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Review

The impact of adolescent pregnancy on maternal and infant health in Turkey: Systematic review and meta-analysis

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ABSTRACT

Objectives: To examine the impact of adolescent pregnancy on maternal and infant health on the basis of studies conducted in Turkey.
Material and methods: Systematic reviews and meta-analyses of cross-sectional and case-control. A systematic scan was performed in January 2020 based on the keywords "adolescent pregnancy or teenage pregnancy and Turkey" in the electronic databases PubMed, Clinical Key, Science Direct, Web of Science, Google Scholar, National Thesis Center, DergiPark, Ulakbim, Turkish Medline and Turkish Clinics. Two of the authors carried out a scan independently of each other, making a selection of articles, performing data extraction and quality assessment procedures under the supervision of the senior researcher.
Results: The results of a total of 38 studies, of which twenty-three were cross-sectional and 15 were case-control, were compiled for the meta-analysis (adolescents: 20,768; control: 59,481). The results of the meta-analysis showed that the more common effects of adolescent pregnancies were preterm birth (OR: 2.12, $p < 0.001$), early membrane rupture (OR: 1.49, $p < 0.001$), anemia (OR: 2.60, $p < 0.001$), low birthweight/intrauterine growth retardation (OR: 2.06, $p < 0.001$), and fetal distress (OR: 1.78, $p = 0.003$). On the other hand, it was observed in the meta-analysis that childbirth by cesarean section (OR: 0.70, $p < 0.001$), gestational diabetes (OR: 0.35, $p < 0.001$), placenta previa (OR: 0.52, $p = 0.01$), polyhydramnios (OR: 0.52, $p = 0.04$) and macrosomia (OR: 0.54, $p < 0.001$) were less common among adolescents compared to adults.
Conclusion: Our review revealed that adolescent pregnancy had an adverse impact on maternal and infant health in terms of preterm childbirth, early membrane rupture, anemia, low birthweight/intrauterine growth retardation, low Apgar scores and fetal distress.
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Contents

Introduction . . . 2
Aim and research questions . . . 2
Material and methods . . . 2
Design . . . 2
Inclusion and exclusion criteria . . . 8
Identification of studies for inclusion . . . 8
Study selection . . . 8
Data extraction . . . 8
Methodological quality assessment of the studies . . . 8
Data synthesis . . . 8
Results . . . 8
Literatur search results . . . 8
Characteristics of included study . . . 9

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Quality assessment results of the studies . . . 9
Results of meta-analysis of effects of adolescent pregnancy on maternal health and pregnancy outcomes . . . 9
Results of the meta-analysis of effects of adolescent pregnancy on infant health . . . 11
Comparison of early and late adolescent groups in terms of maternal and infant health outcomes . . . 11
Discussion . . . 12
Effects of adolescent pregnancy on maternal health and pregnancy outcomes . . . 12
The effects of adolescent pregnancy on infant health . . . 13
Comparison of early and late adolescent groups in terms of maternal and infant health outcomes . . . 14
Strengths and limitations . . . 14
Implications for health policy . . . 14
Conclusions . . . 14
Authors' contributions . . . 14
Funding sources . . . 14
Ethics (and consent to participate) . . . 14
References . . . 14

Introduction

The World Health Organization (WHO) defines individuals aged 10−19 as adolescents and reports that about 12 million adolescents between the ages of 15−19 give birth every year in developing countries and that the main causes of mortality in this segment of the population are complications of pregnancy and childbirth. WHO resources indicate that the adolescent fertility rate, though steadily decreasing in the past 20 years, is still 11.6 % [1]. The rate varies from region to region but low- and middle-income areas account for the majority of the figures. A systematic review of the results of 52 studies conducted in 24 countries in Africa reveals the prevalence of adolescent pregnancy to be 18.8 % [2].

