


SNP 2024 State of the
Science Symposium
Make Every Day Count



September 26, 2024

Seafood and Reproductive Health, From Eye Health to Faster Swimmers

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The critical role of seafood nutrition for our eyes and sperm (swimmers) quality



**Brain and Retinal cells
need seafood derived
omega-3-DHA and
VLC-PUFAs**

**Testes size and sperm
function is influenced by
omega-3-DHA and
VLC-PUFA**

Inherited and age-related loss of vision associated with omega-3 DHA derived very long chain fatty acids



Normal Vision



STGD3 VISION

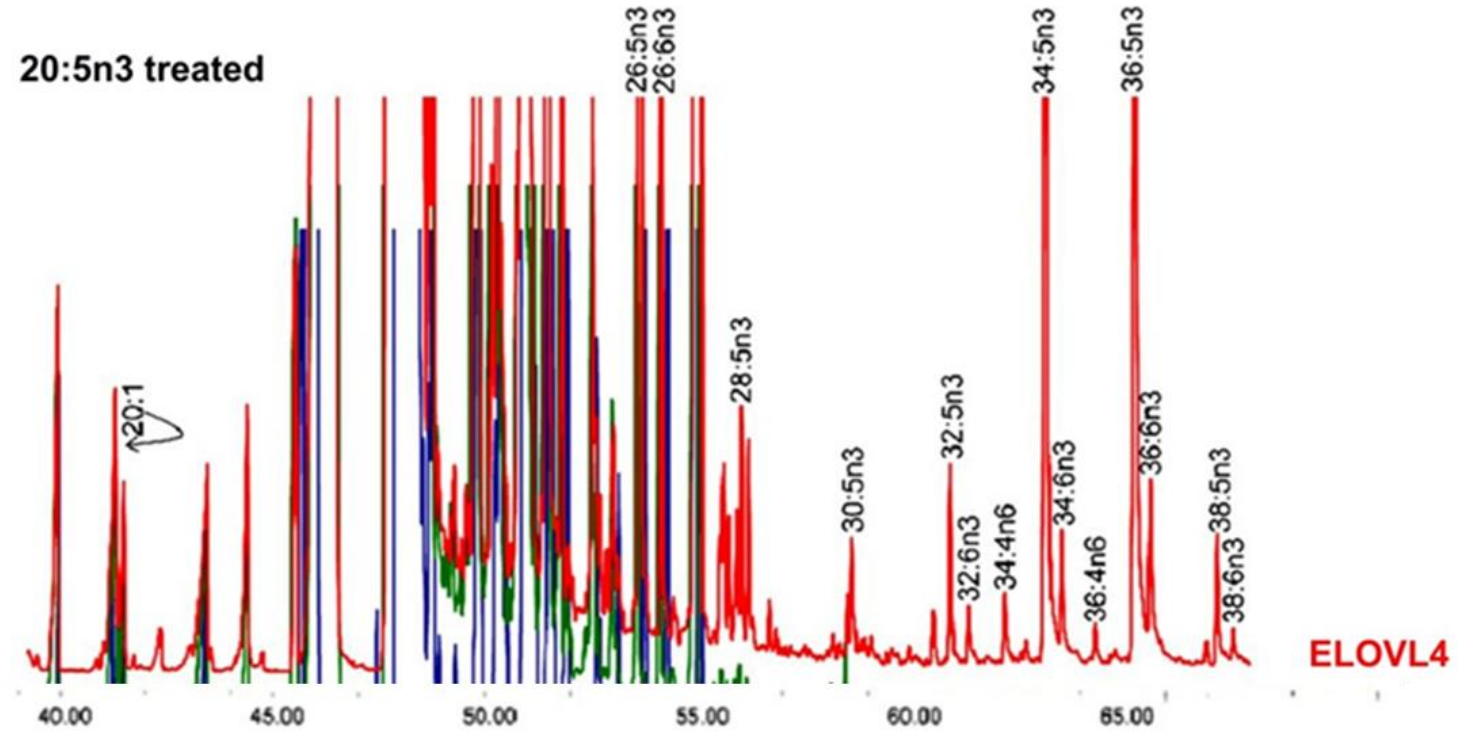


Normal Vision



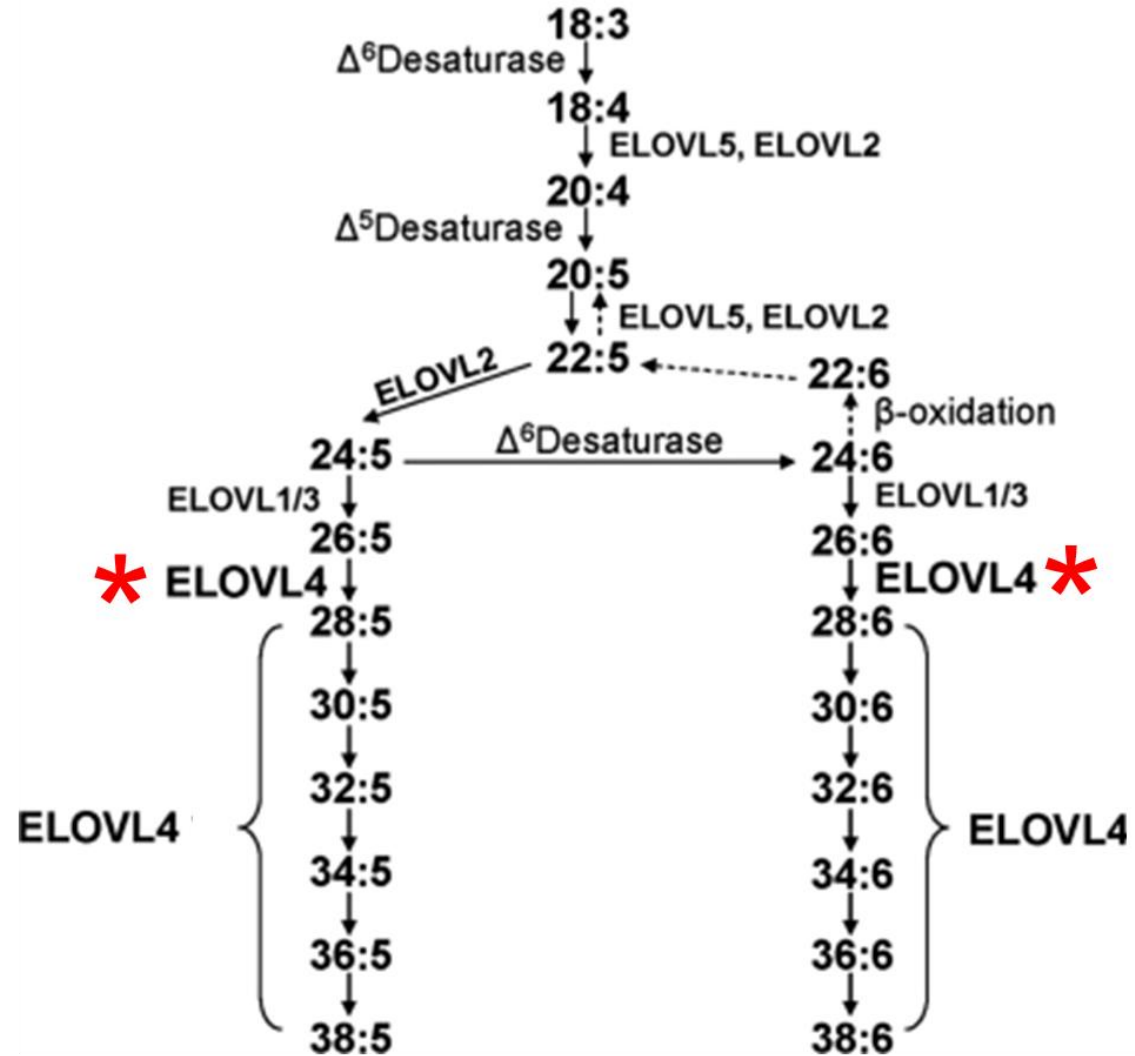
Age-related Macular Degeneration

Stargardt-like Macular Dystrophy(STGD3)



