

The Yakult logo is displayed in a bold, red, sans-serif font.

Science for Health

A short, solid red vertical line is positioned to the left of the title text.

The Female Gut Microbiome: Lessons through life

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In this session

The Female Gut Microbiome

- Changes through the life course

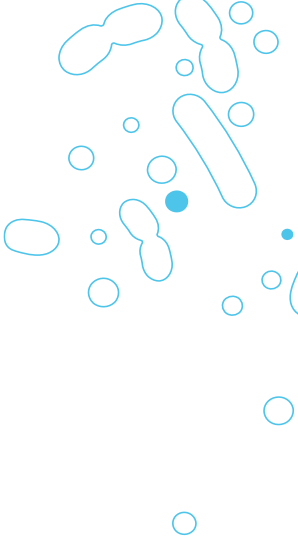
Female Sex Hormones

- Gut microbiome interactions

Key Life Stages

- Puberty
- Fertility
- Menopause

Take-Home Messages



The logo features a large, light pink circle in the background. Inside this circle is a smaller, solid white circle. A dark blue horizontal rectangle is positioned across the center of the white circle. The text "MIND THE GAP" is written in white, uppercase, sans-serif font within this rectangle.

MIND THE GAP



**Less than 25% of health research globally
includes female participants.**

**Women make up only 38% of participants in
clinical trials.**

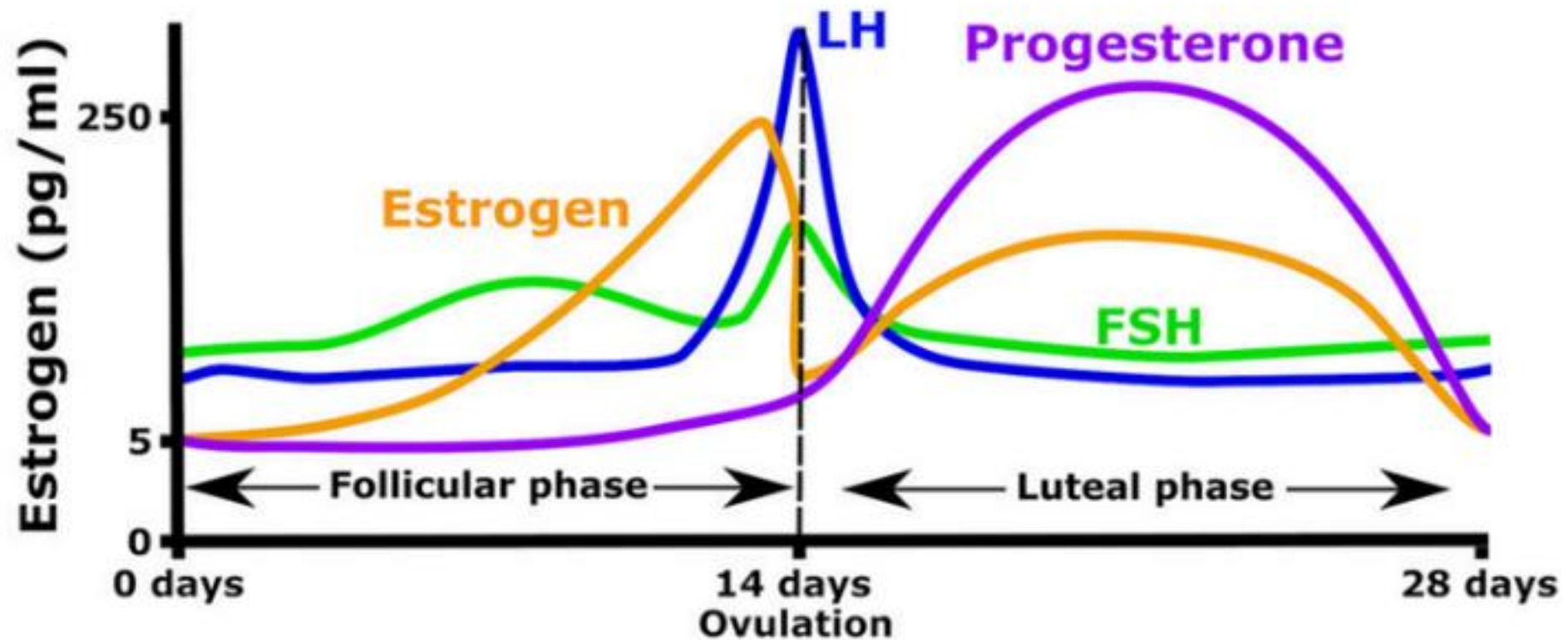


**Women experience longer diagnosis times
than men.**

**1 in 2 women feel they have had their pain
dismissed because of their gender.**

THE INNER POWER

Female hormone fluctuations



Chidi-Ogbolu & Baar (2019) *Front Physiol*, 9: 1834.



Gut Glossary



Microbes

The population of microorganisms (bacteria, archaea, yeast, viruses) that live on or in the human body

