

Author	Type of study	N	Ethnicity	Trimester	Adjusted for covariates	Maternal Marker Studied	Cutoff used	Outcome	Other outcomes/Comments
Early gestation									
Wang H.	prospective	747	China	1st prenatal visit	maternal age, maternal race, pre-pregnancy BMI, height, smoking, planned pregnancy, marital status, education, family's socio-professional category, delivery, season, Vit D supplementation, physical activity, Vit D lifestyle score, and infant sex	25(OH)D	Deficiency ≤ 20 ng/ml) insufficiency 20–29 ng/ml sufficiency ≥ 30 ng/ml	Reported a nonlinear relation between 25(OH)D, birth weight and head circumference ($P < 0.01$). Birth weight and head circumference increased by 69 (95% CI: 38–122) g and 0.31 (0.22–0.40) cm, respectively, per 1 ng/ml increase in maternal 25(OH)D, up to 20 ng/ml and leveled off thereafter	For each 1 unit decrease of maternal 25(OH)D, the unadjusted and adjusted risk of SGA increased by 19% (odds ratio 1.19 [95% CI 1.13–1.25], $P < 0.001$) and 9% (1.08 [1.03–1.16], $P = 0.009$), respectively.
Fernando et al.	retrospective	304	Australia	Early pregnancy <20w	maternal covariates including age, body mass index (BMI) and ethnicity	Total, free and bioavailable 25(OH)D	-	Higher maternal total and free 25(OH)D concentrations were associated with higher neonatal birthweight ($\beta = 5.05$, $p = 0.002$ and $\beta = 18.06$, $p = 0.02$, respectively	
Hyde et al.	prospective	402	Australia	At booking <16 and 28-32	Maternal smoking status	25(OH)D	-	In smokers, but not non-smokers, serum 25(OH)D status at recruitment was inversely associated with newborn's fat mass percentage but positively associated with lean mass (both $p < 0.05$)	No association at 28–32 weeks of gestation
Leffelaar et al.	prospective	3730	The Netherlands (multiethnic)	12-14w	fetal sex, maternal height, parity, maternal age, smoking, maternal pre-pregnancy	25(OH)D	Deficient ≤ 29.9 nmol/l, insufficient 30–49.9 nmol/l	compared with women with adequate Vit D levels, women with deficient Vit D levels	Neonates born to mothers with a deficient Vit D status showed accelerated growth in weight and length during the first year of life

					BMI and educational level		and adequate'≥50 nmol/l	had infants with lower birth weights (2114.4 g, 95 % CI 2 151.2, 2 77.6) and a higher risk of SGA (OR 2.4, 95 % CI 1.9, 3.2)	
van den Berg et al.	population-based birth cohort study	2,274	Netherlands	Early pregnancy	Maternal overweight, season of blood sampling, and maternal smoking	25(OH)D	-	women in the lowest 25(OH)D quartile had a higher risk of an SGA offspring (OR 1.57, 95% CI 1.03–2.39) 25(OH)D appears to be a modifiable contributor to the association between low maternal education and SGA offspring, particularly in overweight women and women who conceived in the winter period	
Gernand et al.	retrospective	2146	USA multicentric	At booking and every 8 weeks after and up to 26	season of blood sampling, gestational age, pre-pregnancy body mass index, height, parity, smoking, marital status, socioeconomic status, maternal age, study site (accounts for latitude), and infant sex	25(OH)D	-	mothers with 25(OH)D of 37.5 nmol/liter or greater gave birth to newborns with 46 g [95% confidence interval (CI), 9–82 g] higher birth weights and 0.13 cm (0.01–0.25 cm) larger head circumferences compared with mothers with less than 37.5 nmol/liter No association was observed between 25(OH)D and ponderal index, placental weight, or the placental to fetal weight ratio Maternal 25(OH)D of 37.5 nmol/liter or greater vs. less than 37.5 nmol/liter in the first trimester was associated with half the risk of small for gestational age (adjusted odds ratio 0.5; 95% CI 0.3– 0.9), but no second-trimester association was observed	
Rodriguez et al.	Prospective cohort	2382	Spain	11-15 w	child's sex, gestational age, month at blood sampling, parity, maternal age, ethnic background, maternal social class and education level, maternal pre-pregnancy body mass index,	25(OH)D3	Insufficiency: 20–29.99 ng/ml] deficiency: <20 ng/ml], sufficiency: ≥30 ng/ml]	Offspring of mothers with higher circulating 25(OH)D3 concentration tended to have smaller HC [coefficient (SE) per doubling concentration of 25(OH)D3, 0.10 (0.05), P = 0.038].	No evidence reported of an association between Vit D status in pregnancy and GDM, preterm delivery, FGR, SGA and anthropometric birth outcomes