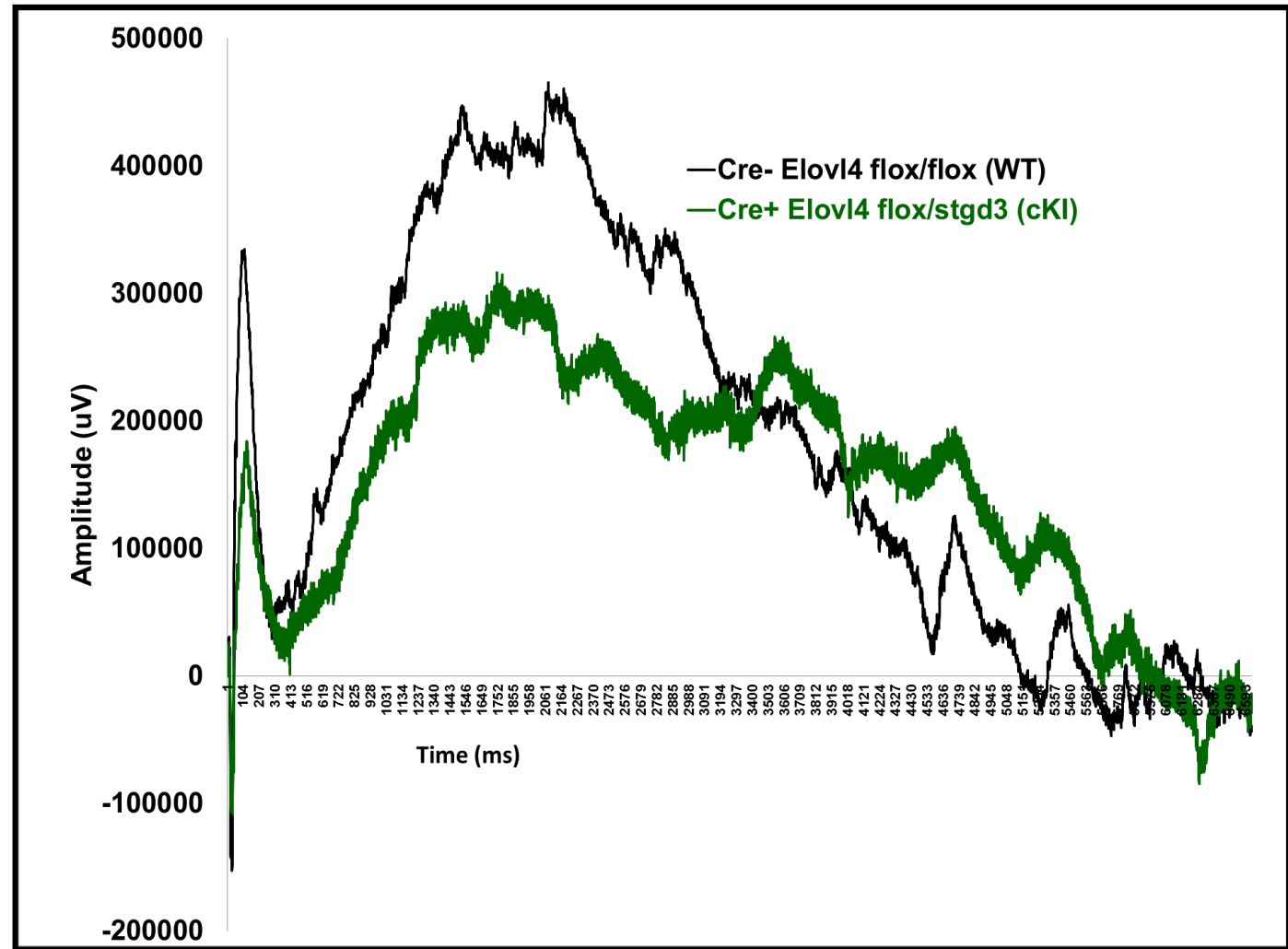
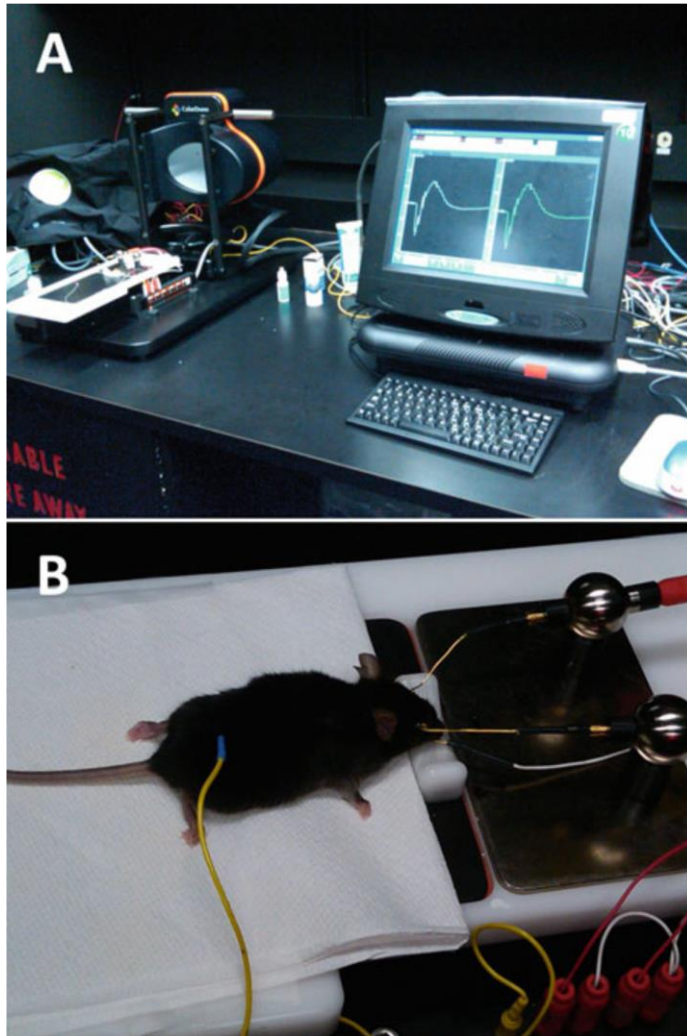
Agbaga M-P et al., PNAS 105:12843–12848 (2008)

N-3 Fatty Acids Elongation and Desaturation Pathways



Agbaga M-P et al., PNAS 105:12843–12848 (2008)

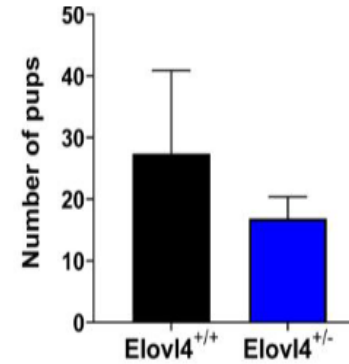
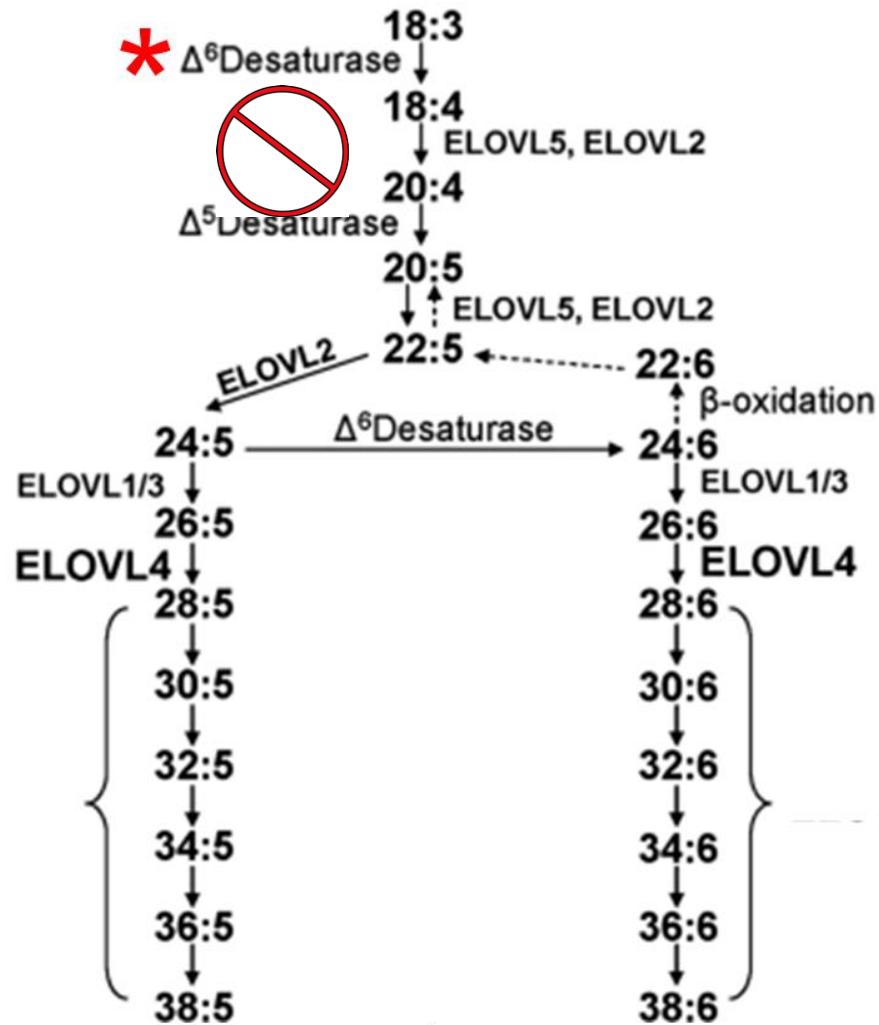
Reduced visual function in rodent models of STGD3



