural Tube Defects.