Metabolome

By-products microbes produce ○

Microbiota

The community of microbes

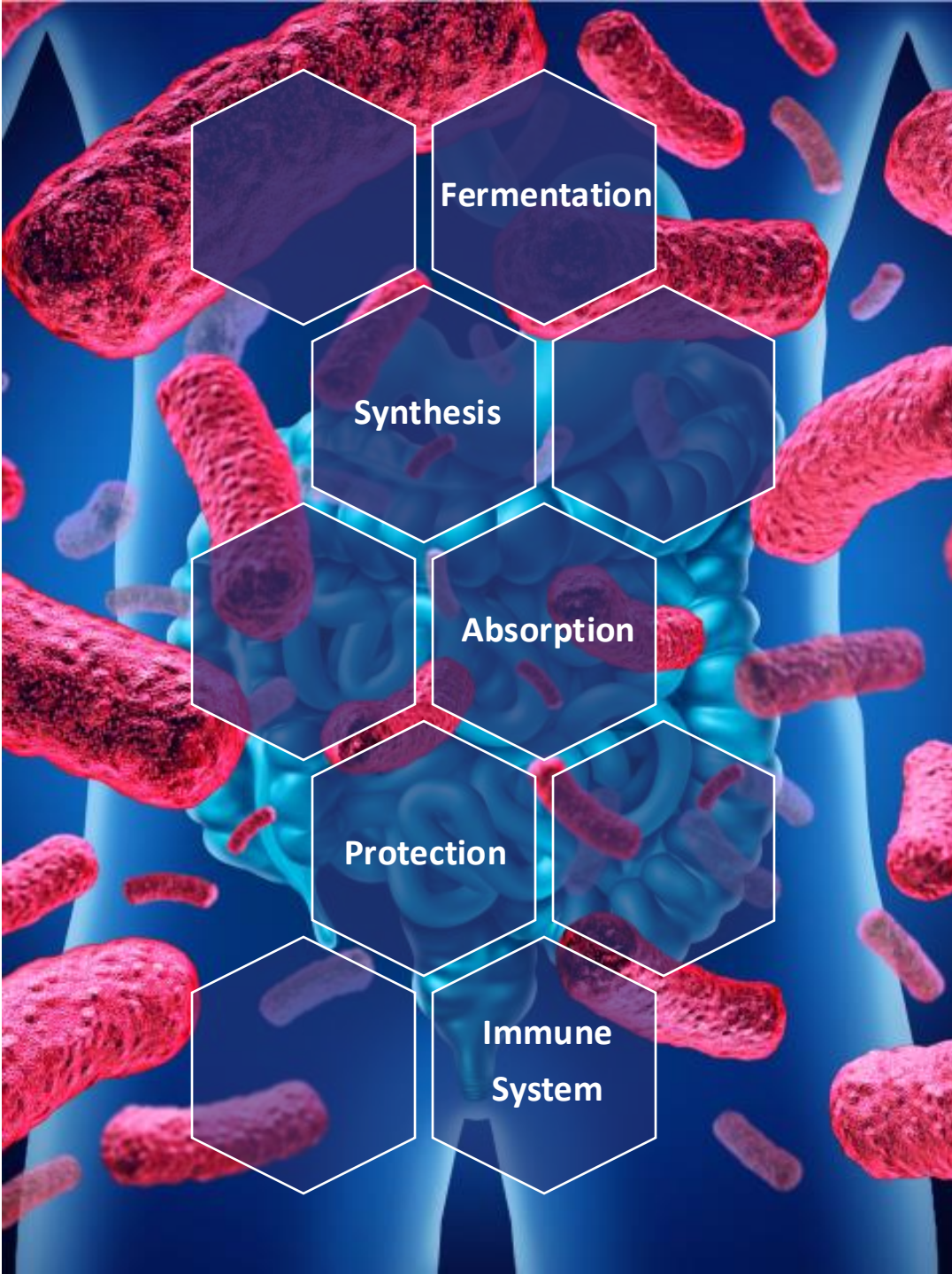


Microbiome

The genes of the microbes that comprise the microbiota

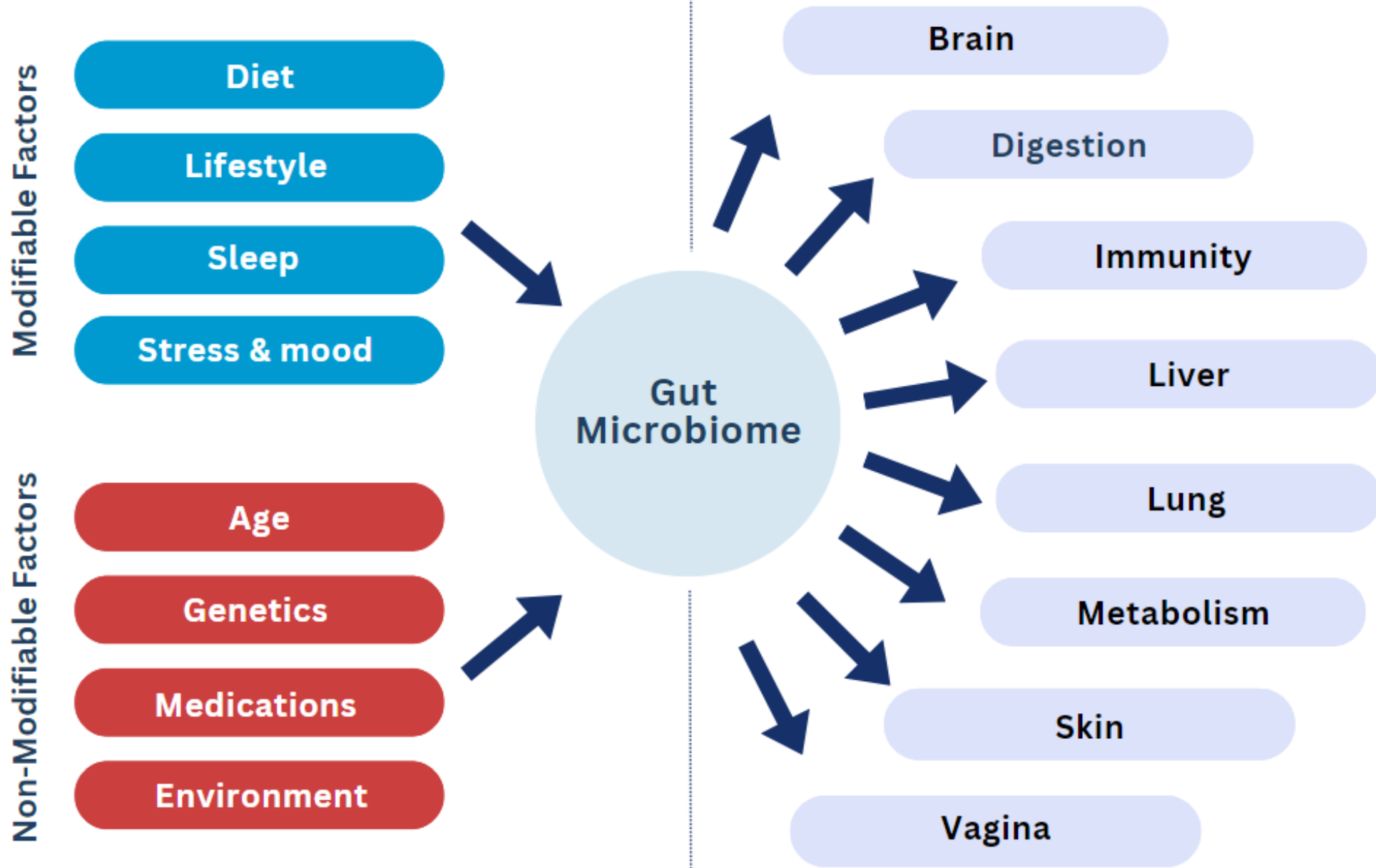
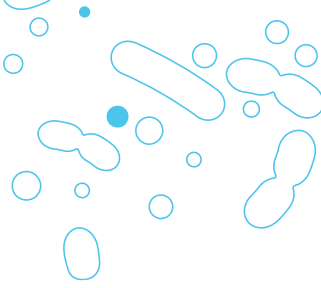






The Role of the Intestinal Microbiota

1. **Fermentation** of non-digestible dietary fibre
 - Producing short-chain fatty acids (SCFAs)
 - These acids provide energy to our gut cells
2. **Synthesis** of some vitamins
 - Including vitamin K and some B vitamins
3. **Absorption** of nutrients
 - Including calcium, magnesium and iron
4. **Protection and defence**
 - Good bacteria compete against bad bacteria for space and nutrients
 - They produce substances that protect against infection
5. **Maintenance of the immune system**
 - 70-80% of our immune cells are in the gut



Factors affecting our gut microbiota

DIET

Food we eat that is not digested is available to the gut microbiota for fermentation.



FACTORS AFFECTING THE GUT MICROBIOTA

MEDICATION

Antibiotics, PPIs, laxatives, metformin, NSAIDs can all negatively impact the composition of our gut bugs.



AGE AND GENETICS

As we age, the diversity of our microbiota decreases.

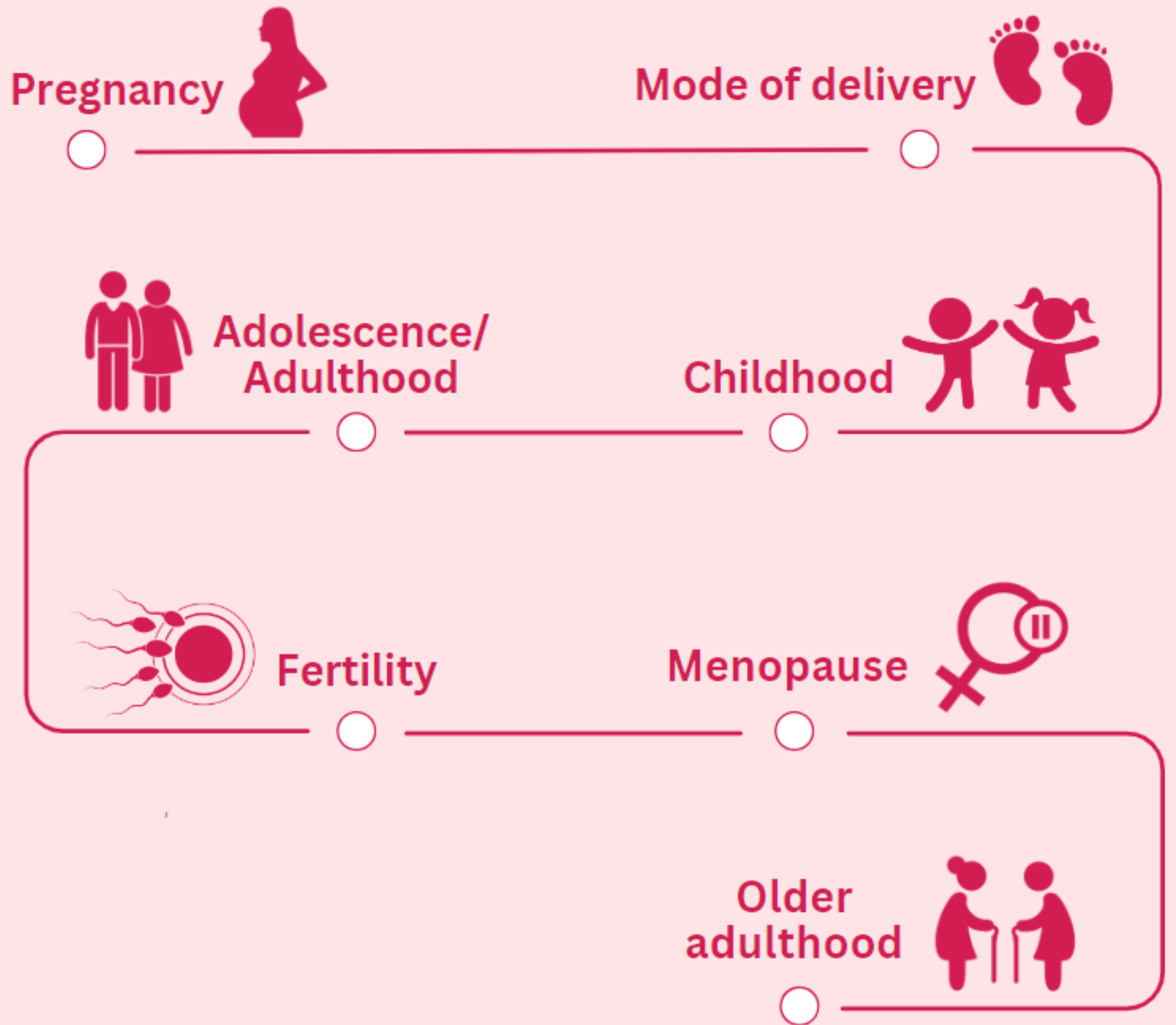
Genetics may affect the microbes that live in our gut, and how we interact with those microbes.

LIFESTYLE FACTORS

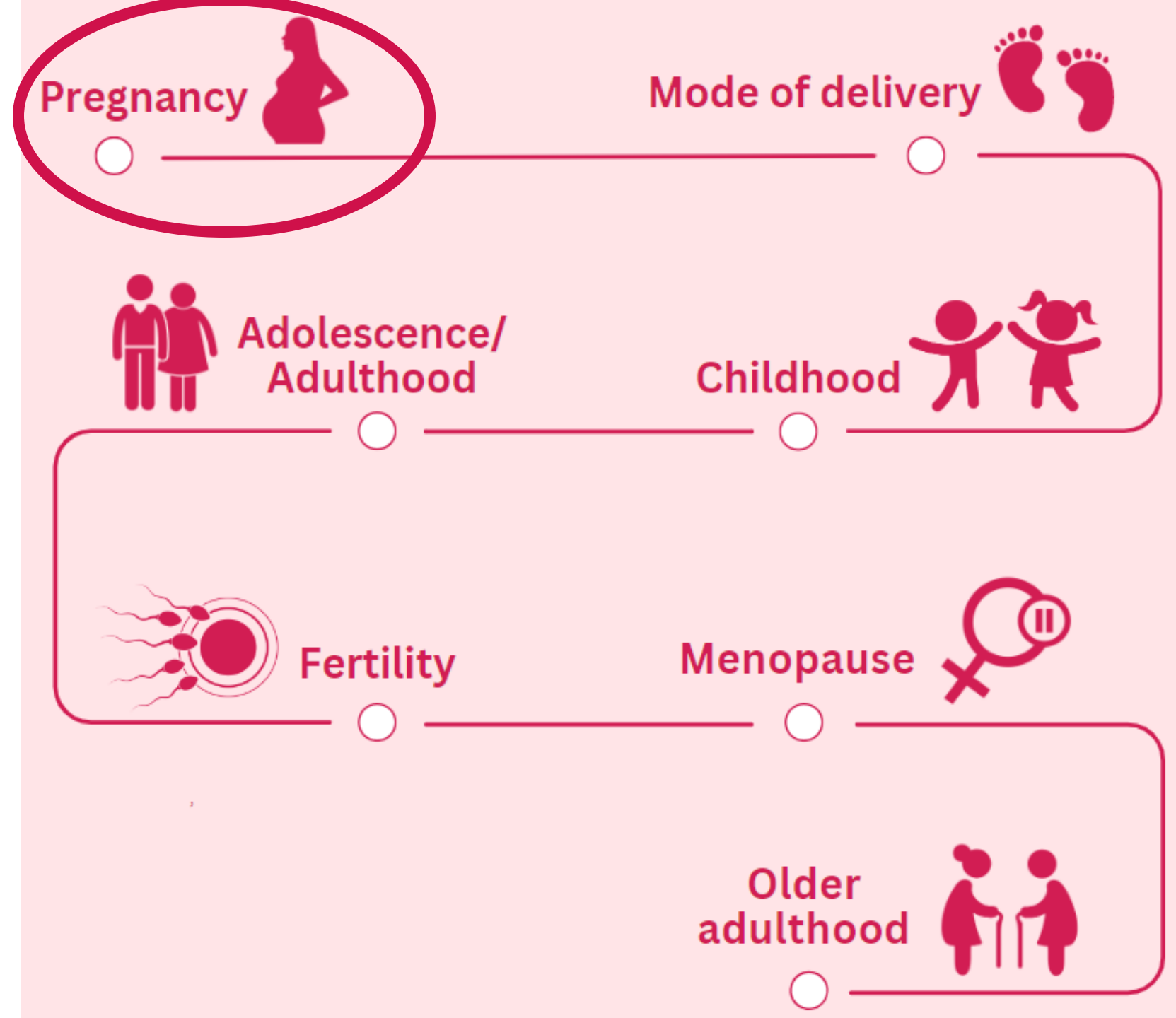
There are several lifestyle factors that affect the gut microbiota such as sleep, stress and physical activity.