Turkey is a developing country with a predominantly young population. The Population Health Survey for Turkey, 2018 reports that 3.5 % of adolescents have children, 1.5 % have married before the age of 15, and 0.2 % have had children before the age of 15 [3]. A calculation made on the basis of study data reported from seven different hospitals in Turkey over the period 2015–2017 indicates that 7.9 % of births (range: 2.6–9.2; 6989/88895) occurred in adolescence [4–10]. In Turkey, national data and results of other research on mother-infant health focused on the 15–49 age group for married women. Therefore data on the adolescent's pregnancy rates could not be reached. In addition, adolescent pregnancies have not been shown among the causes of maternal death.

Adolescent pregnancies are an important social problem that all healthcare professionals, managers and politicians should address carefully due to their high prevalence, physical, psycho-social and economic effects on individual and social health. It should be handled with a multidisciplinary approach. The data obtained from this study are expected to contribute to the accumulation of national and international knowledge that will ultimately make possible the improvement of healthcare services for adolescent mothers and their babies.

Adolescent pregnancy brings with it many physical and psychological problems related to maternal and infant health. It is reported that pregnant adolescents are more prone to be confronted with issues that include anemia, nutrition deficiency, less weight gain than is to be expected, abortus, preterm birth, preeclampsia, hemorrhage, birth trauma, cesarean section or interventions during labor, anxiety and depression [11,12]. In the postpartum as well, it is asserted that hemorrhage, anemia, depression, urinary, sexual and breastfeeding problems occur at a higher rate in this group [13]. Reports indicate that there is an increased likelihood of prematurity, low birthweight, congenital anomalies, late onset of the sucking reflex, meconium aspiration, organ function deficiencies, jaundice, hypoglycemia, asphyxia, perinatal mortality and other unwanted conditions among babies born of adolescent mothers [11,14].

At the same time, adolescent pregnancies give rise to very serious sociocultural and economic outcomes. Adolescent pregnancy can be a barrier to the education of girls in the population, prohibiting them from attaining professional roles and benefiting from economic resources. Academic failure, alcohol and substance abuse, sexual abuse, unprotected sex and unwanted pregnancies are some of the potential issues faced by adolescents [1,2,15]. In short, teenagers who become pregnant are unable to contribute to production, causing increased health expenditure and creating a significant economic risk for society.

The negative aspects of childbirth during adolescence represent an important issue that must be resolved if an environment is to be created where healthy infants can thrive, healthy generations can grow and socioeconomic development can take place [1,15]. Many studies have been carried out in Turkey on adolescent pregnancy and its effect on maternal and infant health and most have been published in international journals. There is no work however in which the results of these studies have been compiled and therefore the present study's aim is to provide a more comprehensive picture of data for Turkey by means of a systematic review.

Aim and research questions

This systematic review and meta-analysis was aimed to determine the effects of adolescent pregnancy on maternal and infant health, based on data compiled from studies conducted in Turkey. The questions to be answered in the study were: 1) What are the effects of adolescent pregnancy on maternal health? 2) What are the effects of adolescent pregnancy on infant health?

Material and methods

Design

The protocol of this systematic review and meta-analysis was registered on the PROSPERO database (CRD42020166088). This systematic review and meta-analysis was carried out on the basis of Preferred Reporting Items for Systematic Review and Meta-analysis (PRISMA) [16]. The scan of the literature, selection of articles, data extraction and quality assessment of the included articles were performed independently by two of the researchers, while all of these phases were completed under the supervision of the first (senior) author. Whenever there was disagreement over a particular study, the three authors held discussions and arrived at an agreement. At the same time, prior to the start of the study, a pilot study that included all the stages of the research was conducted with the participation of all three authors, who concurred on a common roadmap.

Table 1
Characteristics and main findings of the studies included in the systematic review and meta-analyses.