					maternal smoking and alcohol consumption during pregnancy, and maternal energy intake during pregnancy				
Schneuer et al.	prospective, nested case-control study	5109	Australia multiethnic	1 st trim. (10-14 w)	maternal age, parity, smoking during pregnancy, maternal weight, previously diagnosed hypertension, previously diagnosed diabetes, season at sampling, country of birth, or socioeconomic disadvantage	25(OH)D	-	Low 25(OH)D serum concentrations in the first trimester of pregnancy are not associated with adverse pregnancy outcomes and do not predict complications	
Aji et al.	prospective cohort	232	Indonesia	1 st and 3 rd trim.	maternal age, pre-pregnancy BMI and gestational age at delivery	25(OH)D	Deficiency: <12 ng/mL Insufficiency: 12-19 ng/mL Sufficiency ≥ 20 ng/mL	Not associated with neonatal anthropometry at birth (p>0.05) (LBW, birth length, low HC)	
Yuniati et al.	prospective cohort	203	Indonesia	1 st trim.	maternal age, pre-pregnancy body mass index, and parity	25(OH)D	deficient <20 ng/mL, insufficient 20-29.99 ng/mL and normal ≥30 ng/mL	No significant association reported between maternal serum Vit D and neonatal birth weight, before and after adjustment for confounders	
Park et al.	prospective	523	Korea	1 st trim.	maternal age, pre-pregnancy body mass index, BMI at booking, BMI at GDM screening, gestational age at sampling, previous GDM, Vit D intake	25(OH)D	Sufficient ≥ 50 nmol/L, borderline 25-49.9 nmol/L, insufficient <25 nmol/L	birth weight was independent of maternal serum 25-OH-D levels during the first, second and third trimester of pregnancy.	neither GDM prevalence nor fetal growth during pregnancy is associated with Vit D deficiency at 1st trim. in Korean women

					and season of sampling				
2 nd trimester									
Liu et al.	Retrospective cohort study	15724	China	26-28 w	maternal age at delivery, education level, employment status, parity, history of macrosomia, pre-pregnancy BMI, height, use of folic acid supplements, maternal serum concentrations of triglycerides, high density lipoprotein cholesterol, calcium and hemoglobin in the 1st trim.	25(OH)D	Severe deficiency: <10.0 ng/mL deficiency: 10.0-19.9 ng/mL insufficiency: 20.0-29.9 ng/mL sufficiency: >30.0 ng/mL	severely 25(OH)D deficient mothers had a decreased risk of LGA compared with those with sufficient 25(OH)D concentrations (Adjusted odds ratio (OR): 0.65; 95% confidence interval (CI): 0.43 0.96).	Compared to mothers with no 25(OH)D deficiency and no GDM, those with both 25(OH)D deficiency and GDM had 0.15 (95% CI: 0.09, 0.21) higher infant birth weight Z-score and a higher risk of LGA (OR: 1.29; 95% CI: 1.09, 1.52). Maternal 25(OH)D deficiency and GDM had additive interaction on the risk of LGA (relative risk due to interaction: 0.18).
Chen et al.	retrospective cohort	2814	China	14-19 w	age, BMI, parity, season of blood collected	25(OH)D	-	the hazard ratio (HR) (95% CI) per standard deviation (SD) increase of maternal serum 25(OH)D concentrations was 0.849 (95% CI 0.726, 0.993) for LBW	Higher early pregnancy Vit D was associated with a lower risk of GDM, cesarean section, preterm birth, and LBW
Casey et al.	Prospective HAPO study	1585	Northern Ireland	24-32 w	season of sampling, maternal age at OGTT, maternal BMI at OGTT, smoker during pregnancy, alcohol use during pregnancy, family history of diabetes,	25(OH)D	25(OH)D quintiles (≤25 nmol/l, 25-01-49-9 nmol/l, 50-74-9 nmol/l, 75-99-9 nmol/l and ≥100 nmol/l)	birth weight standard deviation scores (SDS) and birth length SDS were significantly associated with maternal total 25(OH)D P=0.002 (95% CI 0.00-0.10) and P=0.03 (95% CI 0.01-0.13)	There were no significant associations with maternal 25(OH)D and other measures of neonatal anthropometrics or markers of neonatal glycaemia