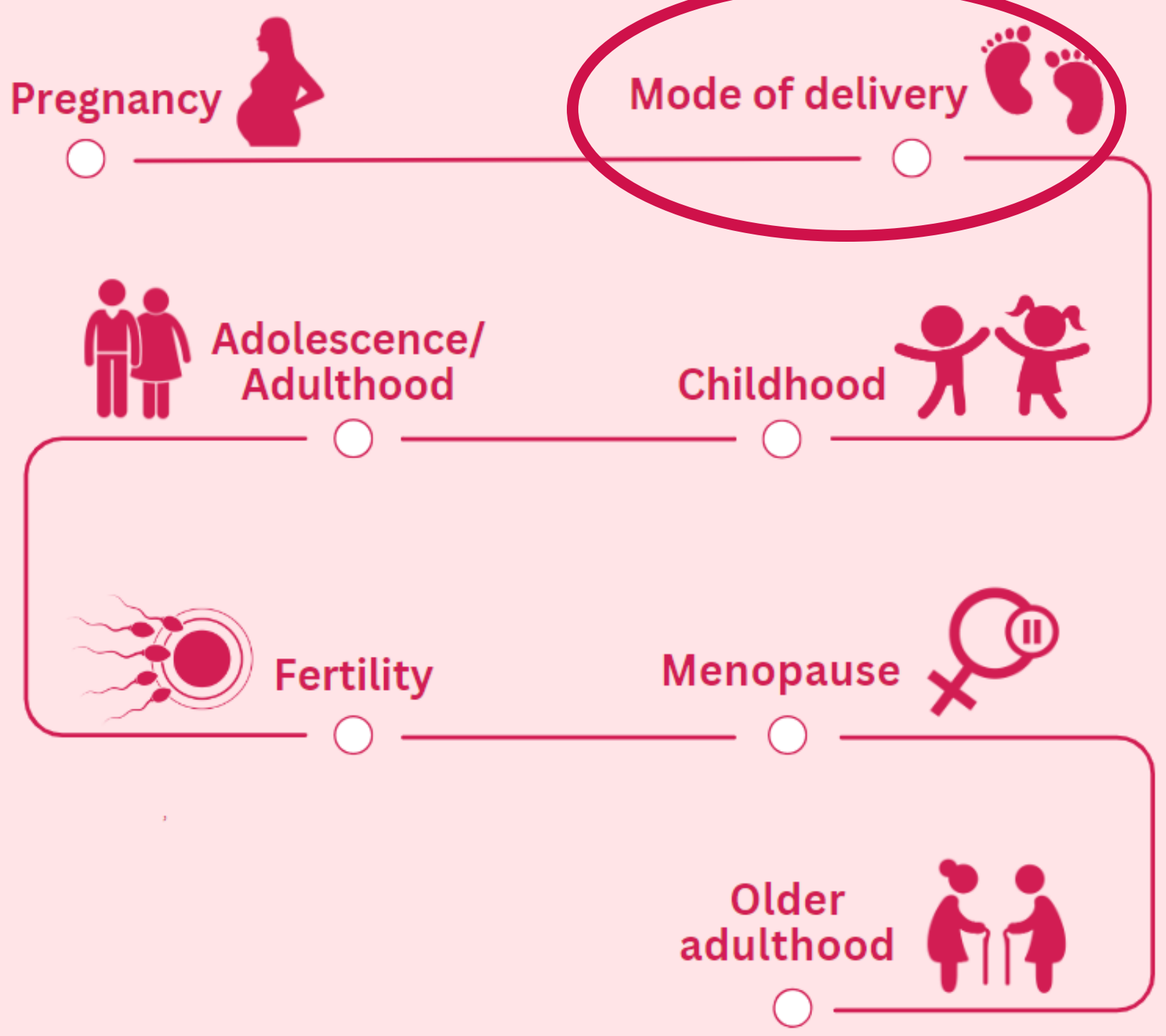
The Female Gut Microbiota



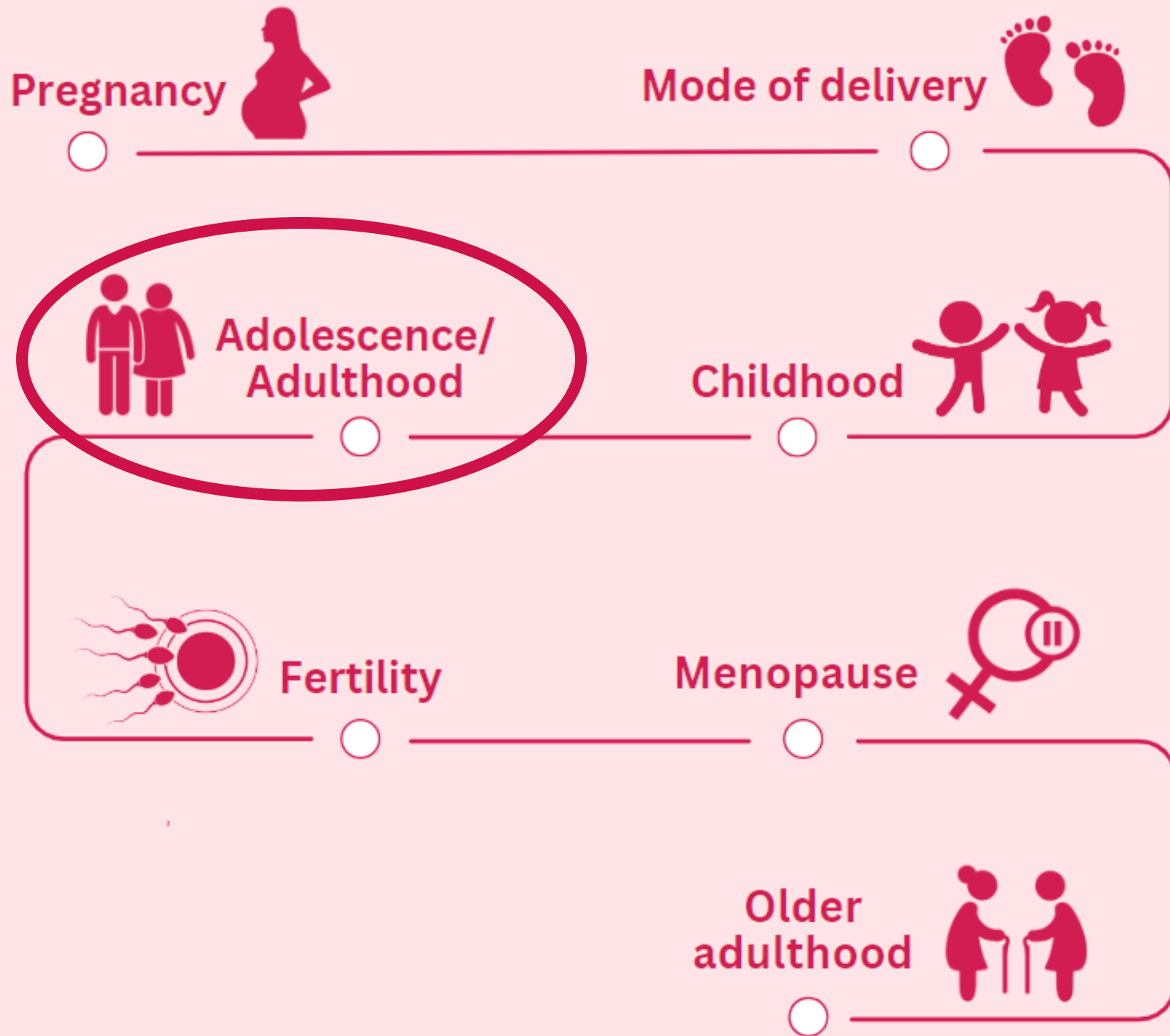
The Female Gut Microbiota



The Female Gut Microbiota

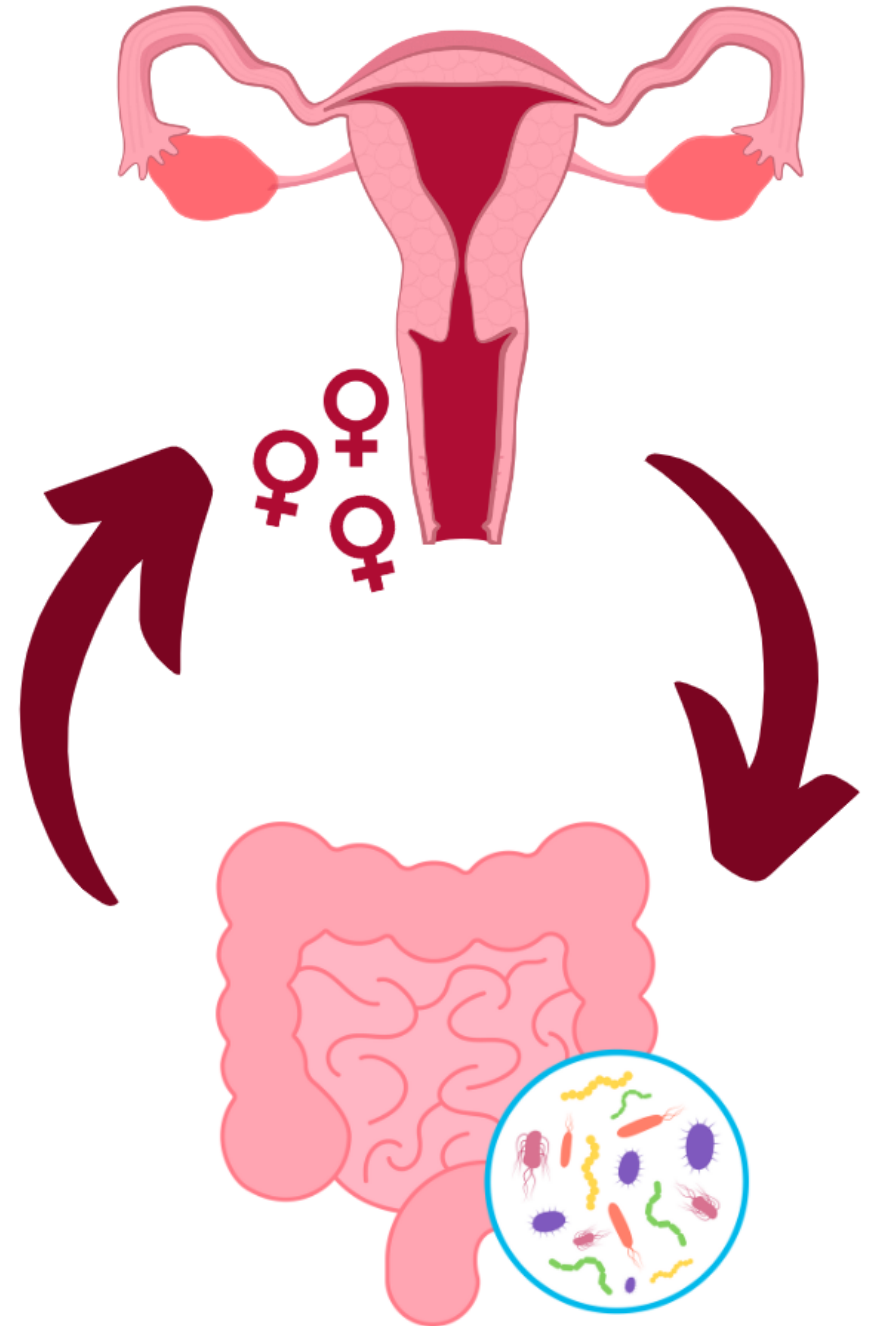


The Female Gut Microbiota

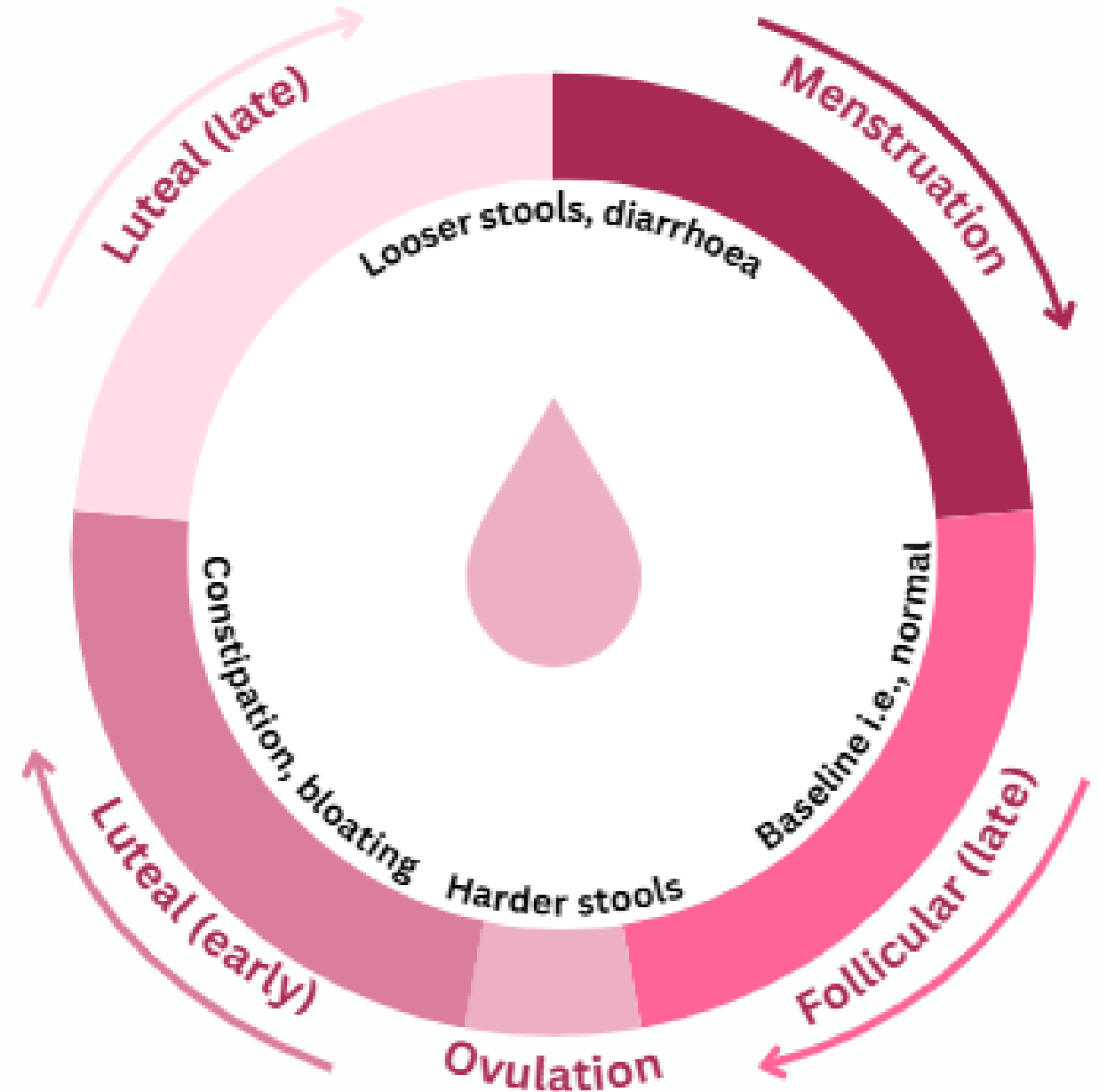


The Oestrobolome

- A unique collection of microbes within the gut microbiome, capable of metabolising and regulating circulating oestrogen levels.
