A Systematic Review and Meta-Analysis of the Association of Adipokines with Metabolic Well-being of Expectant Mothers

Saba Tariq
NIHR Midlands PSRC

Authors: Saba Tariq, Sundus Tariq, Naeem Mubarak, Fatima Rahman Rana, Gabriel Ruiz-Calvo,Javier Zamora

Background: Adipokines are bioactive molecules secreted by adipose tissue that play key roles in metabolic regulation. During pregnancy, they influence maternal physiology, fetal development, and the risk of complications such as gestational diabetes and hypertensive disorders.

Objectives: This systematic review aimed to evaluate adipokines such as leptin, chemerin, omentin, vaspin, irisin, apelin, and retinol-binding protein-4 as potential biomarkers for maternal health, fetal growth, placental function, and pregnancy complications.

Methods: A comprehensive search was conducted in PubMed, MEDLINE, Embase, Cumulative Index to Nursing and Allied Health Literature, Scopus, Web of Science, Cochrane Central Register of Controlled Trials, Science Direct, Educational Resources Information Centre, and ProQuest, including gray literature. Studies published from January 1, 1994, onward were considered. Studies were included if they examined adipokine levels during pregnancy, investigated maternal body fat, inflammation, and adipokine alterations, explored effects on glucose metabolism, insulin resistance, lipid profiles, and blood pressure, and analyzed adipokines' relationships with gestational diabetes mellitus and pregnancy-related high blood pressure disorders. The Newcastle–Ottawa scale was used to assess study quality. A meta-analysis was performed for adipokine-outcome relationships reported in at least two studies.

Results: Our meta-analysis showed that leptin and apelin were significantly associated with pregnancy-related high blood pressure disorders, highlighting their biomarker potential, while chemerin and retinol-binding protein-4 showed variable associations with gestational diabetes mellitus and other complications.

Conclusion: This review emphasizes the need for further research to clarify how adipokines influence maternal and fetal health. It highlights leptin and apelin as promising biomarkers for predicting and managing pregnancy-related high blood pressure disorders, contributing to improved pregnancy outcomes.

A Systematic Review and Meta-Analysis of the Association of Adipokines with the Metabolic Well-being of Expectant Mothers

Saba Tariq[1,2], Sundus Tariq[1,3], Naeem Mubarak[4], Fatima Rahman Rana[4], Gabriel Ruiz-Calvo[5], Javier Zamora[5]

[1]Post-doctoral fellow, Midlands Patient Safety Research Collaboration, University of Birmingham, UK
[2]Professor, University Medical & Dental College, The University of Faisalabad, Pakistan
[3]Associate Professor, Istanbul Medipol University, Research Institute for Health Sciences and Technologies (SABITA), Istanbul, Turkey.
[4]Lahore University of Biological and Applied Sciences, Lahore, Pakistan.
[5]Instituto Ramón y Cajal de Investigación Sanitaria (IRYCIS), Madrid, Spain

NIHR SafetyNet Symposium 2025
psrc-network.nihr.ac.uk

Abstract

Background:

Adipokines are bioactive molecules secreted by adipose tissue that play key roles in metabolic regulation. During pregnancy, they influence maternal physiology, fetal development, and the risk of complications such as gestational diabetes and hypertensive disorders.

Objectives:

This systematic review aimed to evaluate adipokines, including leptin, chemerin, omentin, vaspin, irisin, apelin, and retinol-binding protein-4 (RBP-4), as potential biomarkers for maternal health, fetal growth, placental function, and pregnancy complications.

Methodology:

- Database Search (1994-2025)
- Studies included with adipokine levels during pregnancy, maternal body fat, inflammation and adipokine alteration, gestational diabetes mellitus (GDM), raised blood pressure during pregnancy and insulin resistance.
- Study quality was assessed by the Newcastle Ottawa Scale.
- Meta-analysis performed for adipokine-outcome relationships in ≥ 2 studies.

Results:

Our meta-analysis showed that leptin and apelin were significantly associated with pregnancy-related high blood pressure disorders, highlighting their biomarker potential, while chemerin and retinol-binding protein-4 showed variable associations with gestational diabetes mellitus and other complications.

Conclusion:

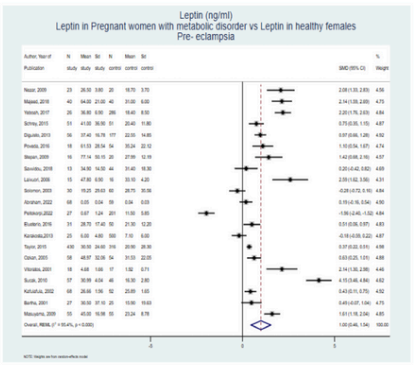
This review emphasizes the need for further research to clarify how adipokines influence maternal and fetal health. It highlights leptin and apelin as promising biomarkers for predicting and managing pregnancy-related high blood pressure disorders, contributing to improved pregnancy outcomes.