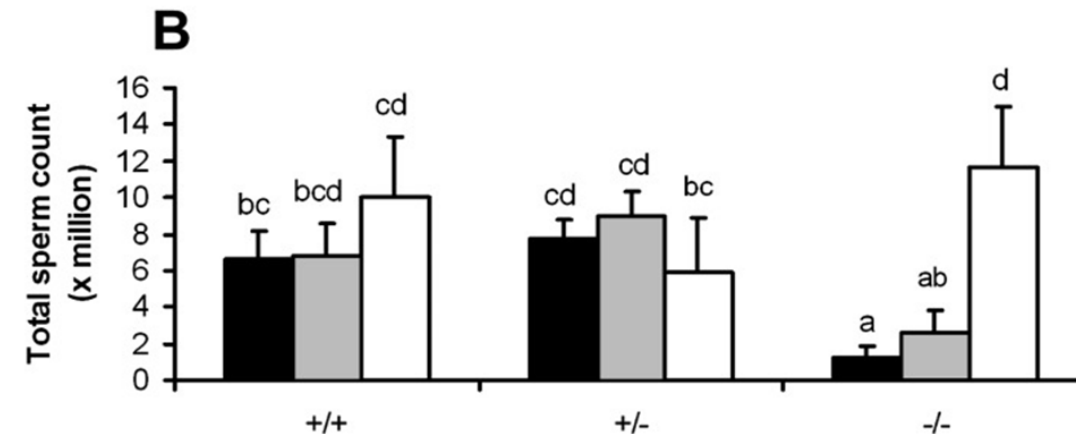
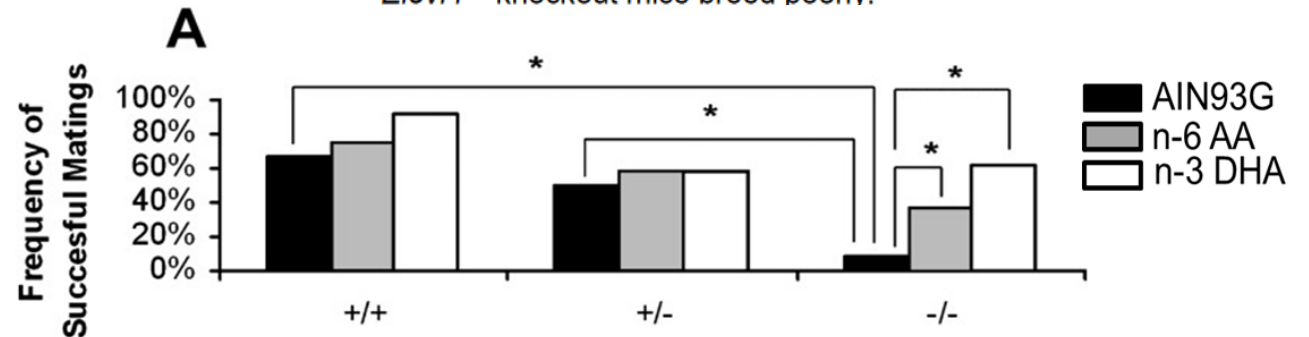
<https://europepmc.org/article/med/30649775>

Agbaga Lab (Work in progress)

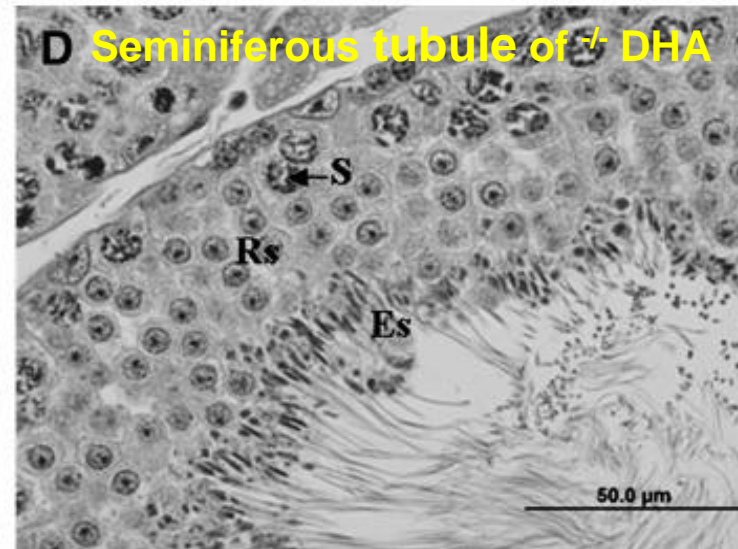
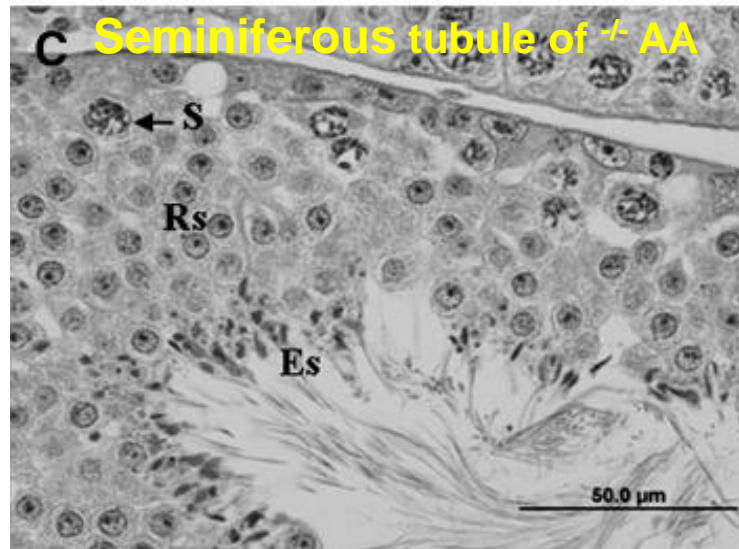
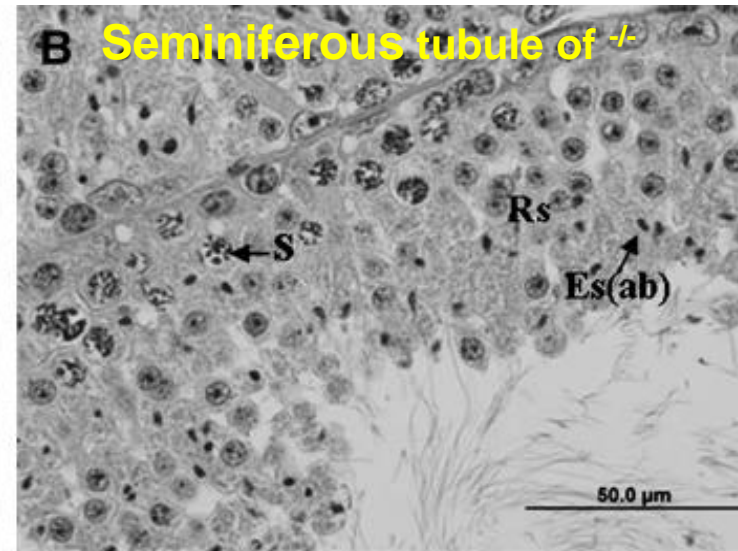
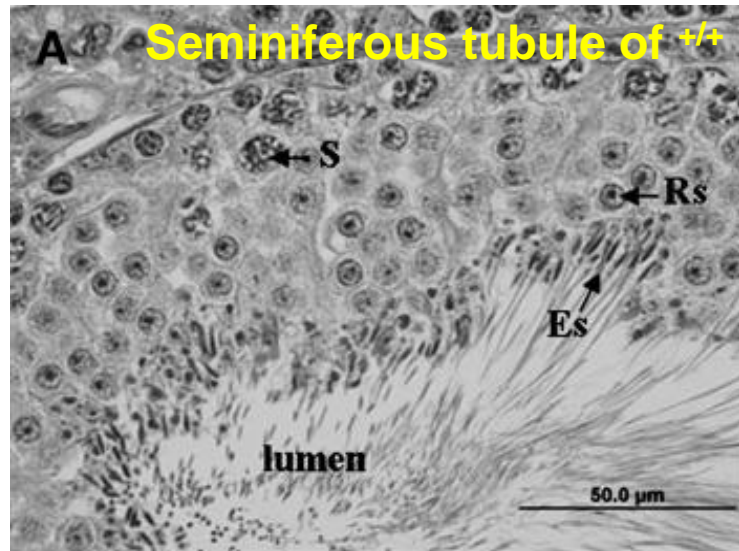
Dietary omega-3, DHA, fully restores fertility and spermatogenesis



