PIPADOR REVISION

MRCOG Part 1 Revision Notes

Fats: Adipose Tissue

BIOCHEMISTRY • LECTURE 220

VISUAL EXAMINATION REVISION NOTES

2026 Edition

220

MRCOG PART 1 REVISION NOTES | BIOCHEMISTRY

Fats: Adipose Tissue

White, brown and beige fat, lipogenesis and lipolysis, adipokines, pregnancy, fetal and neonatal fat, and obesity in O&G

≈ 3–4 kg	≈ 15%	Leptin	UCP1
Maternal fat gained in pregnancy	Fetal body fat at term	Adipocyte satiety & reproductive signal	Brown fat heat (neonate)

■ **KEY FACTS: Learning objectives**

- Describe the structure and types of adipose tissue (white, brown, beige) and their distribution.
- Describe the regulation of lipogenesis and lipolysis.
- Describe adipose tissue as an endocrine organ (leptin, adiponectin, aromatase) and its links to reproduction.
- Describe adipose changes in pregnancy, the fetus/neonate, and the consequences of obesity in O&G.

220.1 Types of adipose tissue

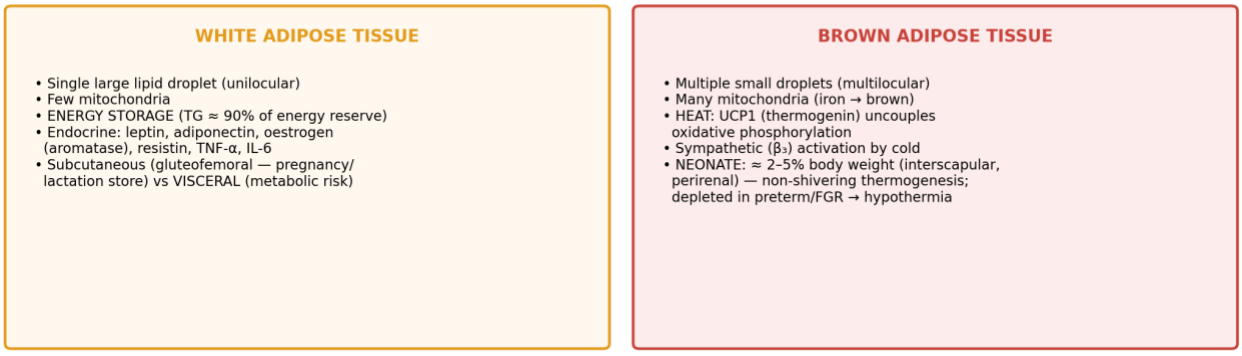


Figure 220.1 — White and brown adipose tissue

Beige (brite) adipocytes within white depots can acquire UCP1 and thermogenic capacity with cold exposure or β_3 stimulation. **Distribution** matters: **visceral** (central, android) fat drains to the portal vein and is strongly linked to insulin resistance, dyslipidaemia, hypertension and PCOS; **gluteofemoral** (gynoid) fat is metabolically protective and mobilised in late pregnancy and lactation.