Publication City	Data collection year	Study design / data source	Age (Sample size)	Mean / median age, year (SD)	Data on maternal health (adolecent and control)	Data on baby health (adolecent and control)	Quality score
Ağaçayak et al. (2016) [5] Diyarbakır	2015	Retrospective cross-sectional (hospital records)	15–19 (50) 20–23 (96)	18.12 ± 0.94 21.65 ± 1.08	Needing blood transfusions: 11/50 and 5/96 Hemoglobin value: 11.14 ± 2.20 and 11.88 ± 1.62 Cesarean section: 33/50 and 65/96 Preterm birth: 21/50 and 27/96 Preeclampsia: 9/50 and 7/96	Birth weight (gr): 2605.3 ± 931.1 and 2546.7 ± 713.3 1. minute Apgar score: 5.44 ± 2.23 and 5.52 ± 2.08 5. minutes Apgar score: 6.72 ± 2.46 and 7.63 ± 1.88 Fetal anomaly: 7/50 and 3/96 NICU admission: 17/50 and 16/96	Yes: 6/8
Akdemir et al. (2014) [27] Sakarya	2010–2012	Retrospective cross-sectional (hospital records)	15–19 (77) 20–35 (1220)	18.0 26.8	Cesarean section: 35/77 and 293/1220 Preterm birth: 12/77 and 22/1220 PPROM: 6/77 and 55/1220 Preeclampsia: 2/77 and 30/1220 Eclampsia: 2/77 and 3/1220 CPD: 13/77 and 43/1220	Low birth weight:18/77 and 33/1220 Intrauterine fetal death: 7/77 and 3/1220 Neonatal mortality: 2/77 and 1/1220 Fetal anomaly: 4/77 and 12/1220	Yes: 6/8
Aslan Çetin et al. (2019) [19] İstanbul	2013–2018	Retrospective case-control (hospital records)	≤19 (3875) 20–29 (3875)	17.32 ± 0.95 26.11 ± 3.19	Needing blood transfusions: 15/3875 and 16/3875 Gestation age (week): 37.60 ± 2.57 and 37.76 ± 2.75 Cesarean section: 711/3875 and 1626/3875 Preterm birth: 504/3875 and 328/3875 PPROM: 125/3875 and 61/3875 GDM: 84/3875 and 121/3875 Preeclampsia: 49/3875 and 133/3875 Eclampsia/HELLP: 9/3875 and 23/3875 CPD: 74/3875 and 55/3875 Malpresentation: 94/3875 and 42/3875 Placental abruption: 28/3875 and 24/3875 Placenta previa: 9/3875 and 20/3875	Birth weight (gr): 3063.56 ± 536.98 and 3311.74 ± 976.69 1. minute Apgar score: 8.58 ± 1.19 and 8.53 ± 1.05 5. minute Apgar score: 9.67 ± 1.03 and 9.59 ± 0.96 1. minute Apgar score <7: 144/3875 and 126/3875 5. minute Apgar score <7: 504/3875 and 328/3875 Fetal Distress: 222/3875 and 137/3875 Prenatal death: 62/3875 and 76/3875 IUGR: 167/3875 and 63/3875 Macrosomia: 9/3875 and 16/3875	Yes:10/10