					gestational age at delivery, sex of neonate, parity, systolic blood pressure at OGTT, maternal height, fasting plasma glucose and maternal education				
Mosavat et al.	prospective	890	Australia	2 nd trim. (18 w)	Seasonal effect, maternal age, pre-pregnancy and gestational weight, race/ethnicity	25(OH)D	< 30 nmol/L (severe Vit D deficiency), 30–49 nmol/L (mild Vit D deficiency), 50–78 nmol/L (normal Vit D level), and > 78 nmol/L (ideal Vit D level)	Maternal serum levels of 25(OH)D were positively associated with birth weight (r = 0.10, p = 0.003), body length (r = 0.10, p = 0.005) and head circumference (r = 0.10, p = 0.007) of the neonate. No association with the risk for low birth weight	Low maternal serum levels of 25(OH)D are associated with GDM gestational diabetes, and race/ethnicity may modify this relationship
Morley et al.	prospective	374	Australia	<16w & at 28-32 w	infant sex, maternal height, whether first child, whether the mother smoked in pregnancy, and season when blood sample was taken	25(OH)D	Low 25(OH)D group <28 nmol/L	Low maternal 25(OH)D in late pregnancy is associated with reduced intrauterine long bone growth [knee-heel length 4.3 mm smaller (95% CI -7.3, -1.3) & reduced mid-upper arm (0.1, 95% CI -0.06, 0.3) and slightly shorter gestation	no evident relationship between birth size measures and maternal 25(OH)D or PTH
Gernand et al.	prospective	792	USA	12-26 w	latitude, obesity status, race, treatment group, risk group,	25(OH)D	Tested different cutoffs Deficiency <30	Maternal Vit D status in the 2nd trim. is associated with risk of SGA	High risk for preeclampsia development study group Under treatment with low doses of aspirin

					gestational age at blood sampling, season at blood sampling, height, marital status, smoking, education, age, and infant sex		nmol/L Inadequacy 30-50 nmol/L Insufficiency <75 nmol/L	among all women, and in the subgroups of white and nonobese women No association in black or obese women	
Burris et al.	prospective	1067 white 236 black	USA	2 nd trim.	season of blood draw, maternal age, pre-pregnancy body mass index and race	25(OH)D	severe deficiency (<25 nmol/L), deficiency (25 to <50 nmol/L), insufficiency (50 to <75 nmol/L), and sufficiency (≥75 nmol/L)	The odds of SGA were higher with maternal 25(OH)D levels <25 vs. ≥25 nmol/L (adjusted OR 3.17; 95% [CI]: 1.16, 8.63)	The increased odds of SGA among black vs. white participants decreased from an OR of 2.04(1.04, 4.04) to 1.68 (0.82, 3.46) after adjusting for 25(OH)D
Eckhardt et al.	prospective	2473	USA	<26 w	infant sex, infant age, maternal pre-pregnancy BMI, socioeconomic status, race/ethnicity, season of blood draw and infant feeding	25(OH)D	Cut point for dichotomous categorization: 30 nmol/L Group quartiles: 30, 30–49, 50–74 and ≥75 nmol/L	Infants with maternal 25(OH)D ≥30 nmol/L vs <30 nmol/L had z-score for length and for head circumference measures 0.13 (95% CI 0.03–0.23) and 0.20 (95% CI 0.11–0.28) units higher, respectively, across the first year of life	Low maternal Vit D status was associated with deficits at birth in infant weight and BMI that were recouped across the first year of life associations with reduced measures of linear and skeletal growth were sustained from birth to 12 months
Tian et al.	nested case control study (preterm and term)	2558	USA	4-29 weeks	age, education, parity, pre-pregnancy body mass index, season at blood draw, and smoking	25(OH)D	-	Maternal serum concentrations of 25(OH)D in early and mid-pregnancy were positively associated with BW/GA among non-Hispanic Black male and female infants [beta (β) = 0.015, standard error (SE) = 0.007, P = 0.025; β = 0.018, SE = 0.006, P = 0.003, respectively] and non-Hispanic White male infants (β = 0.008, SE = 0.003, P = 0.02)	
Eggemoen et al.	Population based, multiethnic cohort study	719	Norway (multiethnic)	15 & 28 w	maternal age, parity, education, prepregnancy BMI, season,	25(OH)D	Consistently sufficient level (≥37nmol/l at GW 15 and 28)	significantly associated with birth weight, head circumference,	Sex-specific associations for abdominal circumference and sum of skinfolds were found (P for interaction <0.05)

