

Table S1. Search terms and strategy.

Aspect 1		Aspect 2
Fetal life	AND	Vitamin D
fetal life OR Fetus OR foetus OR fetal OR foetal OR foetale OR Pregnant OR Pregnancy OR Neonate OR fetal programming OR periconception OR periconceptual OR periconceptionally OR preconception OR preconceptional OR preconceptionally OR Newborn OR Maternal OR Prenatal OR prenatally		vitamin D OR 25-hydroxyvitamin D OR 1,25-dihydroxy- vitamin D OR calcitriol OR ergocalciferol OR cholecalciferol OR vitamin D2 OR vitamin D3 OR 1- alpha hydroxyvitamin D3 OR 1-alpha-hydroxy-vitamin D3 OR 1-alpha hydroxy-vitamin D3 OR 1-alpha hydroxy calciferol OR 1-alpha-hydroxy-calciferol OR 1- alpha hydroxycalciferol OR 1,25 dihydroxyvitamin D3 OR 1,25-dihydroxy-vitamin D3 OR 1,25- dihydroxycholecalciferol OR 1,25- dihydroxycholecalciferol OR 25-hydroxy-vitamin D OR 25 hydroxy vitamin D OR 25-hydroxycholecalciferol OR 25 hydroxycholecalciferol OR 25 hydroxyvitamin D OR alfacalcidol OR calcidiol OR calcitriol OR calciferol OR ergocalciferol OR cholecalciferol OR calcifediol OR ultra violet rays OR UV rays OR sunlight OR ergocalciferols

Search terms used in the search are presented in the following table. The example is for PubMed database. All terms were searched for as free text as well as MeSH terms. Filters applied: Human.

Table S2. Study identification.

Author, Year, Country	Study design	Outcome (method of assessment)	Trial registration	Conflict of interest
Ates, 2016, Turkey [24]	Cohort	Congenital Malformations (not reported)	Not reported	The authors declare no conflicts of interest
Chawes, 2016, Denmark [16]	RCT	Congenital Malformations, any (not reported)	Clinicaltrials.gov NCT00856947	Dr Bisgaard reports receiving consulting fees from Chiesi.
Cooper, 2016, UK [17]	RCT	Congenital abnormalities (not reported)	ISRCTN 82927713. European Clinical Trials Database, EudraCT 2007–001716–23.	The authors declare that “This work was supported by grants from Arthritis Research UK, Medical Research Council (MRC), Bupa Foundation, National Institute for Health Research (NIHR) Southampton Biomedical Research Centre, University of Southampton and University Hospital Southampton NHS Foundation Trust, and NIHR Musculoskeletal Biomedical Research Unit, University of Oxford. IS and AP were funded by the MRC (programme code U105960371). The work leading to these results was

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Daglar, 2014, Turkey [22]	Controlled cross-sectional	Neural tube defects; meningocele, meningomyelocele, encephalocele, anencephaly and fetal acrania (Ultrasonographic examinations)	Not reported	The authors declare no conflicts of interest

























Dilli, 2018, Turkey [26]	Case-control	Congenital heart disease (confirmed by echocardiography or catheterisation.)	Not reported	The authors declare no conflicts of interest
Fernández-Alonso, 2012, Spain [20]	Cross-sectional	Congenital Malformations (not reported)	The study protocol was approved by the Research Ethics Committee of the study hospital.	Not reported
Litonjua, 2016, USA [18]	RCT	Major fetal or congenital anomaly (not reported)	clinicaltrials.gov (NCT00920621)	<p>The authors declare that; “All authors have completed and submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest.</p> <p>Dr Litonjua reported receiving personal fees from UpToDate Inc and Springer Humana Press. Dr</p>

				<p>McElrath reported receiving grants from the National Institutes of Health (NIH). Dr O'Connor reported receiving grants from the NIH. Dr Bacharier reported receiving grants from the NIH and National Heart, Lung, and Blood Institute (NHBLI), and personal fees from Aerocrine, GlaxoSmithKline, Genentech/Novartis, Merck, Schering, Cephalon, DBV Technologies, Teva, Boehringer Ingelheim, AstraZeneca, WebMD/ Medscape, Sanofi, and Vectura. Dr Zeiger reported receiving grants from the NHBLI, AstraZeneca, Aerocrine, MedImmune, Genentech, Merck, and GlaxoSmithKline and personal fees from Genentech, Novartis, GlaxoSmithKline, and TEVA. Dr Hornsby reported receiving an NIH ancillary grant. Dr Hawrylowicz reported receiving an NIH ancillary grant, a fellowship grant from Wellcome Trust Clinical Training Research Fellowship, grant G100758 from the Medical Research Council Centre,</p>
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Mokhtar, 2018, Egypt [27]	Case-control	Congenital heart defects (confirmed by the pediatric cardiologist using ECHO)	Not reported	The authors declare no conflicts of interest
Nasri, 2016, Tunisia [23]	Case-control study	Neural tube defects	Not reported	The authors declare no conflicts of interest

		(not reported)		
Zhou, 2014, China [21]	Cohort	Malformations including nervous system, circulatory system, digestive system, reproductive system, urinary system, musculoskeletal, chromosome disorder and others. (not reported)	Not reported	The authors declare no conflict of interest
Roth 2018, Canada [19]	RCT	Congenital anomalies (not reported)	ClinicalTrials.gov (NCT01924013)	The authors declare no conflicts of interest
Sirinoglu, 2018, Turkey [28]	Case-control	Fetal anomaly of neural tube origin (sonographically detected)	Not reported	The authors declare no conflicts of interest
Turkmen, 2017, Turkey [25]	Controlled cross-sectional	congenital diaphragmatic hernia	Not reported	The authors declare no conflicts of interest

		(ultrasonographic examinations)		
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		Risk of bias domains					
		D1	D2	D3	D4	D5	Overall
Study	Chawes 2016						
	Cooper 2016						
	Litonjua 2016						
	Roth 2018						

Domains:

D1: Bias arising from the randomization process.


D2: Bias due to deviations from intended intervention.

D3: Bias due to missing outcome data.

D4: Bias in measurement of the outcome.

D5: Bias in selection of the reported result.

Judgement

 Some concerns


 Low

Figure S1a. Risk of bias assessment of included RCTs according to Cochranes Risk of Bias tool 2.

		Risk of bias domains							
		D1	D2	D3	D4	D5	D6	D7	Overall
Study	Ates 2016	!	+	+	?	+	+	-	!
	Daglar 2014	!	?	+	?	+	+	-	!
	Dilli 2018	X	X	+	?	+	+	-	X
	Fernandez-Alonso 2011	!	+	+	+	+	+	-	!
	Mokhtar 2019	!	X	+	?	+	+	-	!
	Nasri 2016	X	+	+	?	-	+	-	X
	Sirinoglu 2018	!	+	+	?	+	+	-	!
	Turkmen 2017	!	+	+	?	+	+	-	!
	Zhou 2014	X	+	+	?	+	+	-	X

Domains:
D1: Bias due to confounding.
D2: Bias due to selection of participants.
D3: Bias in classification of interventions.
D4: Bias due to deviations from intended interventions.
D5: Bias due to missing data.
D6: Bias in measurement of outcomes.
D7: Bias in selection of the reported result.

Judgement
! Critical
X Serious
- Moderate
+ Low
? No information

Figure S1b. Risk of bias assessment of included observational studies according to ROBINS-I.