- 'Recycles' oestrogen by enabling it to re-enter circulation.
- This reactivation of oestrogen is achieved via excretion of the beta-glucuronidase enzyme which is produced by certain types of gut bacteria, e.g., *Bacteroides* and *Firmicutes*.

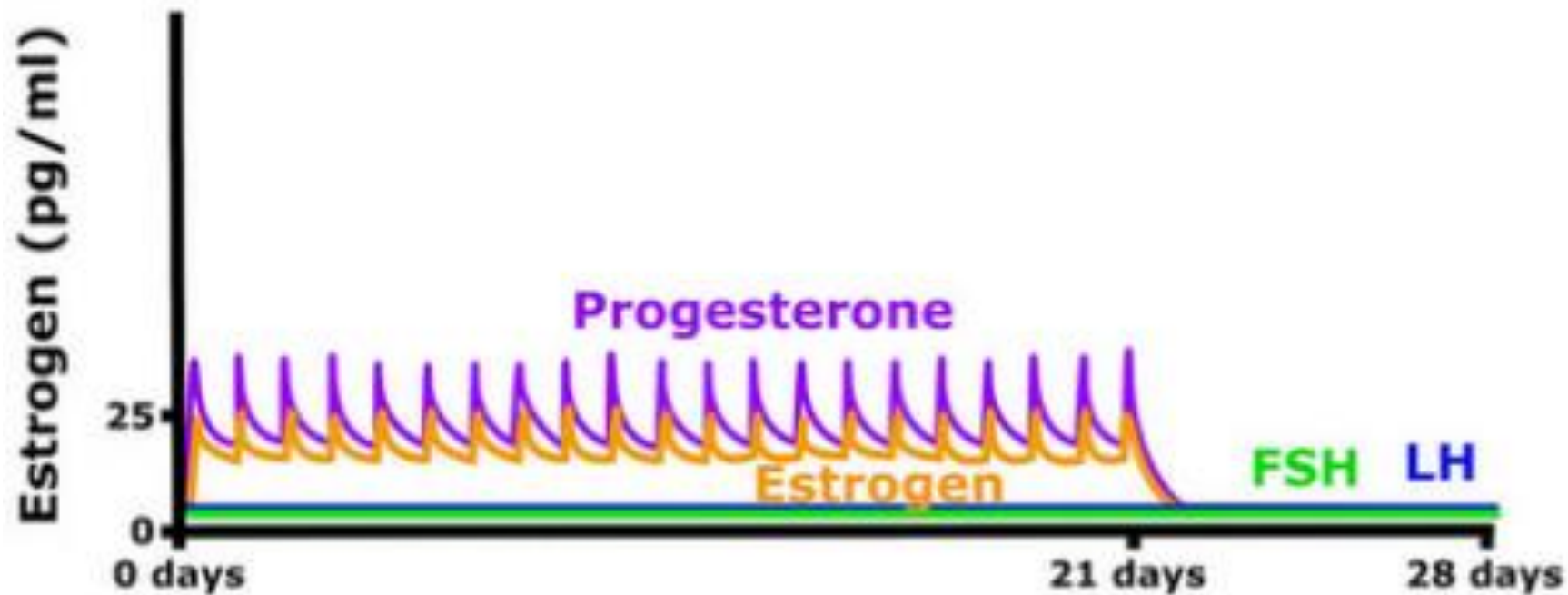


The Menstrual Cycle & The Gut



ORAL CONTRAPETIVE PILL

“Balance your hormones”



Chidi-Ogbolu & Baar (2019) *Front Physiol*, 9: 1834.