					gestational age and neonate sex		consistently deficient level (<37nmol/l at GW 15 and 28) increasing level (<37nmol/l at GW 15 and ≥37nmol/l at GW 28) decreasing level (≥37nmol/l at GW 15 and <37nmol/l at GW 28)	abdominal circumference and ponderal index (P<0.05 for all), when used as a continuous variable and categorized After adjusting for ethnicity, 25(OH)D was no longer associated with any of the outcomes	
Wen et al.	nested case-control study	1635 (545 women who delivered a macrosomic neonate & 1090 controls)	China	2 nd or 3 rd trim.	maternal age, birthplace, intrapartum BMI, gestational weeks at birth, fetus gender, status of gestational diabetes, parity, sampling trimester, abnormal pregnancy history and sampling season	25(OH)D	<25.0, 25.0–37.4, 37.5–49.9, <50.0, >75.0 nmol/L vs. 50.0–74.9 nmol/L)	Among women who delivered infant with macrosomia, 71.2% of the women had serum 25(OH)D concentrations <50.0 nmol/L compared with 61.1% of the control women (P < 0.001). For women with concentrations <50.0 nmol/L, they had a 33% increased risk of macrosomia compared with women whose 25(OH)D ranged from 50.0 to 74.9 nmol/L	The risk of macrosomia was significantly increased with the decreasing concentrations of serum 25(OH)D in a dose-dependent manner (P for trend = 0.001). Maternal serum 25(OH)D <50.0 nmol/L was associated with the delivery of a macrosomic infant
Tint et al.	prospective	292	Asian	26-28 w	maternal glycemic status	25(OH)D	inadequate ≤75.0 nmol/L sufficient >75.0 nmol/L	Neonates of mothers with mid-gestation 25(OH)D inadequacy had a higher abdominal subcutaneous	Each 1 nmol/L increase in 25(OH)D was associated with a reduction in superficial subcutaneous adipose tissue (β=-0.14 ml; 95% CI: -0.24, -0.04 ml, P = 0.006) and deep

								adipose tissue volume, especially deep subcutaneous adipose tissue ($r = -0.206$, $P < 0.001$) which is metabolically similar to visceral adipose tissue in adults	subcutaneous adipose tissue ($\beta = -0.04$ ml; 95% CI: -0.06 , -0.01 ml, $P = 0.006$), but was not associated with internal adipose tissue
Godang et al.	prospective	202	Norway	14-16 & 30-32 w	maternal BMI	25(OH)D	-	Neonatal total body fat mass was positively associated with umbilical cord plasma 25(OH)D, $P=0.02$ Umbilical cord plasma - but not maternal - 25(OH)D was a significant predictor of neonatal total fat mass	Maternal and umbilical cord plasma 25(OH)D levels varied significantly with season However, a strong positive association between maternal 25(OH)D and umbilical cord plasma 25(OH)D was reported $\beta=0.42$, $P<0.001$)
Bodnar et al.	nested case-control study retrospective	412 SGA infants (n = 77 white and n = 34 black) non-SGA infants (n = 196 white and n = 105 black	USA	22 w	Race/ethnicity, pre-pregnancy BMI, smoking status, season of sample collection, marital status, private insurance, use of periconceptional multivitamins at least once per week, any pre-pregnancy physical activity, and intensity of physical activity, socioeconomic status	25(OH)D	deficiency <37.5 nmol/L sufficiency.>75 nmol/L	U-shaped relation between serum 25(OH)D and risk of SGA among white mothers ($P<0.0001$), with the lowest risk from 60 to 80 nmol/L There was no relation between 25(OH)D and SGA risk among black mothers	Compared with serum 25(OH)D 37.5–75 nmol/L, SGA odds ratios (95% CI) for levels <37.5 and >75 nmol/L were 7.5 (1.8, 31.9) and 2.1 (1.2, 3.8), respectively One SNP in the Vit D receptor gene among white women and 3 SNP in black women were significantly associated with SGA
Yu et al.	retrospective	10,586	China	13-27 w	Gestational	25(OH)D	Deficiency <50	With the increase in	Low maternal Vit D levels were