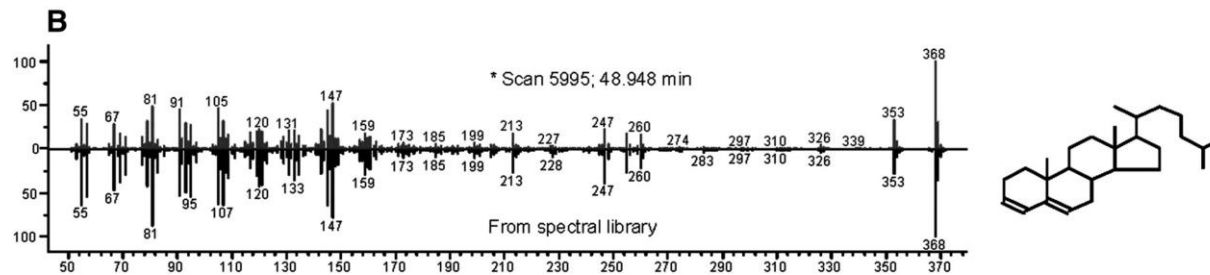
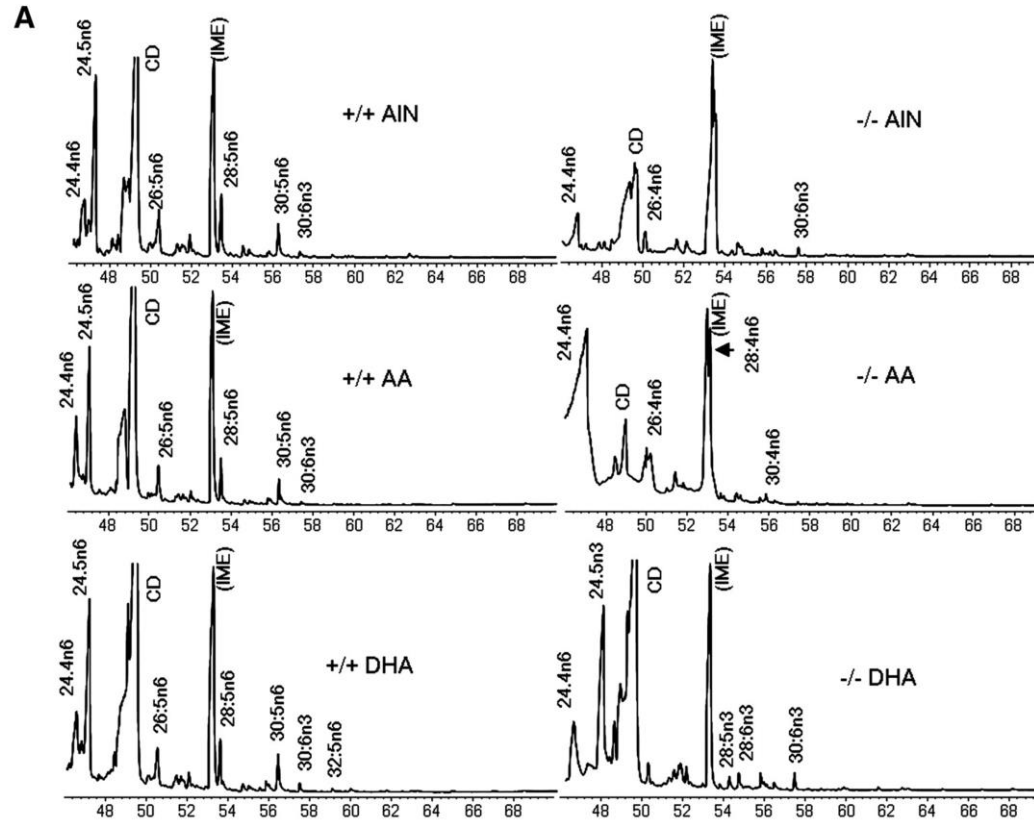
Elov4^{+/-} knockout mice breed poorly.



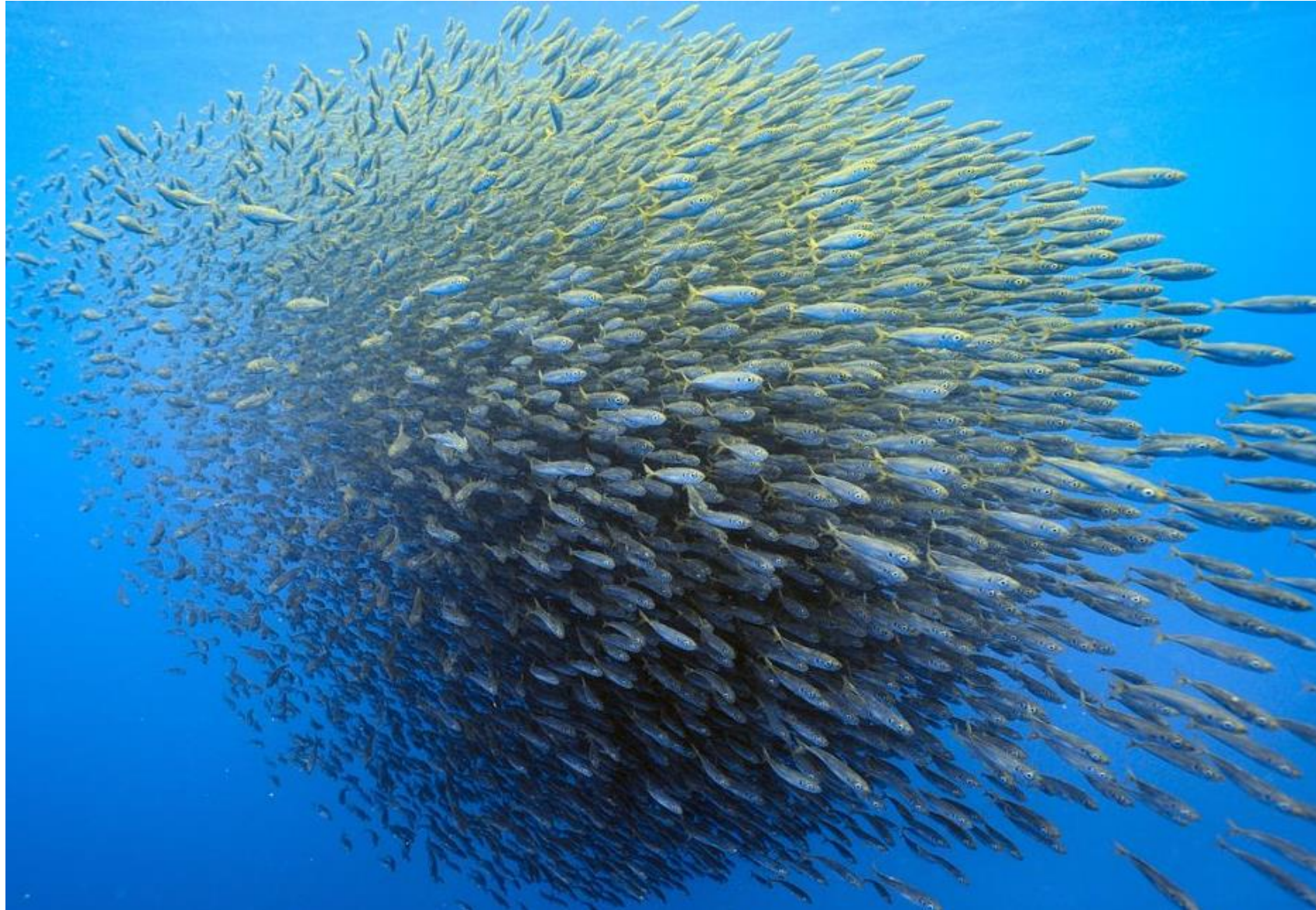
Dietary omega-3, DHA, fully restores fertility and spermatogenesis