GUT-SKIN AXIS



PREBIOTICS



PROBIOTICS









PROBIOTICS

Acne & Probiotics

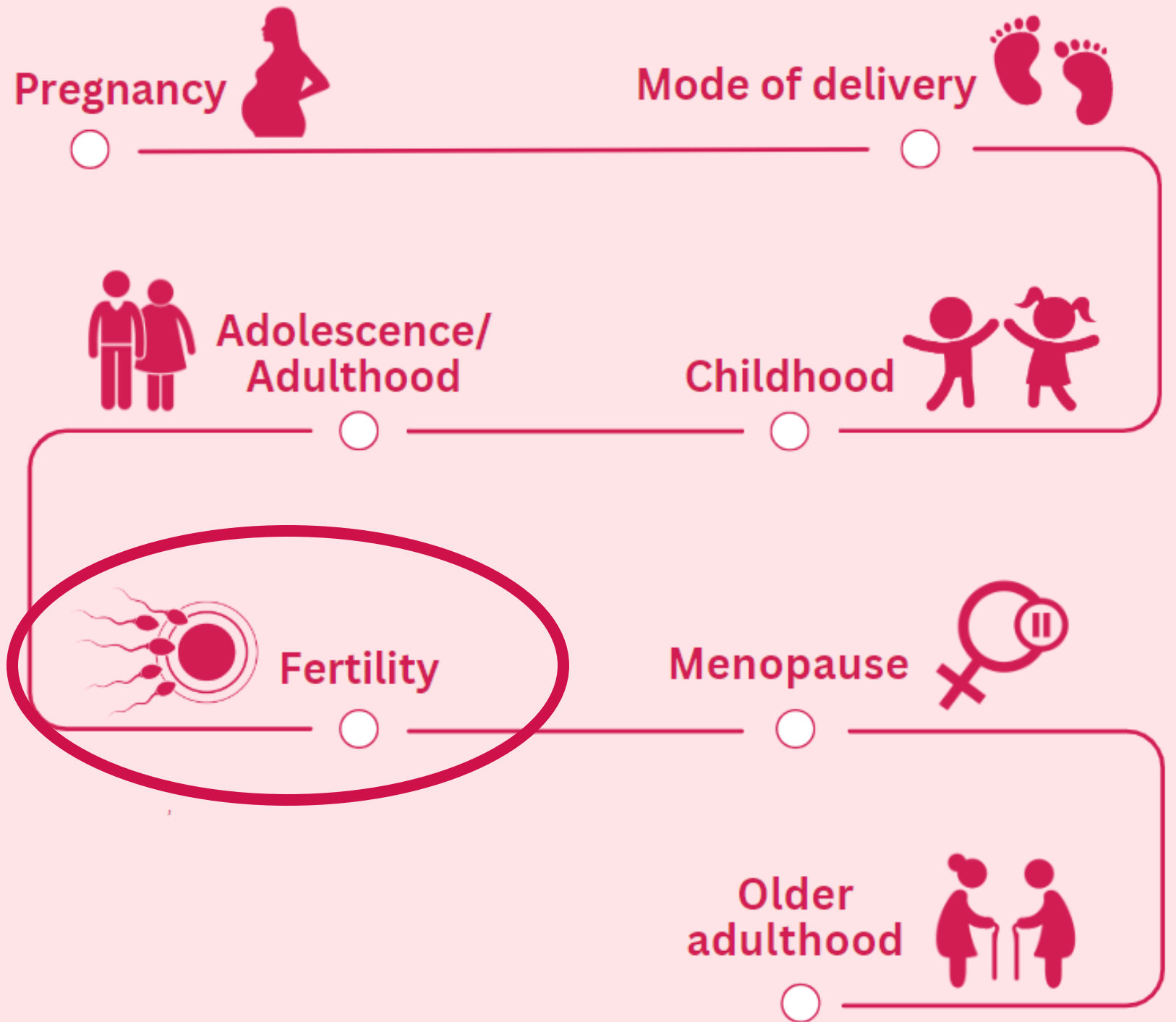
Systematic Review

- **4 placebo-controlled trials** of oral probiotics (**8-12 weeks**) in acne patients
- Outcomes included lesion counts, Global Acne Grading System (GAGS) score, Investigator Global Assessment (IGA) rating, sebum and hydration
- **Significant improvement in clinical assessment of acne** was observed following treatment with *Lactiplantibacillus plantarum* oral supplementation and *Lactobacillus rhamnosus* SP1
- Mechanisms not discussed

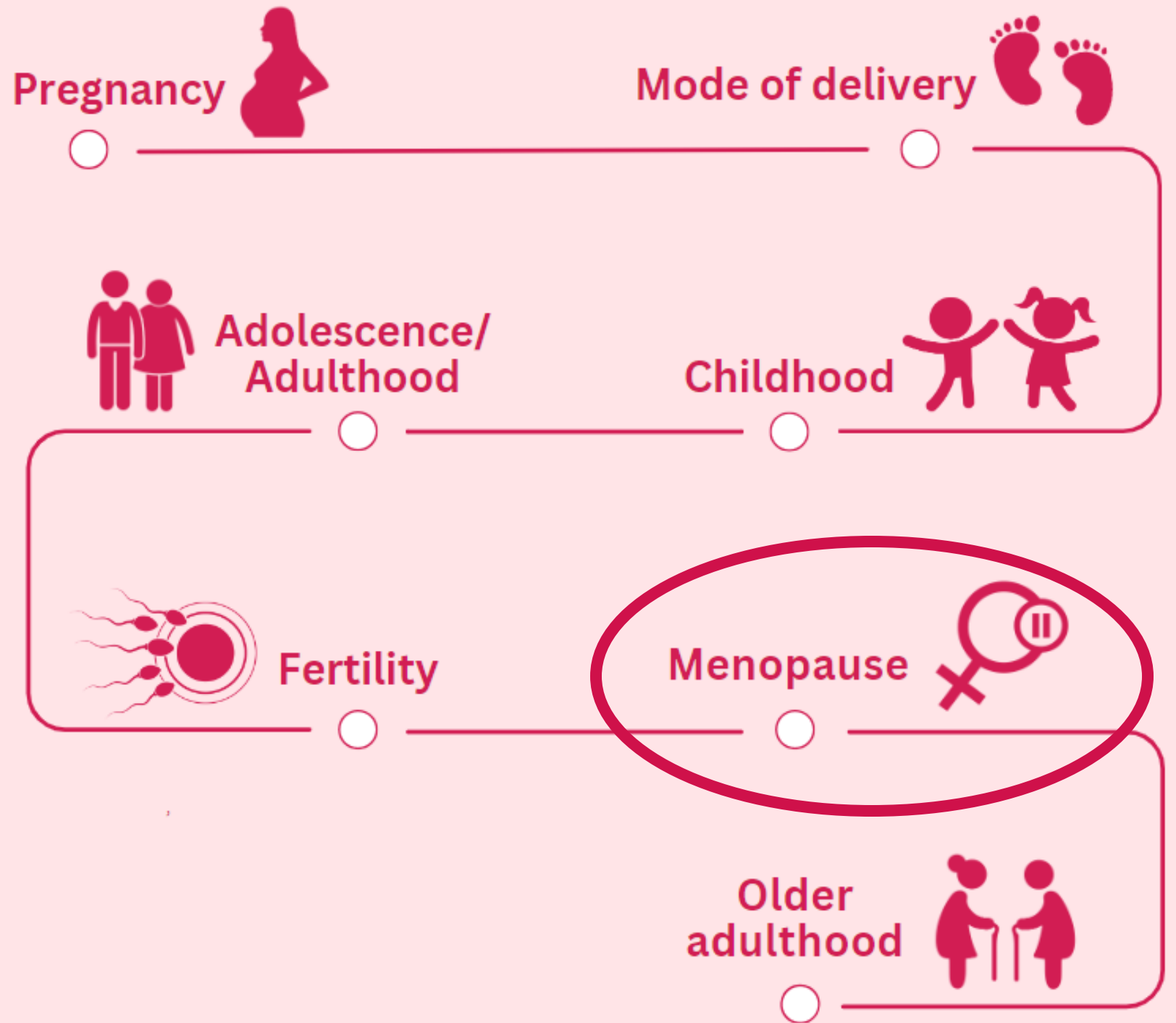


Boby et al. (2024) Arch. Dermatol.
Res. 316:101.