	cohort				diabetes, high blood pressure, parity, pre-pregnancy BMI, maternal age, occupation, education, gestational age at birth, fetal sex, complications, and season of blood collection		nmol/L Insufficiency 50–75 nmol/L	25(OH)D levels, the risk of SGA and LGA tended to increase and decrease, respectively. However, 25(OH)D concentration was not an effective predictor of SGA or LGA	not associated with SGA or LGA
Boyle et al.	prospective cohort	1710	New Zealand (multiethnic)	15 weeks	Maternal BMI, ethnicity	25(OH)D	-	Maternal 25(OH)D concentration was not associated with development of preeclampsia, spontaneous preterm birth or SGA infants	
Zhou et al.	prospective	1953	China	16-20 w	maternal age, systolic/diastolic pressure, pre-pregnancy body mass index and serum calcium	25(OH)D	Low levels ≤20 ng/ml medium levels 21-29 ng/ml high level ≥30 ng/ml	No significant associations with neonatal outcomes reported	higher prevalence of gestational diabetes and preterm delivery in women with high level of Vit D
3rd trimester									
Bärebring et al.	Prospective cohort study	2052 trimester 1 2046 Trimester 3 1816 Both trimesters 1810	Sweden	1 st and 3 rd trim.	season of conception, origin, Vit D supplementation, Vit D status trajectory Tobacco use, exclusion of preeclampsia cases	25(OH)D	deficiency 25(OH)D < 30 nmol/L	1st trim.: No associations 3rd trim.: 25(OH)D ≥100 nmol/L was associated with lower odds of SGA (OR 0.3, p = 0.031) and LBW (OR 0.2, p = 0.046), compared to Vit D deficient mothers	Women with a ≥30 nmol/L increment in 25(OH)D from T1 to T3 had the lowest odds of SGA, LBW and preterm delivery Lower 25(OH)D in early pregnancy was only associated with pregnancy loss
Shakeri et al.	Longitudinal, cross-sectional study	88	Iran	3 rd trim.	-	25(OH)D	-	Neonatal mean birth weight, length, and head circumference of mothers who were on the 3rd tercile of 25(OH)D serum level was significantly higher	women in the 1st tercile had shorter infants compared to women in the 3rd tercile of Vit D serum levels (p = 0.004) The OR confirmed that Vit D deficiency and insufficiency could predict 1.3 and 1.32