Dietary omega3-DHA and omega-6 AA, are Elongated to VLC-PUFA



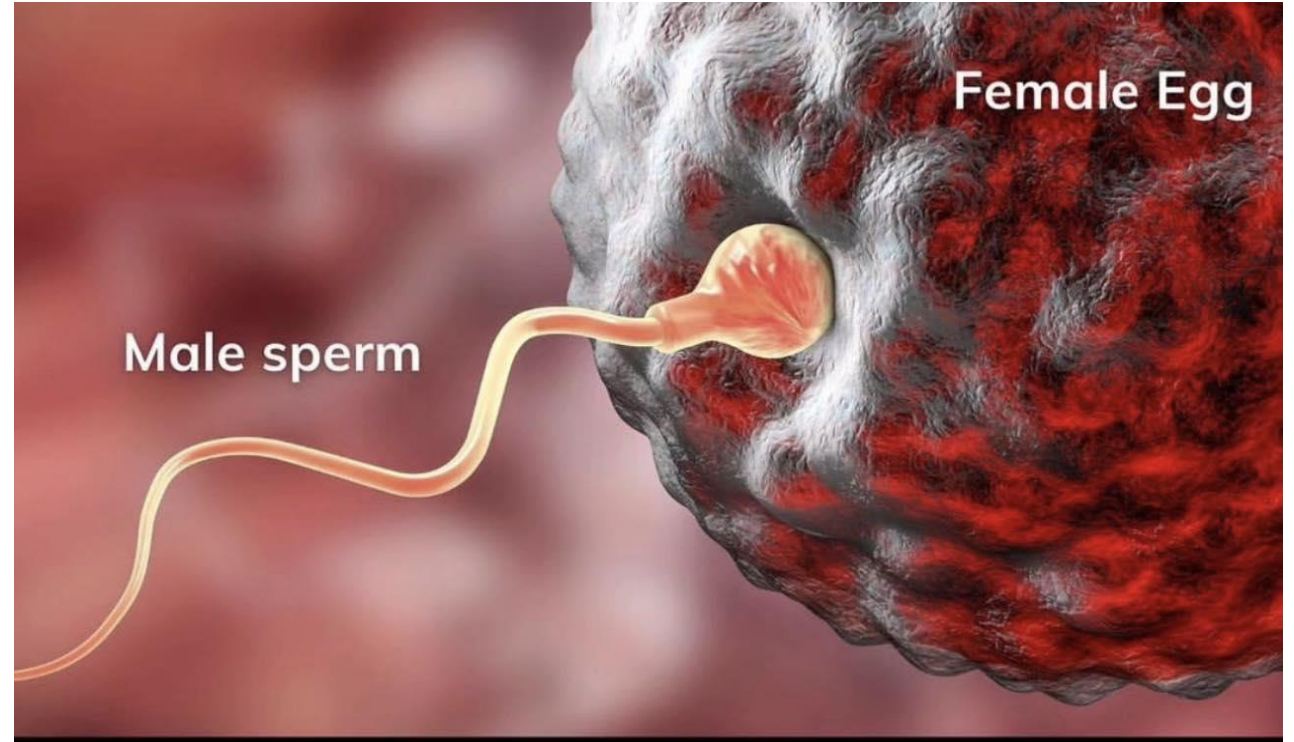
Omega 3 and the Next Generation: The Role of Swimmers



Swimmer (sperm) counts have significantly decreased worldwide in the past 40 years.

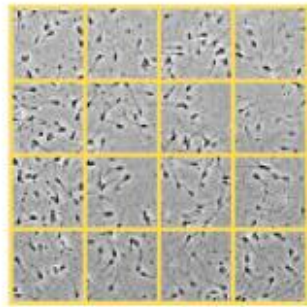


<https://www.newsweek.com/fact-check-sperm-count-decreasing-massively-1763537>

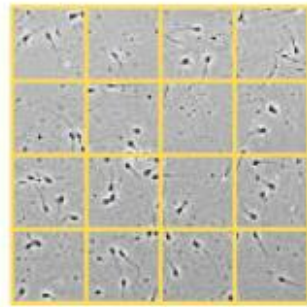


<https://www.facebook.com/photo/?fbid=911618520979777&set=male-factors-that-affects-fertility-low-or-no-sperm-production-abnormal-sperm-fu>

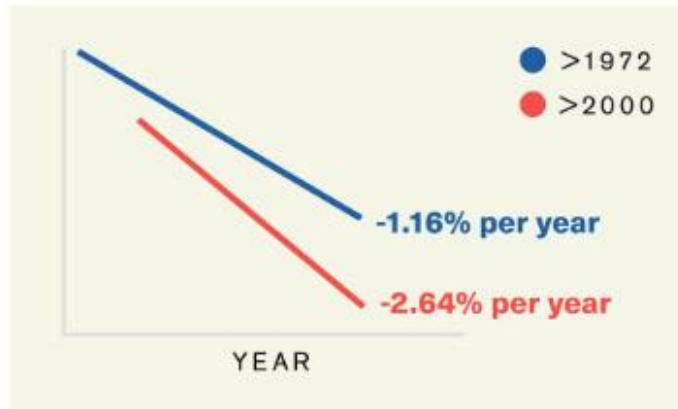
Sperm count is declining at an accelerated pace globally



101 mill/ml
(1973)



