Table 2. Products of adipocytes with an impact on HPG axis

Name	Expression cells/tissues	Regulation by:	Target cells or tissues	Function	Population studies	KO mice, mutations	References
Adipokine/Cytokine							
Chemerin	Adipocytes, granulosa cells, theca cells, corpus luteum, oocytes	TNFa, insulin, androgen	Ovaries	↓Antral follicle growth arrest and steroidogenesis, ↓FSH-induced aromatase expression and stereoidogenesis *Outcomes:* ↑Granulosa cell apoptosis	↑Chemerin (obesity, type 2 diabetes, metabolic syndrome, cardiovascular disease)		86, 90-93, 95, 96
			Immune cells	↑Chemoattraction of macrophages and dendritic cells, ↑macrophage adhesion *Outcomes:* Pro-inflammatory effect	↑Chemerin, ↑CRP, ↑TNFa, ↑IL-6, ↑leptin, ↑resistin (obesity)		87- 90
Cytokines							
IL-6	Adipocytes	Adipose tissue mass and number	Immune cells	↑Immune response *Outcomes:* Pro-inflammatory effect	↑IL-6, IL-8, MIF (women with poor ovarian response), ↑ IL-6 (obesity, metabolic inflammation)		102, 104
TNFa	Adipocytes, macrophages	NEFA	Ovaries	↓ FSH-induced LH receptor and LH secretion, ↓ testosterone *Outcomes:* Subfertility	↑ TNFa , IL-6, IL-8 (infertility), ↑ TNFa (obesity, metabolic inflammation)		17-19, 105
Chemokine							
IL-8	Adipocytes, macrophages		Immune cells, semen	↑Chemoattraction of macrophages *Outcomes:* Pro-inflammatory effect	↑IL-8 (prostatitis-like symptoms in males of infertile couples)		102, 106
Other molecules							
NEFA	Adipocytes	TNFa	Immune cells	↑TNFa in macrophages of adipose tissue *Outcomes:* Pro-inflammatory macrophages	↑ NEFA (obesity)		3
FFA	Adipocytes		Ovaries	↑ Granulosa cell apoptosis *Outcomes:* ↓Granulosa cell survival	↑ FFA in follicular fluid, poor morphology of the cumulus oocyte complex		66, 67
Kisspeptin	Adipose tissue, hypothalamic neurons	Sex hormones, food intake (in adipose tissue) Seasonal breeding, Leptin (in hypothalamus)	Hypothalamus	↑ GnRH *Outcomes:* Stimulates LH/ FSH release, ovulation		**Kisspeptin KO mice & Kisspeptin receptor KO mice** *Characteristic:* Infertile **Inactivating mutations of GPR54 receptor in humans:** *Characteristic:* Hypogonadotrophic hypogonadism	37, 41-45, 49, 51