								than those in the 1st tercile ($p < 0.001$, $p = 0.004$ and $p < 0.001$, respectively)	times lower birth weight and lower infants' length at birth, respectively Vit D deficiency and insufficiency could predict 1.29 times infants with head circumference (HC) under 25th percentile
Wierzejska et al.	cross-sectional	94	Poland	term	Vit D and calcium consumption, gravidity, maternal age and education, pre-pregnancy BMI, weight gain during pregnancy, smoking, caffeine consumption, use of dietary supplements, professional activity during pregnancy, gestational diabetes, and sex of the neonate	25(OH)D	Severe deficiency <10 ng/ml Deficiency 20-30 ng/ml Insufficiency 20-30 ng/ml Optimal >30 ng/ml	No relationship between maternal and neonatal cord blood Vit D concentrations vs. neonatal weight, length, head, and chest circumference at birth was found ($p > 0.05$)	
Velkavrh et al.	prospective	73	Slovenian	3 rd trim.	-	25(OH)D	deficiency <50 nmol/L insufficiency 50-75 nmol/L sufficiency 75-125 nmol/L	no significant association between maternal 25(OH)D and newborn's anthropometric measures at birth (weight $p=0.35$, length $p=0.59$ and head circumference $p=0.47$)	
Wang et al.	prospective	1978	China	At delivery	maternal age, pre-pregnancy BMI, gestational age, season of blood draw, trimester, GDM, preeclampsia, Vit D supplemental, Vit D-calcium co-	25(OH)D	-	Maternal Vit D deficiency significantly increased the risk of neonatal low birth weight (LBW) (aOR 2.83; $P = 0.005$) and small-for-gestational-age	maternal Vit D deficiency independently increased the risk of gestational diabetes mellitus (GDM) (adjust OR, aOR 1.08; $P = 0.026$)

					supplementation, birth weight, infant gender, preterm delivery, IUGR, SGA, neonatal/maternal Vit D deficiency			(SGA) (aOR 1.17; P = 0.015). Vit D supplementation during pregnancy significantly reduced the risk of giving birth to LBW infants (OR = 0.47, 95%CI = 0.33-0.68, P<0.001).	
Arora et al.	prospective	200	India	At delivery	adjusted	25(OH)D	Deficiency <20 ng/ml Insufficiency <32 ng/ml	significant association of hypovitaminosis D with low-birth-weight neonates (p = 0.01).	consecutive deliveries (included pregnancy pathology, preterm births etc)
Kawakib et al.	prospective	100 elective cesarean section	Iraq	At delivery	-	25(OH)D3	Deficiency <20 ng/mL Insufficiency 20-29.9 ng/mL Normal ≥ 30 ng/mL	Vit D deficiency among pregnant women can be directly linked with adverse neonatal outcomes like low Apgar score, low birth weight and head circumference, and respiratory distress syndrome (p<0.001)	
Lee et al.	prospective observational study	575	Malaysia	At delivery	maternal age and BMI	25(OH)D	Deficiency <20 ng/mL Insufficiency 20-29 ng/mL Adequacy ≥30 ng/mL	no statistically significant association between Vit D status with maternal and neonatal outcomes (low birth weight baby and neonatal intensive care unit admission) among the three groups of Vit D status (p>0.05)	GDM prevalence was higher in pregnant women with Vit D deficiency (p = 0.024).
Laird et al.	prospective	172	Seychelles	At delivery	maternal MeHg, child's sex, alcohol and tobacco use in pregnancy, diabetes, gestational age, maternal age,	25(OH)D	Deficiency <30 nmol/L Insufficiency 30-49.9 nmol/L Sufficiency ≥50 nmol/L	Maternal 25(OH)D concentrations were not associated with child anthropometric or neurodevelopmental outcomes	Small Vit D variability as Vit D sufficient mothers were 98% of sample