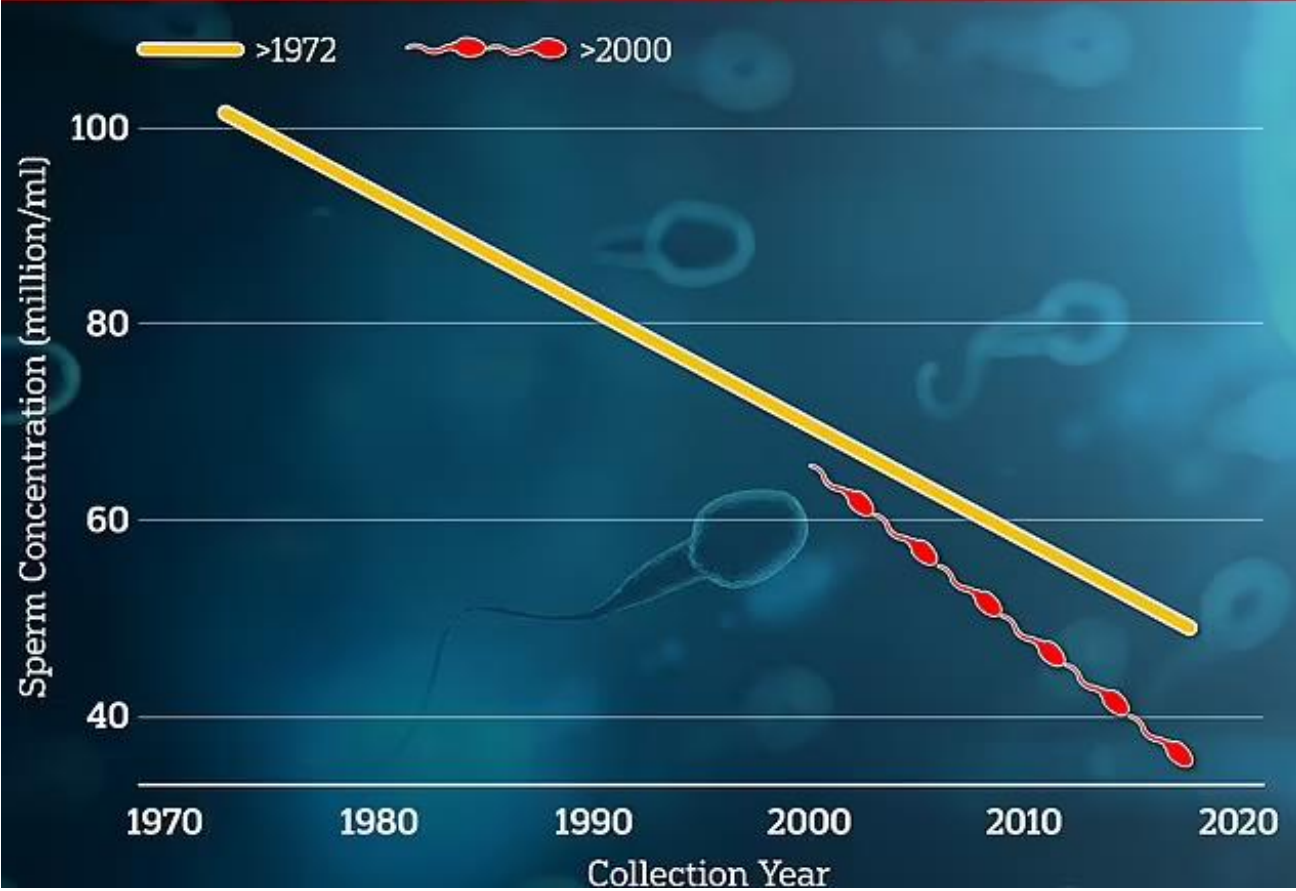
49 mill/ml
(2018)



Sperm count is declining at an accelerated pace globally.

Human Reproduction Update, Vol.29, No.2, pp. 157–176, 2023

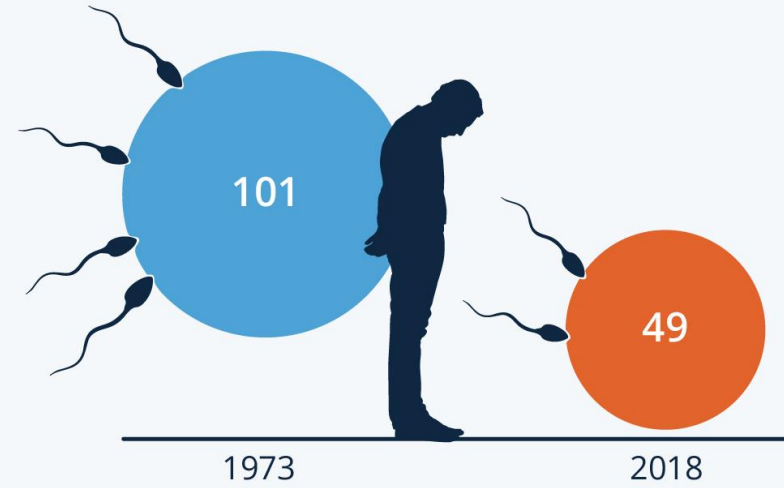
GLOBAL SPERM CONCENTRATION OVER TIME



<https://www.dailymail.co.uk/health/article-11429551/Mens-sperm-rates-halved-1970s.html>

Fragile Fertility

Average sperm count of men worldwide in 1973 and 2018 (million sperm per milliliter of semen)



Source: Levine et al. Temporal trends in sperm count: a systematic review and meta-regression analysis. Human Reproduction Update (2022)



statista

<https://www.statista.com/chart/10439/sperm-counts-of-western-men-halved-in-38-years/>

Consequences of declining sperm quality

12% of women 15 to 44 years in the US have difficulty getting pregnant or carrying a pregnancy to term (CDC)

Male and female factors are identified in 35% of these infertile couples.

In 8% of couples with infertility, a male factor is the only identifiable cause.

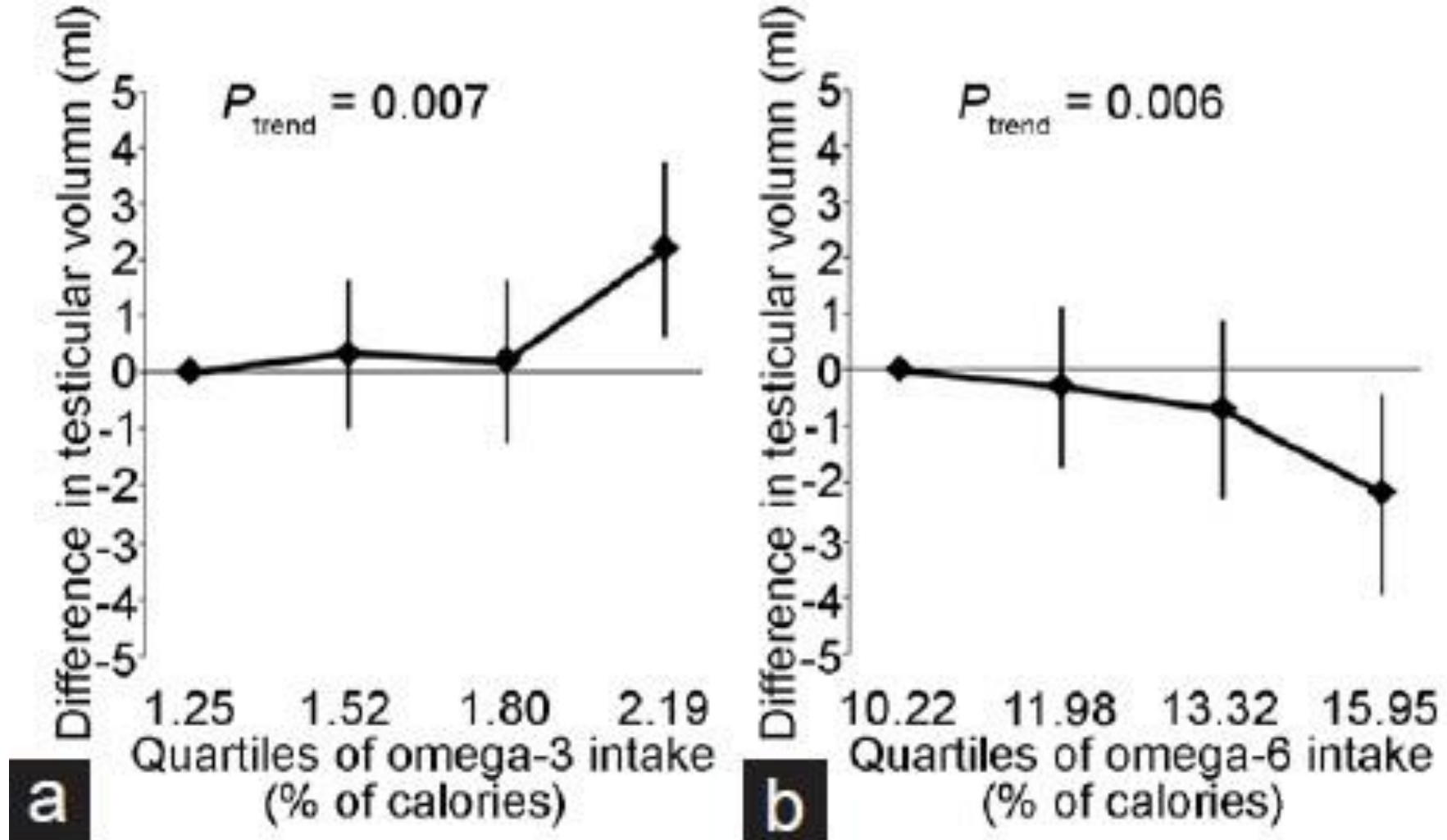
Male fertility is defined as the ability of a man to impregnate a healthy, fertile woman of reproductive age.