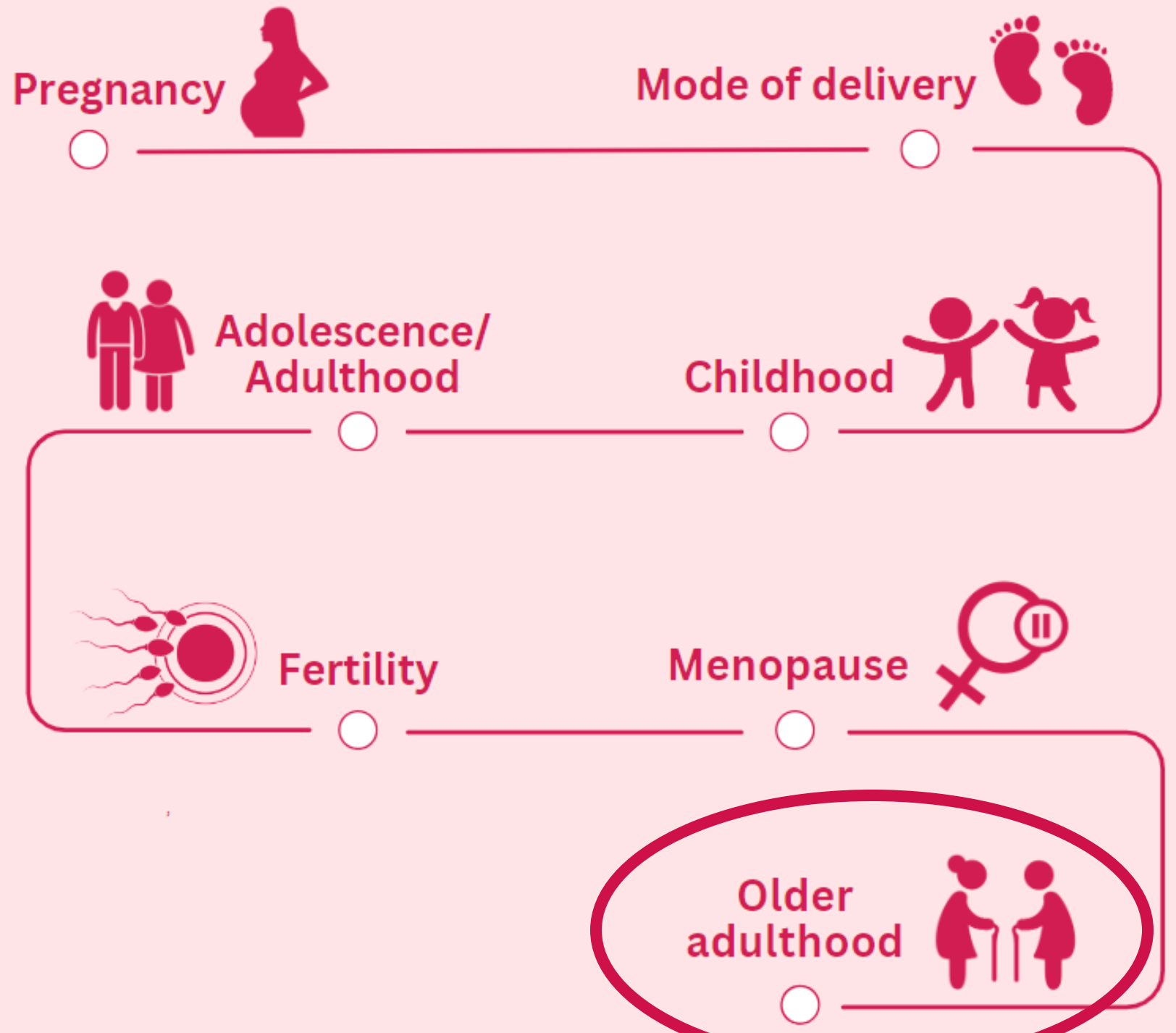
The Female Gut Microbiota



The Female Gut Microbiota



The Female Gut Microbiota





REPRODUCTIVE HEALTH

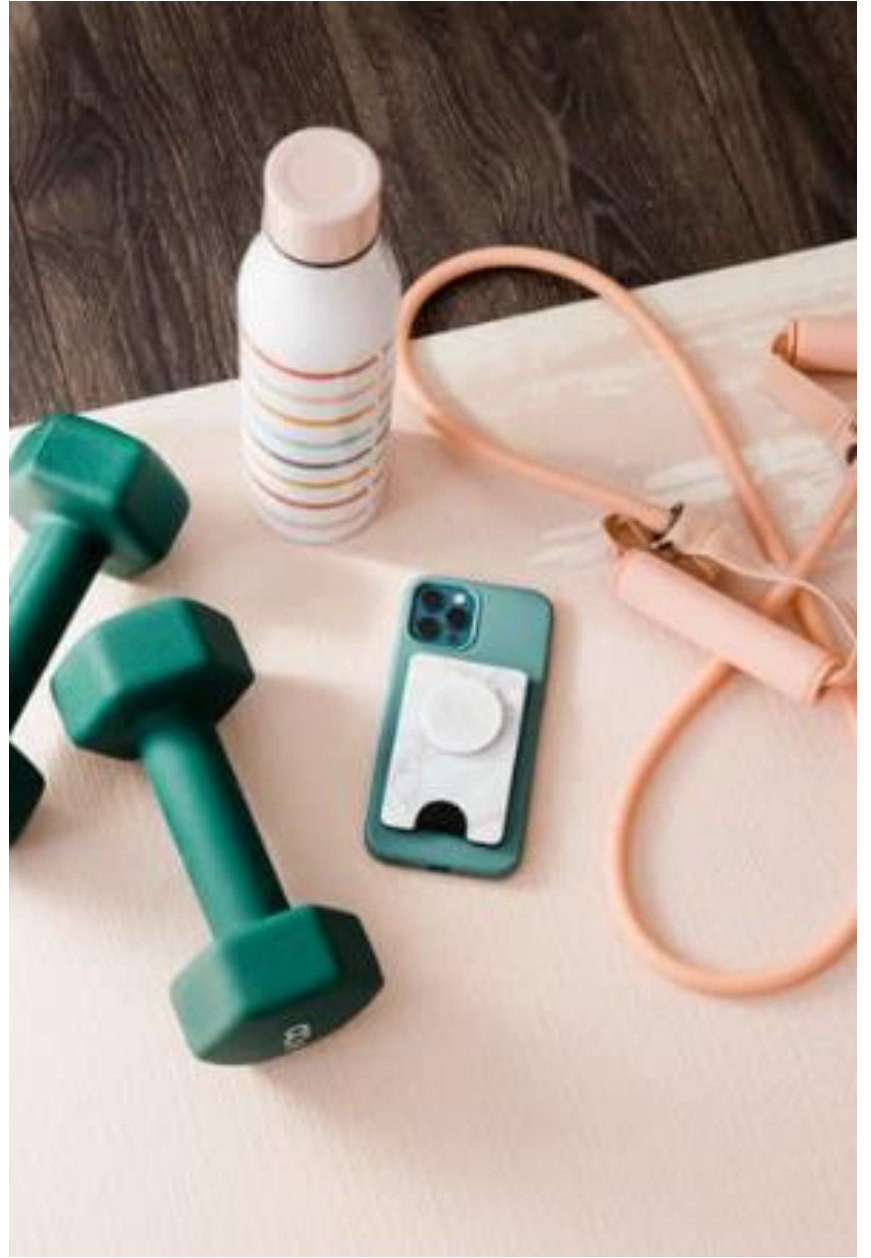
The ability to conceive. Diet & lifestyle factors can affect fertility.

FERTILITY

The inability to become pregnant after 12+ months of regular unprotected sex.

INFERTILITY

Unable to conceive following a successful pregnancy.





FEMALE INFERTILITY & GUT MICROBIOME



- **Gut dysbiosis** can promote **inflammation** and immune dysregulation which can influence reproductive health.
- Gut **dysbiosis** has been linked to both **male** and **female infertility**.
- A **causal** link between dysbiosis and infertility is **not established**.
- The gut microbiota has been implicated in conditions such as **PCOS** and **endometriosis** which are **risk factors** for **infertility**.



Probiotics



PCOS

- Worldwide 8–13% of reproductive-aged women affected with 70% undiagnosed.
- Lower levels of lactobacilli and bifidobacteria observed.
- SRMAs conclude probiotics and synbiotics can have a positive effect.
- Different strains may support different symptoms.
 - Improve testosterone levels, inflammation, metabolic parameters.



Li et al. (2023) *Crit Rev Food Sci Nutr* 63(4): 522–538.
Angoorani et al. (2023) *Front Med* 10: 1141355.
Cozzolino et al. (2020) *Eur J Nutr* 59(7): 2841–2856.
Calcaterra et al. (2023) *Nutrients* 15(14): 3144.
Mukherjee et al. (2023) *Metabolites*, 13(1), 129.

Changes in hormonal profile and BMI in women
with PCOS after 12 weeks of probiotics
(*Lactobacillus* and *Bifidobacteria*) intake.

Szydlowska et al. (2025) *Nutrients*. Doi: [10.3390/nu17030405](https://doi.org/10.3390/nu17030405)

Probiotics



Endometriosis

- 10% (190 million) of reproductive age women and girls globally, and up to 50% of women who are infertile.
- Oestrogen levels, immunity or inflammation which are modulated, at least in part, by the gut microbiota, may play a role.
- Limited research suggests the beneficial effects of *Lactobacillus* administration on endometriosis-related pain.



Qin et al. (2022) *Front Cell Infect Microbiol* 12: 1069557.
Salliss et al. (2021) *Hum Reprod Update* 28(1): 92–131.
Jiang et al. (2021) *Int J Mol Sci* 22(11): 5644.
Khodaverdi et al. (2019). *Int J Fertility & Sterility* (3):178.