					delivery weight gain, maternal BMI at enrolment, mean DHA and mean AA concentrations, Hollingshead SES, and number of other living children			A higher Vit D status was not a limiting factor for neonatal growth or neurocognitive development in the first 5 years of life	
Sandal et al.	prospective	45	Turkey	At delivery	-	25(OH)D3	Vit D deficient group <20 ng/mL Vit D sufficient group >20 ng/mL	No significant differences on neonatal anthropometric parameters at birth	The primary outcome of the study was the association of circulating sclerostin and neonatal parameters
Dullaert et al.	prospective cohort	240	Belgium	At delivery	parity, maternal age, fetal sex, gestational diabetes, maternal glucose level, and preeclampsia	25(OH)D	Deficiency ≤20 ng/mL Insufficiency 21-29 ng/mL	significant association was found between Vit D level <10 ng/mL and birthweight <10th percentile, but in multivariate analysis there was no significant contribution from low Vit D Maternal Vit D at delivery does not correlate with birthweight percentile	
MohammadBeigi	descriptive cross-sectional study	106 53 Iranians and 53 Afghan refugees' women	Iran	At delivery	Gestational age	25(OH)D	Deficiency <10 ng/mL Insufficiency 10-30 ng/mL Sufficiency >30 ng/mL	Maternal and neonatal 25(OH) D levels did not influence neonatal anthropometry	there was a significant correlation between maternal serum 25(OH)D and that of their neonates (P=0.000, R=0.62)
Longitudinal measurements of Vit D throughout pregnancy									
Francis et al.	prospective cohort	321	USA	10-14 w 15-26 w 23-31 w & 33-39 w	maternal age, race/ethnicity, gestational age at blood draw, education, pre-pregnancy BMI, marital status and insurance	25(OH)D	Cutoffs <50 nmol/L, 50–75 nmol/L, & >75 nmol/L	women with an overweight/obese BMI: 25(OH)D <50 nmol/L at 10-14 w was associated with lower birthweight z-score (0.56; 95% CI: -0.99, -0.13) and length (-1.56 cm; 95% CI: -3.07, -0.06)	women with normal BMI: 25(OH)D <50 nmol/L at 10-14 w was associated with lower sum of skinfolds (-2.64 mm; 95% CI: -5.03, -0.24), at 23-31 GW was associated with larger birthweight z-scores (0.64; 95% CI: 0.03, 1.25), and at 33-39 w with both higher birthweight z-score (1.22; 95% CI: 0.71, 1.73)

								at 23-31 w was associated with shorter length (-2.77 cm; 95% CI: -13.38, -4.98) and lower sum of skinfolds (-9.18 mm; 95% CI: -13.38, -4.98)	and longer length (1.94 cm; 95% CI: 0.37, 3.52)
Boghossian et al.	retrospective	252 (220 African American, 32 Caucasians)	USA (interacial)	11-21 w 26-29 w 36 w	maternal ethnicity/race, age, body mass index, smoking statu, caloric intake, corrected serum calcium, and newborn sex	25(OH)D	Deficiency <20 ng/ml Insufficiency 20–29 ng/ml Sufficiency >29 ng/ml	Newborns of deficient mothers had lower total bone mineral density (β -0.009 g/cm ² ; 95% CI -0.016, -0.002), while lean mass (-217 g; -391, -43) and birthweight (-308 g; -540, -76) were significantly negatively associated among males only	
Benaïm et al.	Prospective cohort	168	Brazil	5-13w 20-26w 30-36w All trimesters	maternal education, early pregnancy BMI, skin colour, smoking habit, alcohol consumption and energy intake	25(OH)D	sufficiency \geq 50 nmol/L; insufficiency <50 nmol/L	Mean rate of change during pregnancy in 25(OH)D was directly associated with birthweight z-score (β =0.36, 95% CI 0.07, 0.65), LGA risk (IRR: 1.97, 95% CI 1.07; 3.63) and preterm birth (IRR: 7.35, 95% CI 2.99; 18.07).	
Chen et al.	Prospective, population-based cohort	3658	China	Any stage of pregnancy	BMI before pregnancy, maternal age and season of blood sample, maternal socioeconomic status, maternal periconceptional multivitamin use and parity	25(OH)D	Deficiency <20 ng/mL Insufficiency 20-29.9 ng/mL Sufficiency \geq 30 ng/mL	positive correlation between maternal serum 25(OH)D level and offspring birth weight (r=0.477, P<0.001)	After adjustment for confounders, relative risk (RR) for LBW infants was 12.31 (95% CI: 4.47, 33.89) among subjects with Vit D deficiency and 3.15 (95% CI: 1.06, 9.39) among subjects with Vit D insufficiency RR for SGA infants was 6.47 (95%CI: 4.30, 9.75) among subjects with Vit D deficiency and 2.01 (95%CI: 1.28, 3.16) among subjects with Vit D insufficiency
Bo Chen et al.	prospective	3080 (included	China	>8 w	Maternal age, gestational age,	25(OH)D	deficiency: <50 nmol/L,	In the Vit D deficient group, the	inclusion of cases with gestational pathology