What exactly is driving this decline in fertility?

Dietary factors have not be considered, of which omega-3 fatty acids in promoting sperm health has not been studied.

Fatty acid intake in relation to reproductive hormones and testicular volume among young healthy men

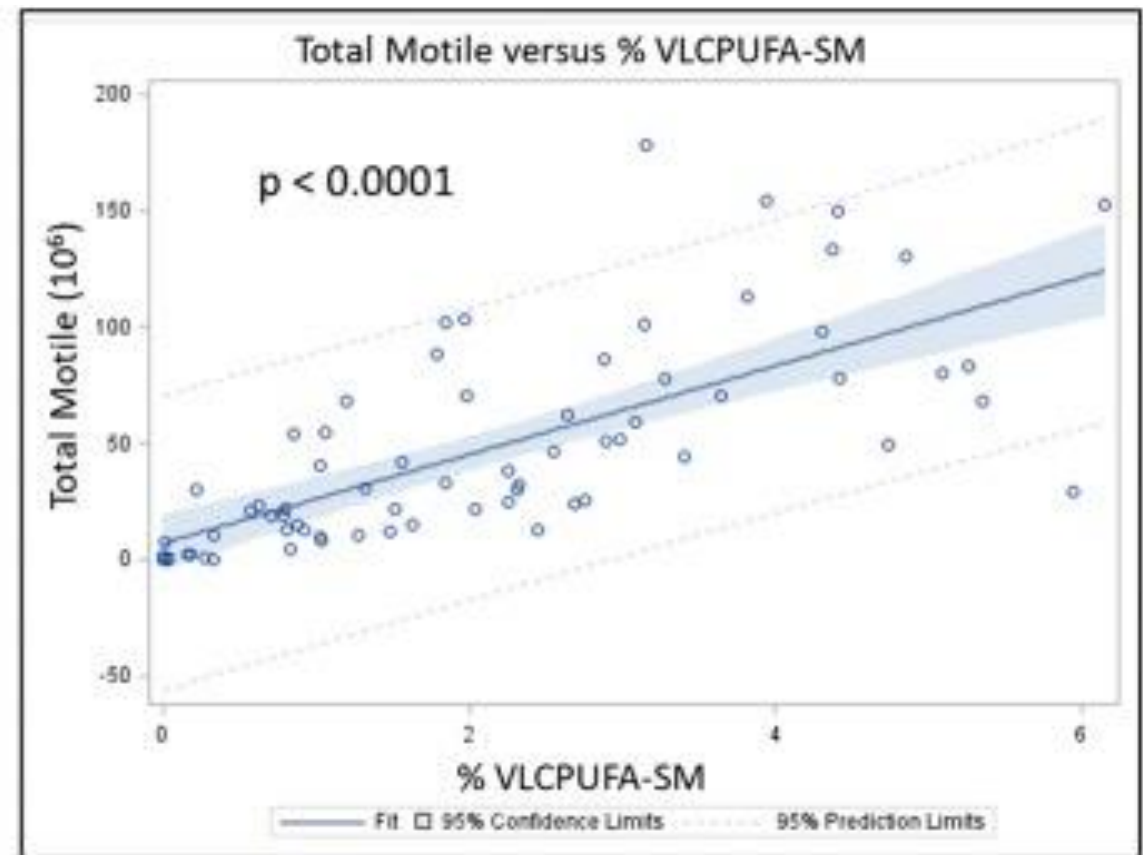
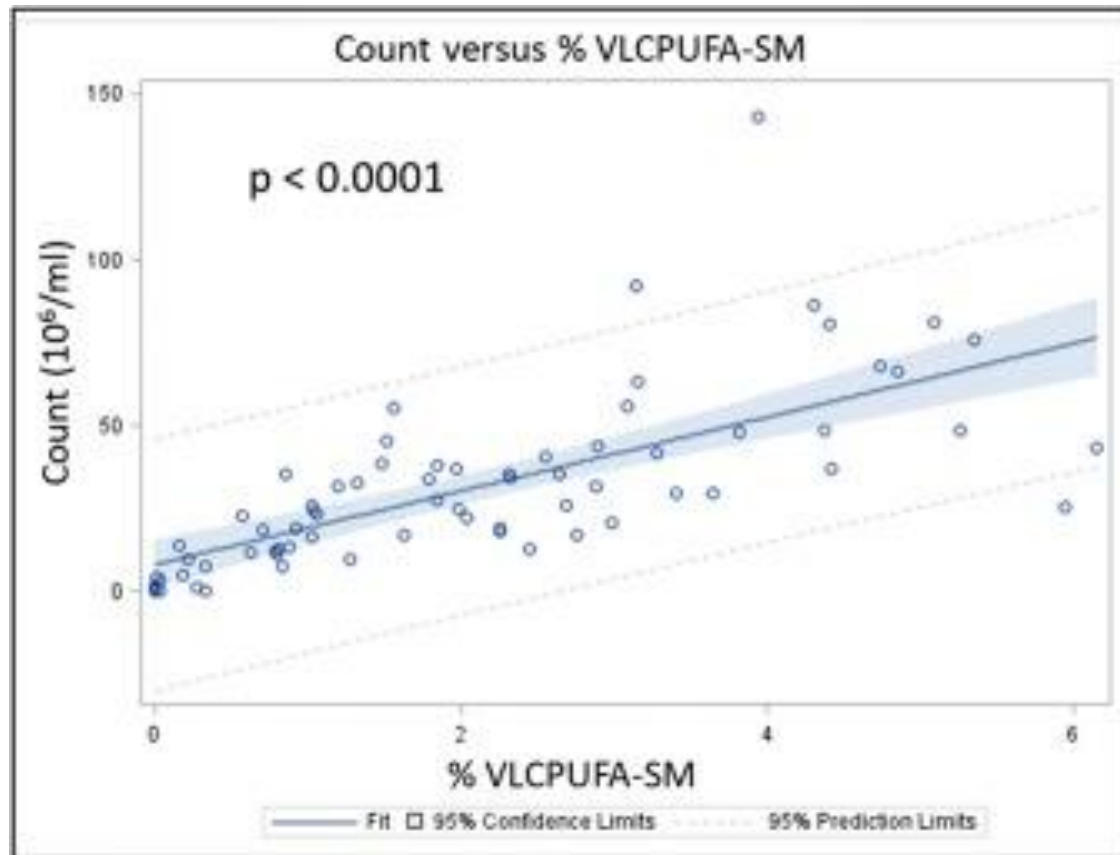
Mínguez-Alarcón, Lidia^{1,2,*}; Chavarro, Jorge E^{3,4,5,*}; Mendiola, Jaime²; Roca, Manuela⁶; Tanrikut, Cigdem^{7,8}; Vioque, Jesús^{9,10}; Jørgensen, Niels¹¹; Torres-Cantero, Alberto M^{2,12}