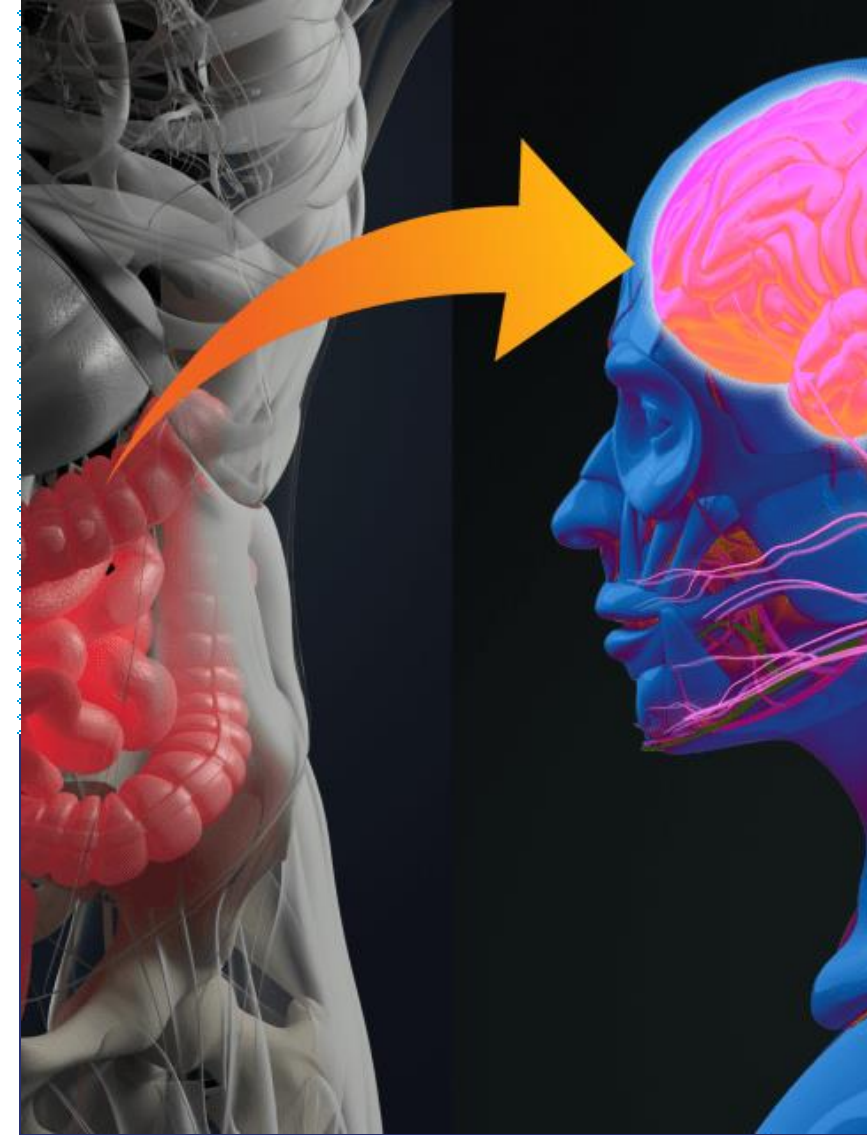




Gut-Brain Axis

Scientifically proven link between the gut and the brain

- Physically connected via the **vagus nerve**
- Bi-directional communication:
 - Immune system
 - Endocrine system
 - Microbial metabolites
- Majority human observational studies and mice studies
- Exploring the potential role for **psychobiotics**



Crosstalk between organs

Postpartum Depression

- Differences in gut microbiota between pregnant women with PPD and those without PPD.
- Microbial-derived metabolites including those associated tryptophan metabolism are altered.
- Limited but promising evidence shows the effectiveness of microbial-related therapies to reduce PPD.



Zhang et al. (2023) *Ann Gen Psychiatry* 22(1), 36.
Liu et al. (2020) *J Agric Food Chem* 68(47): 13697–13710.
Halemani et al. (2023). *J Global Health*, 13.
Desai et al. (2021). *Front in psychiatry*, 12, 622181.



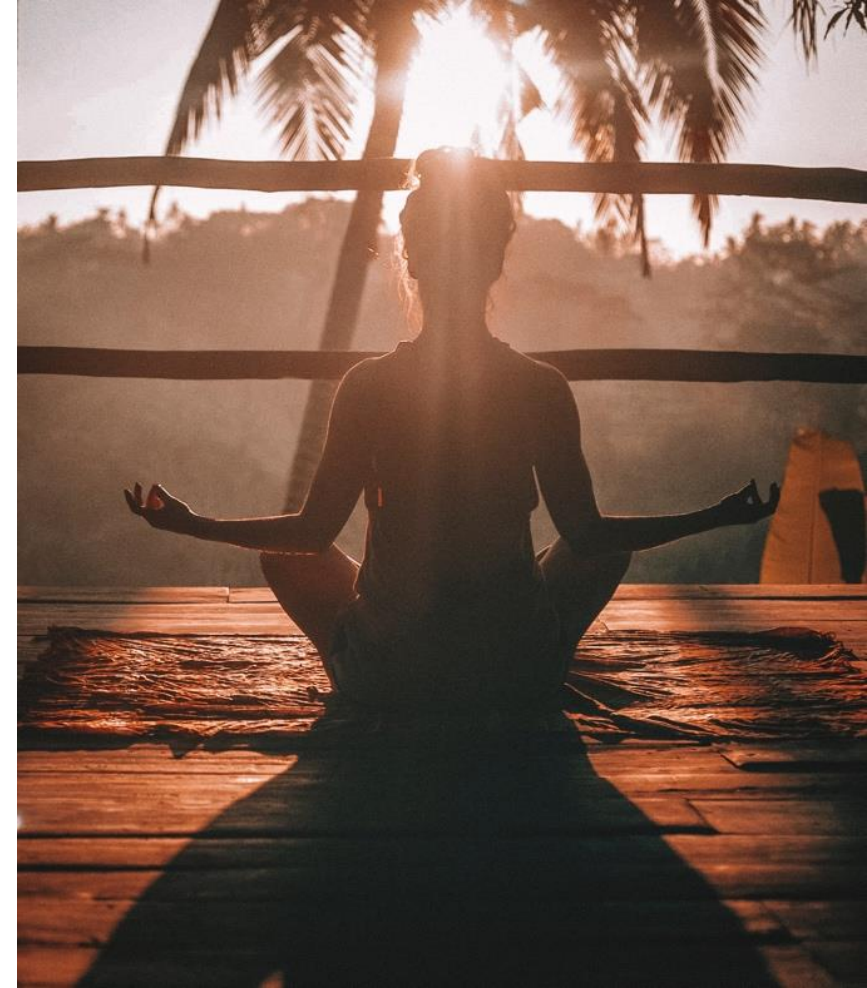
IRRITABLE BOWEL SYNDROME

Targeting the brain

Emerging research

Growing body of evidence demonstrating the effectiveness of non-dietary approaches to improving gut health.

- Meditation¹
- Yoga²
- Hypnotherapy³
- Breath work⁴



References

1. Sun Y et al. (2023)
2. Schumann D et al. (2018)
3. Peters SL et al. (2016)
4. Tuck CJ et al. (2019)



Gut-Vagina Axis



The World's Largest Citizen Science Study Into The Vaginal Microbiome



In Belgium, over 6000 women have already registered to take part.



INFLUENCING FACTORS

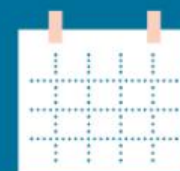
Your age and
stage of life



Use of
period
products



*Use of hormonal
contraceptives*



*The natural
course of your
menstrual cycle*

*Whether
you have
children
or not*



Sexual activity



Some foods and
drinks have
a positive impact...



.... others
appear
less
positive



STUDY HIGHLIGHTS

Largest study on
vaginal microbiome
in the world!



Over



women participated
in Isala

We found



based on the most
important bacteria

80%

has mainly
lactic acid bacteria

2000

Already more than 2000
cultured vaginal bacteria,
and still counting

High-tech
analysis of nearly

4500

swabs, and
still counting



Determination of
factors influencing
the vaginal
microbiome



Let's go international
with sisterhood
projects



Inspired by isala.be



Inspired by isala.be

Base for novel
diagnostics and
therapeutics



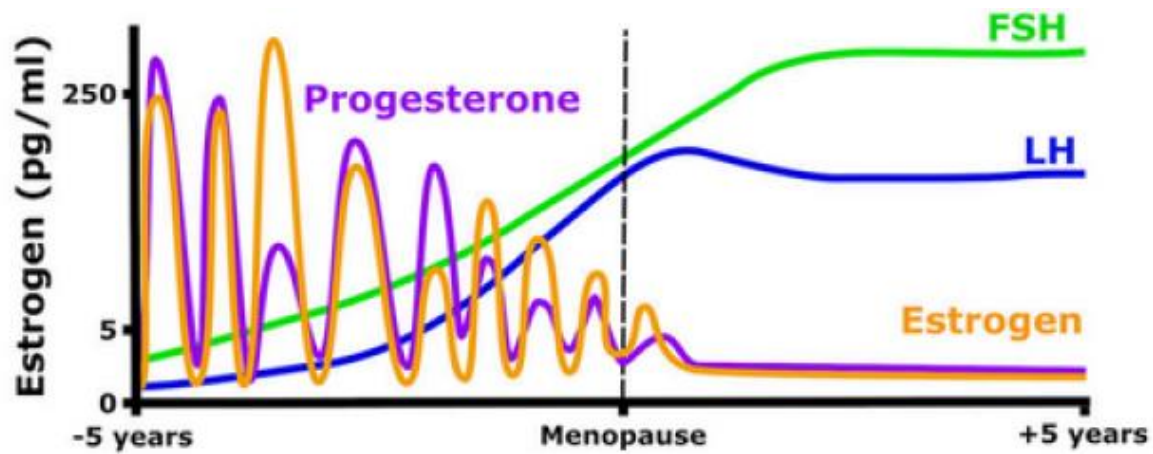
Awarded for
clear science
communication

#letsswab
.....





MENOPAUSE



Chidi-Ogbolu & Baar (2019) *Front Physiol*, 9: 1834.

The transition to menopause, characterised by erratic menstrual cycles.

Perimenopause

Absence of menses for 12 consecutive months, marking a significant change to hormones.

Menopause

**The
menopause is
1 day in a
woman's life**



PERIMENOPAUSAL SYMPTOMS



Irregular
menstrual cycles



Hot flashes



Sleep disturbances



Incontinence



Low mood



Night sweats



Muscle and
joint pain



Sexual
dysfunction



MENOPAUSE & GUT MICROBIOME



Postmenopausal women have **lower** gut microbiome **diversity**.