Ayyıldız et al. (2015) [49] Zonguldak	2011–2013	Retrospective cross-sectional (hospital records)	17–19 (50) 20–34 (121)	18 ± 0.5 25.7 ± 3.0	Gestation age (week): 36.46 ± 3.19 and 37.94 ± 2.15 Hemoglobin value: 10.32 ± 1.35 and 12.23 ± 1.28 Preeclampsia:11/50 and 13/121	Birth weight (gr): 2874.80 ± 560.31 and 3214.21 ± 427.84 1. minute Apgar score: 7.50 ± 1.93 and 8.42 ± 0.95 5. minutes Apgar score: 8.24 ± 2.08 and 9.09 ± 0.99 IUGR: 5/50 and 4/121	Yes: 6/8
Balcı et al. (2020) [51] Amasya	2010–2015	Retrospective case-control (hospital records)	13–19 (272) 20–49 (269)		Preeclampsia: 2/272 and 19/269 GDM: 0/272 and 16/269	Low birth weight (<2.500 g): 18/272 and 12/269 IUGR: 6/272 and 12/269 Fetal anomaly: 0/272 and 1/269 Macrosomia: 5/272 and 18/269	Yes: 10/10
Barut (2018) [28] Şanlıurfa	2017–2018	Retrospective case-control (hospital records)	15–19 (68) 20–23 (168)	18.18 ± 0.98 21.67 ± 1.10	Hemoglobin value: 10.55 ± 2.32 and 11.50 ± 1.89 Needing blood transfusions:16/68 and 4/168 Gestation age (week): 34.46 ± 4.09 and 36.47 ± 2.93 Cesarean section: 35/68 and 106/168 Preterm birth: 26/68 and 15/168 Preeclampsia: 6/68 and 6/168 Placenta previa: 7/68 and 5/168 CPD/obstructed labour: 2/68 and 8/168 Malpresentation: 5/68 and 14/168	Birth weight (gr): 2525.29 ± 840.04 and 2836.25 ± 716.04 1. minute Apgar score: 5.97 ± 2.37 and 6.36 ± 2.02 5. minutes Apgar score:7.53 ± 2.84 and 8.05 ± 2.47 Fetal Distress: 9/68 v and 14/168 Fetal anomaly: 2/68 and 2/168	Yes: 10/10
Bildircin et al. (2014) [29] Samsun	2006–2013	Retrospective cross-sectional (hospital records)	15–19 (527) 20–40 (1298)	18.0 ± 0.9 28.9 ± 5.2	Hemoglobin value: 11.3 ± 1.6 and 11.9 ± 1.1 Hypertension: 72/527 and 186/1298 PROM: 29/527 and 51/1298 Cesarean section: 352/527 and 1134/1298 Postpartum hemorrhage: 6/527 and 48/1298 Polyhydramniosis: 13/527 and 53/1298 Oligohydramniosis: 65/527 and 135/1298	Birth weight (gr): 2371.0 ± 1111.9 and 2970.9 ± 807.5 IUGR: 32/527 and 64/1298 Low birth weight (<2.500 g): 234/527 and 282/1298 Very low birth weight (<1500 g): 114/527 and 89/1298 5. minutes Apgar score: 7.2 ± 2.0 and 7.2 ± 1.4	Yes:8/8
Budak and Akgol (2019) [6] Diyarbakır	2018	Retrospective case-control (hospital records with a questionnaire)	≤19 (100) 19 ≤ yaş (100)	18.05 ± 0.9 21.9 ± 1.2	Anemia: 36/100 and 36/100 Hemoglobin value: 11.5 ± 1.6 and 11.5 ± 1.6 Cesarean section: 31/100 and 20/100 Preterm birth: 7/100 and 8/100 Postterm birth: 4/100 and 3/100	Fetal Distress: 4/100 and 2/100 Birth weight (gr): 3102.0 ± 486.7 and 3042.8 ± 497.4 1. minute Apgar score: 7.8 ± 0.4 and 7.5 ± 0.7 5. minute Apgar score: 9.1 ± 0.3 and 8.9 ± 0.3 5 minute Apgar <7: 0/100 and 0/100	Yes:10/10