Method of sperm quality evaluation in humans

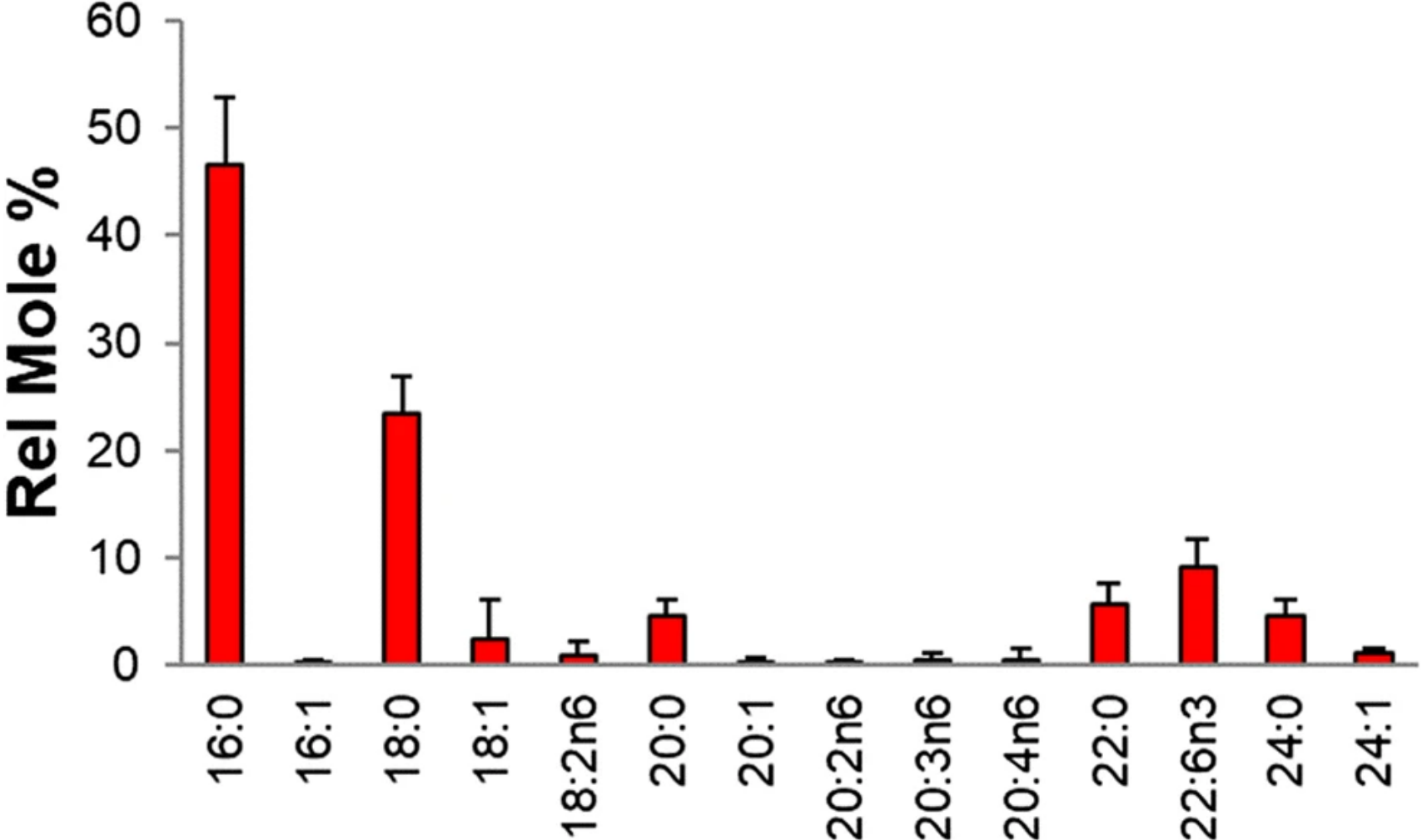
- We enrolled 70 men from whom we collected sperm ejaculates
- Volume of semen, pH, viscosity, sperm concentration and motility were measured
- % of normal shaped-spermatozoa
- Lipids extracted sperm cell pellet and analyzed

Positive correlation between the levels of VLC-PUFA with sperm count and total motile count



Sum of all VLC-PUFA-SM species = 0 to 6.1% of the overall SM pool (mean 2.1%). Lower levels of VLC-PUFA-SM positively correlated with lower total motile count.

Fatty acid profile of sperm pellet total lipid extract (n = 70).



Critical role of VLC-PUFA in sperm function

› [J Assist Reprod Genet. 2019 Jul;36\(7\):1379-1385. doi: 10.1007/s10815-019-01464-3.](#)

Epub 2019 May 9.

Decreased very long chain polyunsaturated fatty acids in sperm correlates with sperm quantity and quality

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Martin-Paul Agbaga ^{2 3 5}, Robert E Anderson ^{2 3 5}

Affiliations + expand

PMID: 31073727 PMCID: PMC6642247 DOI: 10.1007/s10815-019-01464-3

[Free PMC article](#)

Sperm very long-chain polyunsaturated fatty acids: relation to semen parameters and live birth outcome in a multicenter trial

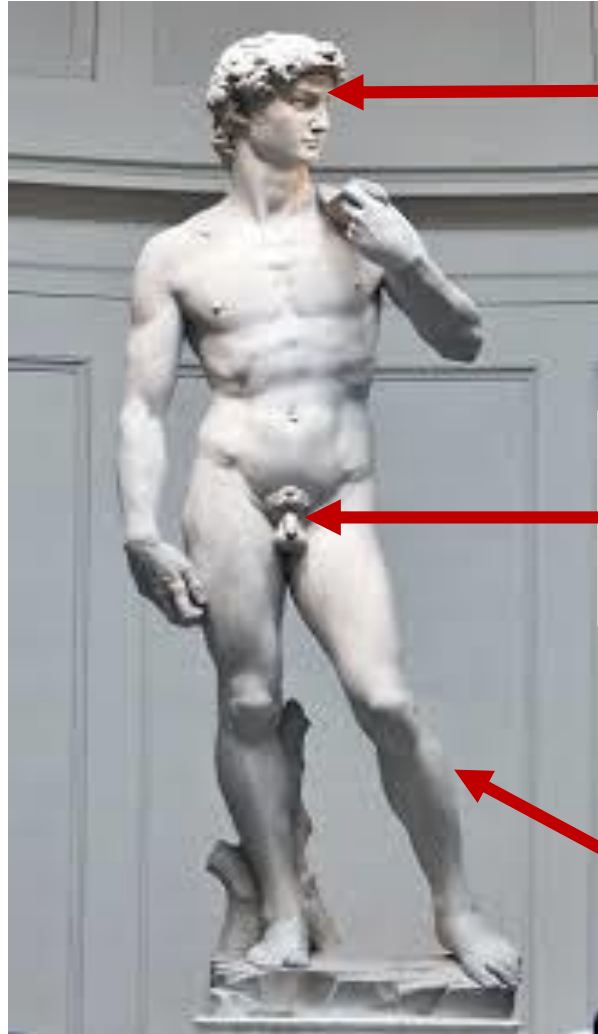
Sarah Z Gavrizi ¹, Pardis Hosseinzadeh ², Richard Steven Brush ³, Madison Tytanic ³, Erin Eckart ⁴, Jennifer D Peck ⁵, LaTasha B Craig ¹, Michael P Diamond ⁶, Martin-Paul Agbaga ⁷, Karl R Hansen ¹

Male from 185 couples with unexplained infertility provided semen for analysis.

After adjustment for female age and treatment group, the probability of a live birth outcome was 72% more likely among men with higher levels of VLC-PUFA percentage than those with lower levels.

VLC-PUFA are essential for normal sperm structure and function.

Fish derived Very Long Chain Polyunsaturated Fatty Acids (VLC-PUFA) in eye and reproductive organs health: Why you must eat seafood



Brain and eye balls need omega-3 DHA and VLC-PUFAs

Testes size and sperm function are influenced by DHA and VLC-PUFA

Skin health is supported by omega-3 DHA and VLC-SFA



Key Takeaways

- Fish oil derived VLC-PUFA are critical to eye and reproductive health
- There is significant decrease in total sperm count in the past four decades.
- DHA-enriched fish oil supplementation increased VLC-PUFA and total testosterone levels, and improve fertility in males.
- Need to improved seafood nutrition to return our neuronal and reproductive tissue essential fatty acid levels to their physiological levels to improve health and perpetuate the species