220.2 Storage and release

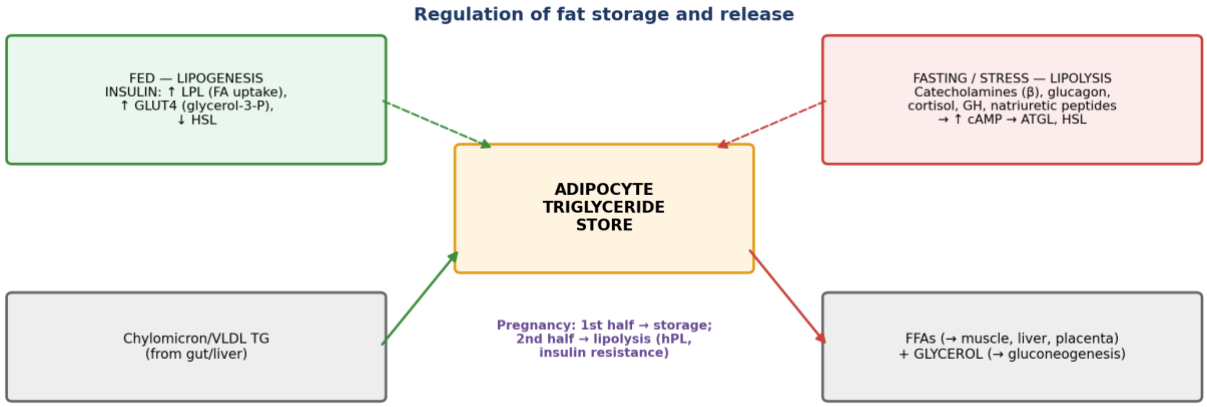


Figure 220.2 — Regulation of lipogenesis and lipolysis

Enzyme	Role	Regulation
Lipoprotein lipase (LPL)	Hydrolyses chylomicron/VLDL TG at capillaries → FA uptake	↑ Insulin in adipose (fed); ↑ in mammary gland in lactation, ↓ in adipose (diverts fat to milk)
Hormone-sensitive lipase (HSL) & ATGL	Intracellular TG hydrolysis (lipolysis)	↑ Catecholamines (β_1/β_3), glucagon, cortisol, GH; ↓ insulin (most potent anti-lipolytic)
Glycerol-3-phosphate	Backbone for TG synthesis	From glucose (GLUT4 — insulin); adipose lacks glycerol kinase → glycerol released to liver

220.3 Adipose tissue as an endocrine organ

Product	Actions / clinical relevance
Leptin	∝ fat mass; satiety (hypothalamus), ↑ energy expenditure; permissive for puberty and GnRH pulsatility (low in anorexia/athletes → hypothalamic amenorrhoea); obesity = leptin resistance; placenta also secretes leptin (↑ in pregnancy, ↑↑ in pre-eclampsia)
Adiponectin	Insulin-sensitising, anti-inflammatory; ↓ in obesity, GDM, PCOS, type 2 diabetes
Aromatase	Converts androstenedione → oestrone: main postmenopausal oestrogen; obesity → unopposed oestrogen → endometrial hyperplasia/cancer, gynaecomastia
Resistin, TNF-α, IL-6, PAI-1	Insulin resistance, inflammation, thrombosis (VTE risk in obesity)
11β-HSD1	Local cortisol regeneration in visceral fat — central obesity
Free fatty acids	Excess → hepatic insulin resistance, lipotoxicity

220.4 Pregnancy, the fetus and the neonate

Stage	Adipose physiology
Early pregnancy (anabolic)	Insulin sensitivity maintained, ↑ LPL → fat deposition ≈ 3–4 kg (mostly subcutaneous, hips/thighs) — energy reserve for late pregnancy and lactation
Late pregnancy (catabolic)	Insulin resistance, hPL, placental GH → ↑ lipolysis; FFAs and glycerol fuel the mother; ketones and FFAs cross the placenta; DHA selectively transferred
Lactation	Adipose LPL ↓, mammary LPL ↑ → fat redirected to milk; gluteofemoral stores mobilised
Fetus	White fat accrues mainly after ≈ 28–30 weeks (insulin-driven) → ≈ 12–15% body fat at term (the fattest mammalian neonate — brain energy reserve); macrosomia in maternal diabetes; ↓ fat in FGR (asymmetric)

Stage	Adipose physiology
Neonate	Brown fat (interscapular, perirenal, axillary) → non-shivering thermogenesis (noradrenaline → β_3 → UCP1) triggered by cold at birth; preterm/FGR babies have little → hypothermia (warm, dry, skin-to-skin, plastic wrap < 32 wk)

220.5 Obesity in O&G

Area	Effects of obesity (BMI ≥ 30)
Fertility	Anovulation, PCOS, ↓ IVF success, ↑ miscarriage
Pregnancy (RCOG GTG 72)	↑ GDM, pre-eclampsia, VTE, stillbirth, congenital anomalies (NTD, cardiac), macrosomia, shoulder dystocia, induction, caesarean, wound infection, PPH, anaesthetic difficulty; folic acid 5 mg, vitamin D, aspirin if additional risk, GDM screening, VTE assessment
Gynaecology	Endometrial hyperplasia/cancer (aromatase), HMB, urinary incontinence, surgical complications
Offspring	Childhood obesity, metabolic programming (DOHaD)

220.6 Must-know summary

■ EXAM TIP

- White fat stores TG (unilocular); brown fat makes heat via **UCP1** (multilocular, many mitochondria).
- **Insulin** stores fat (↑ LPL, ↓ HSL); catecholamines/glucagon/cortisol/GH release it.
- **Leptin** (satiety, permissive for GnRH); **adiponectin** ↓ in obesity/GDM/PCOS; **aromatase** → oestrone (endometrial cancer risk).
- Pregnancy: early fat storage, late lipolysis; lactation diverts LPL to breast.
- Fetal fat after 28 wk (≈ 15% at term); neonatal brown fat — preterm/FGR hypothermia.

■ MNEMONIC / MEMORY AID

'Leptin Limits eating, Adiponectin Aids insulin'. Brown fat = 'Burns' (UCP1 heat).