The gut microbiome becomes **more similar** to the **male** gut microbiome.



Decrease in **short-chain fatty acid** (SCFA) producing bacteria.



Via the **oestrobolome**, gut microbes can **reactivate** and help retain sex hormone levels in postmenopausal women.



Research suggests **HRT** reduces gut microbiota **dysbiosis**.

Probiotics Post-menopause

- **SRMA:** Overweight and obese postmenopausal women. Probiotics supplementation reduced insulin, HOMA-IR and TNF- α .

Li et al. *Probiotics Antimicro* 15.6 (2023): 1567-1582.

- **RCT** (n=66): 6-week probiotic yoghurt intervention significantly lowered anxiety and stress scores, but not sleep quality.

Shafie et al. *Nutrition ESPEN*, 50, (2022) 15-23.



Effects of prebiotic-rich yogurt on menopausal symptoms and metabolic indices in menopausal women: a triple-blind randomised controlled trial

Mehrnaz Shafie ¹, Aziz Homayouni Rad ², Mojgan Mirghafourvand ³

Over 6 weeks, 100 g of prebiotic-rich (inulin) yogurt daily improved:

- Menopausal symptoms ($p < 0.001$)
- Anxiety scores ($p < 0.001$)
- Depression scores ($p = 0.003$)
- Vasomotor ($p < 0.001$)
- Low-density lipoprotein ($p = 0.028$)



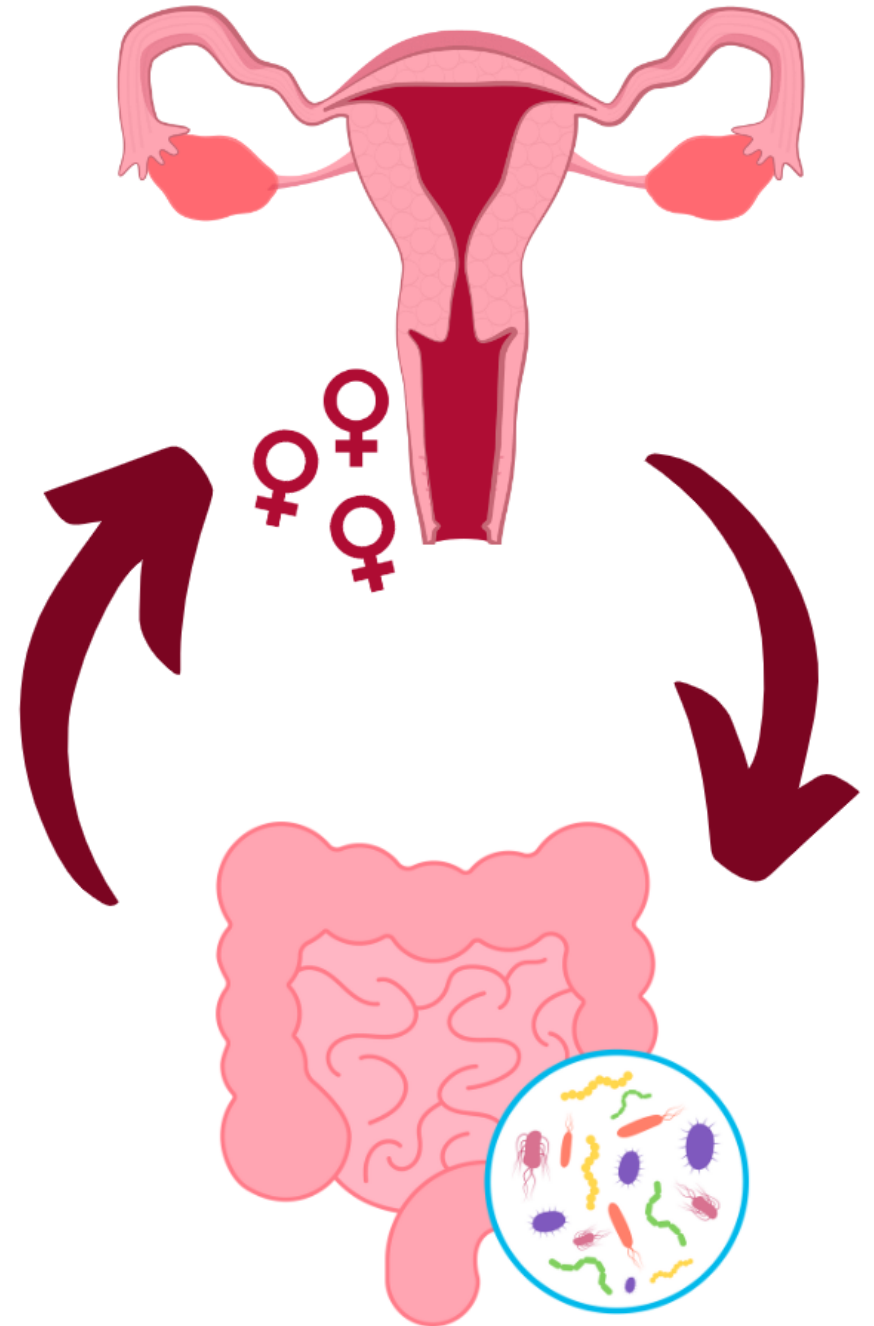


By 2039 there will be ~1.2 billion menopausal and postmenopausal women.

It is necessary to develop innovative strategies to improve health for what can be up to 1/3 of a woman's life.

The Oestrobolome

- A unique collection of microbes within the gut microbiome, capable of metabolising and regulating circulating oestrogen levels.
- 'Recycles' oestrogen by enabling it to re-enter circulation.
- This reactivation of oestrogen is achieved via excretion of the beta-glucuronidase enzyme which is produced by certain types of gut bacteria, e.g., *Bacteroides* and *Firmicutes*.



Diet & Lifestyle Advice



Fibre-rich



Omega-3



Limit sat fat



Sleep



Exercise



Mindfulness

TAKE HOME MESSAGES



- A **bi-directional relationship** exists between the gut microbiome and female sex hormones.
- Sex hormones fluctuate throughout a woman's life. The oestrobolome is a **unique collection of microbes within the gut microbiome** which can recycle oestrogen.
- Lower gut microbiota **diversity and dysbiosis** are common features of PCOS. Emerging research highlights the potential role of probiotics and synbiotics to help treat PCOS.
- Postmenopausal women have lower gut microbiome diversity and **decreased abundance of gut microbial beta-glucuronidase**, the enzyme involved with the oestrobolome.
- **Diet and lifestyle choices** can support female health throughout life by supporting the gut microbiota.

Female Gut Health New Resource

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The Female Gut Health Guide

Lessons Through Life



A Guide for HCPs

Find out more at yakult.co.uk/HCP

Menstruation

The gut microbiome plays a role in the menstrual cycle, and vice versa. Menstruation cycles can vary between women; however, on average, it lasts 28 days and includes 3 main phases:

- Follicular phase
- Ovulation
- Luteal phase

through the cycle, which causes an increase in the luteinising hormone levels then rise to support a fertilised egg. In the ovulation, progesterone and oestrogen levels decline and then rise again.

also be associated with symptoms. throughout the cycle, associated with however, more

ced, this may lead to cyclical changes in oestrogen levels which can influence the menstrual cycle.⁴⁵

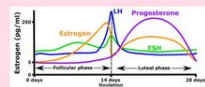


Figure 1. Hormonal fluctuation during a normal menstrual cycle.⁴⁵
Choi-Ogburn & Bar (2019) Front Physiol, 9: 1634.

UK: Luteinising hormone (LH); Follicle-stimulating hormone (FSH)

Light

progesterone) may modulate and influence irritable bowel syndrome (IBS).⁴⁶ and women are 5-20% of the population struggle with IBS.⁴⁷ Correlations exist between worsened IBS gastrointestinal symptoms and the menstrual cycle, possibly due to elevated prostaglandin levels during the potential role of sex hormones in this condition.



Visceral sensitivity is a characteristic of IBS. Oestrogen is known to regulate visceral sensitivity, as well as gut motility and psychological conditions which are collectively characteristics of IBS.⁴⁸

@yakultscience_ukie
Yakult Science for HCPs in UK & Ireland

The Gut Microbiota and Reproductive Health

Endometriosis and endometriosis are reproductive conditions which are influenced by females, and may be influenced by alterations in the gut microbiota.

PCOS

Condition which affects how a woman's ovaries work. Approximately 8-13% of women struggle with PCOS and up to 70% of affected women remain undiagnosed.⁴⁹ The exact cause is unknown, however it is often hereditary, and

- Fertility issues
- Excessive hair growth
- Weight gain

Microbiota associated with PCOS?

Oestrogen (a predominant male sex hormone) is one of the main signs of PCOS. The gut microbiota plays a role in regulating this hormone.⁵⁰ Lower gut microbiota diversity is a common feature of PCOS.⁵¹ Gut dysbiosis increases intestinal permeability, associated with elevated androgen production and inflammation which can lead to insulin resistance. A number of systematic reviews and meta-analyses have investigated the use of probiotics and prebiotics (probiotics and prebiotics combined) to help treat PCOS. It remains difficult to identify optimal probiotic strains, Lactobacillus and Bifidobacterium are commonly used in studies.

"Evidence suggests that probiotics or synbiotics may improve testosterone levels, decrease inflammation, and improve insulin resistance and blood glucose levels in women with PCOS, in turn improving fertility in these women. Much more research needs to be done in this area, but taking a probiotic with a Lactobacillus strain may help to support fertility outcomes for some people - in addition to eating plenty of fruit, vegetables, nuts, seeds, and wholegrains to promote a healthy gut microbiome."



Ro Huntriss RD
Founder of Fertility Dietitian UK
and author of 'Gut Health for Fertility'

Find out more at yakult.co.uk/HCP
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Thank you

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