Key Clinical Implications:

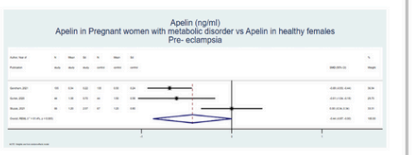
- Leptin and apelin may serve as early biomarkers for hypertensive disorders in pregnancy, supporting safer care.
- Chemerin and retinol-binding protein-4 are associated with an increased risk of gestational diabetes, suggesting the need for closer metabolic monitoring.

Results

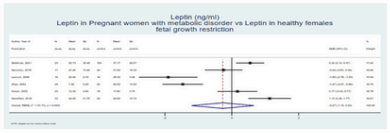
1 Leptin in pregnant women with metabolic disorders versus healthy females with Pre-Eclampsia



2 Apelin in pregnant women with metabolic disorders versus Apelin in healthy females – Pre-eclampsia



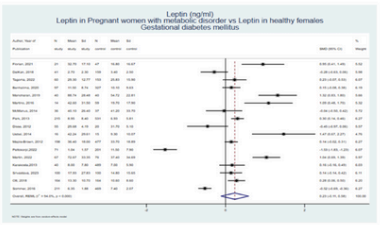
3 Leptin in pregnant women with metabolic disorders versus healthy females - Fetal Growth Restriction.



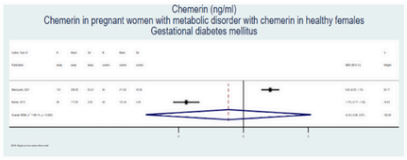
4 Meta-analysis

Outcome	Adipokine	Random Effect Model		Heterogeneity		Studies
		ES/SMD	95% CI	I^2	P*	
Preeclampsia	Apelin	-0.44	[-0.87, -0.00)	81.4	0.005*	(12–14)
GDM	Chemerin	-0.46	-3.00-2.07	99.1	<0.001	(15,16)
Fetal Growth Restriction	Irisin	-0.39	-0.90- 0.13	60.7	0.111	(17,18)
GDM	RBP-4	0.62	-0.28-1.53	96.2	<0.001	(19–21)
Preeclampsia	RBP-4	-0.15	-1.00-0.69	0.0	0.016	(22,23)
Fetal Growth Restriction	Leptin	-0.27	-1.19-0.65	91.7	<0.001	(24–29)
Gestational Diabetes Mellitus	Leptin	0.23	-0.11-0.58	94.0	<0.001	(30–46)
Gestational Hypertension	Leptin	1.23	-0.31-2.78	99	<0.001	(47–51)
Miscarriage	Leptin	0.68	-1.29-2.65	95.3	<0.001	(52–54)
Preeclampsia	Leptin	1.00	0.46- 1.54	95.4	<0.001*	(23,25,27,33,35,49–51,55–66)
Small for gestational stage	Leptin	1.87	-1.55-5.29	91.5	<0.001	(67–69)
Spontaneous Abortion	Leptin	-0.11	-3.20-2.98	98.6	<0.001	(70–72)
Undesirable Outcome	Leptin	-0.14	-0.97-0.69	86.8	<0.001	(73–76)

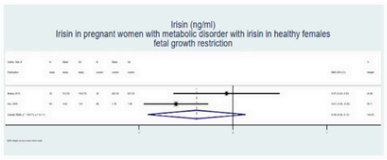
5 Leptin in pregnant women with metabolic disorders versus healthy females with Gestational Diabetes Mellitus



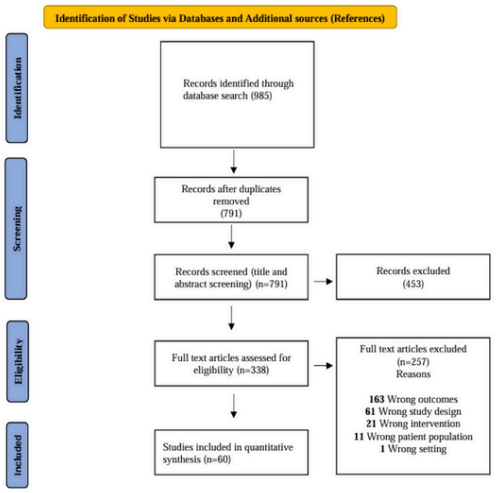
6 Chemerin in pregnant women with metabolic disorders versus healthy females - Gestational Diabetes Mellitus



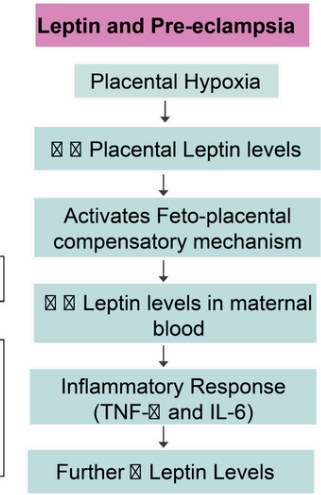
7 Irisin in pregnant women with metabolic disorders versus healthy females - Fetal Growth Restriction



8 Prisma Flow Diagram



9 Possible mechanism between pre-eclampsia and leptin levels during pregnancy



Leptin as a biomarker of pre-eclampsia indicating placental dysfunction and hypoxia

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Contact:
Dr. Saba Tariq
s.tariq@bham.ac.uk