		pathology)			season, education level, weekly time outdoors, Vit D supplement, calcium supplement and trace element supplement during pregnancy		insufficiency: 50 - 75 nmol/L sufficiency: ≥ 75 nmol/L	occurrence of spontaneous abortion and SGA was higher than those of other groups (P=.018 & P=.016 respectively)	
Pereira-Santos et al.	prospective	327	Brazil	Up to 34w	maternal education level, time of onset of prenatal care, number of consultations, maternal BMI, gestational age, neonatal sex, maternal smoking, use of closed clothing season, socioeconomic class and maternal religion	25(OH)D	Deficient <50 nmol/l, insufficient 50–75 nmol/l and sufficient >75 nmol/l	Vit D serum concentration had a direct and statistically significant association with birth weight Each nmol increase in maternal Vit D serum concentration correlated with an increase in birth weight of 3,06 (95 % CI -1.37, 4.75) g (P \leq 0.01)	
RCTs and Systematic Reviews									
Fang et al.	metanalysis	16 studies						maternal Vit D deficiency led to an increased risk of a low birthweight neonate (OR = 2.39, 95% CI: 1.25-4.57)	neonates of deficient mothers had a lower birthweight of only 0.08 kgr (95% CI: -0.10 to -0.06) compared to controls
Santamaria et al.	Systematic review & metanalysis	30 studies 35032 mother-offspring pairs						Low prenatal Vit D levels were associated with lower birth weight (mean difference MD -100.69; 95% CI -162.25, -39.13), increased risk of small-for-gestational-age (OR 1.55; 95% CI 1.16,	No associations were observed between prenatal Vit D status and other growth parameters at birth, age 1 year, 4-6 years or 9 years, nor with diabetes type 1 Prenatal Vit D may play a role in infant adiposity and accelerated postnatal growth

								2.07) and an elevated weight in infant at the age of 9 months (MD 119.75; 95% CI 32.97, 206.52)	
Tous et al.	Systematic review and metanalysis	54						<p>Vit D deficient mothers (<30 nmol/L) had neonates with lower birthweight (MD -87.82g; 95% CI -119.73, -55.91 g), head circumference (MD -0.19 cm; 95% CI -0.32, -0.06 cm) and a higher risk of small for gestational age infants (OR 1.59; 95% CI 1.24, 2.03) compared to mothers with Vit D levels ≥30 nmol/L.</p> <p>Vit D insufficiency (<50 nmol/L) was associated with a higher risk of SGA and PTB (OR 1.43; 95% CI 1.08, 1.91 and OR 1.28; 95% CI 1.08, 1.52, respectively)</p>	
De-Regil et al.	Cohrane metanalysis	15 trials 2833 women						<p>Vit D supplemented women during pregnancy, less frequently had a baby with a birthweight below 2500 g than those receiving no intervention or placebo (RR 0.40; 95% CI 0.24 to 0.67, moderate quality)</p> <p>There was also some indication that Vit D supplementation increases infant length (mean difference (MD) 0.70, 95% CI -0.02 to 1.43; four trials, 638 infants) and head circumference at birth (MD 0.43, 95% CI 0.03 to 0.83; four trials, 638 women)</p>	
Aghajafari et al.	Systematic review and metanalysis	31 studies						<p>Maternal 25(OH)D insufficiency was associated with small for gestational age infants (1.85, 1.52 to 2.26).</p> <p>Pregnant women with low serum 25(OH)D levels had an increased risk of bacterial vaginosis and low birthweight infants</p>	
Pérez-López et al.	Systematic review and metanalysis of RCTs	13 trials 2299 pregnancies						<p>Birth weight and birth length were significantly greater for neonates in the Vit D supplemented group; mean difference: 107.6 g (95% CI 59.9-155.3</p> <p>Incidence of preeclampsia, GDM, SGA, low birth weight, preterm birth, and cesarean section were not influenced by Vit D supplementation</p>	

								g) and 0.3 cm (95% CI 0.10-0.41 cm), respectively	
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Table S2: Studies on the effects of maternal Vit D status during gestation on neonatal anthropometric indices. FGR: fetal growth restriction, SGA: small for gestational age, EFW: estimated fetal weight, AGA: appropriate for gestational age, LGA: large for gestational age, GDM: gestational diabetes mellitus, LBW: low birthweight, HC: head circumference, PTB: preterm birth, SNP: single nucleotide polymorphism