Table 1 (*Continued*)

Publication City	Data collection year	Study design / data source	Age (Sample size)	Mean / median age, year (SD)	Data on maternal health (adolecent and control)	Data on baby health (adolecent and control)	Quality score
					Preeclampsia: 4/100 and 3/100 Malpresentation: 21/100 and 10/100 CPD: 4/100 and 6/100 Postpartum depression: 14/100 and 10/100		
Çakır Nemli (2017) [30] İzmir	2011–2014	Retrospective cross-sectional (hospital records)	13–17 (78) 24–28 (75)	16.46 ± 0.89 25.57 ± 1.38	Hemoglobin value: 11.62 ± 1.50 and 11.58 ± 1.19 Gestation age (week): 37.82 ± 2.47 and 38.58 ± 2.18) Preterm birth: 25/78 ve 10/75 Cesarean section: 42/78 ve 25/75 GDM: 2/78 ve /75 CPD/obstructed labour: 16/78 and 7/75; 1/78 and 2/75 Breech presentation: 7/78 and 2/75 Preeclampsia: 2/78 and 2/75 Gestational hypertension: 6/78 and 16/75 Oligohydramniosis: 15/78 and 7/75 Polyhydramniosis: 1/78 and 4/75	Birth weight (g): 3037.94 ± 562.71 and 3151.56 ± 442.81 1. minute Apgar score: 6.98 ± 0.69 and 7.06 ± 0.68 5. minute Apgar score: 7.93 ± 0.43 and 7.98 ± 0.41 IUGR: 19/78 and 7/75 Fetal distress: 36/78 and 22/75 Macrosomia: 4/78 and 0/75 Fetal anomaly: 1/78 and 3/75	Yes: 6/8
Çetin et al. (2015) [31] İstanbul	2007–2015	Retrospective case-control (hospital records)	≤18 (306) 19–40 (301)	15.78 ± 0.89 26.59 ± 4.20	Gestation age (week): 34.26 ± 3.86 and 37.73 ± 3.31 Anemia: 86/306 and 35/301 Cesarean section: 86/306 and 54/301 PPROM: 20/306 and 13/301 Preterm birth: 104/306 and 39/301 GDM: 16/306 and 25/301 Gestational hypertension: 19/306 and 15/301 Preeclampsia: 24/306 and 6/301 Eclampsia: 8/306 and 1/301 Postpartum hemorrhage: 17/306 and 10/301 Perineal injury: 33/306 and 6/301 Shoulder dystocia: 6/306 and 3/301 Placenta previa: 1/306 and 7/301 Placental abruption: 13/306 and 5/301	Birth weight (g): 2507.58 ± 586.22 and 3011.29 ± 636.70 Low birth weight: 99/306 and 11/301 1. minute Apgar score: 3.70 ± 1.26 and 5.59 ± 1.32 5. minute Apgar score: 6.29 ± 1.41 and 7.63 ± 1.24 Fetal Distress: 26/306 and 7/301 NICU admission: 51/306 and 9/301 Fetal anomaly:7/306 and 5/301 Stillbirth: 7/306 and 0/301	Yes: 10/10
Çift et al. (2017) [32] Bursa	2005–2014	Retrospective cross-sectional (hospital records)	14–18 (243) 19–36 (2738)	17.2 (14–18) 25.2 (19–34)	Preterm birth: 26 /243 and 128/2738 Preeclampsia: 21/243 and 142/2738 Cesarean section: 71/243 and 947/2738 Eclampsia: -/243 and 2/2738 PPROM: 7/243 and 45/2738 GDM: 2/243 and 32/2738 CPD/ obstructed labour: 31/243 and 320/2738 Breech presentation: 6/243 and 60/2738 Postpartum hemorrhage: 6/243 and /2738 Ablation placenta: 2/243 and 31/2738 Placenta previa:1/243 and 22/2738	Fetal distress: 18/71 and 164/947 IUGR: 20/243 and 71/2738 Macrosomia: 3/71 and 35/947	Yes: 8/8
Dağlı and Cantürk (2019) [33] Kırşehir	2016	Case-control (hospital records with a questionnaire)	≤19 (53) 20–35 (65)	17,51 ± 0,72 23,95 ± 4,43	Hemoglobin value: 12.011 ± 1.70 and 12.54 ± 1.45 Cesarean section: 11/53 and 31/65 CPD/ obstructed labour: 5/53 and 17/65 Breech presentation: 0/53 and 5/65 Placental abruption: 1/53 and 1/65	Birth weight (gr): 3095.85 ± 527.39 and 3184.38 ± 577.72 1. minute Apgar score: 8.36 ± 1.11 and 8.29 ± 1.33 5. minute Apgar score: 9.7 ± 0.95 and 9.68 ± 1.29 Fetal Distress: 5/53 and 8/65	Yes: 5/10
Demirci et al. (2016) [25] İstanbul	2008–2012	Retrospective cross-sectional (hospital records)	≤15 (85) 16–19 (1197) 20–34 (735)	14.63 ± 0.65 17.27 ± 0.74 23.01 ± 4.57	Anemia: 168/1282 and 75/735 GDM: 2/1282 and 24/735 Preeclampsia: 49/1282 and 64/735 Urinary infection: 95/1282 and 72/735 Episiotomy: 932/1282 and 438/735 Cesarean section: 254/1282 ve 184/735) Eclampsia: 2/1282 and 1/735 Preterm birth: 299/1282 and 147/735 Early preterm birth (<34 week): 138/1282 and 73/735 Postpartum hemorrhage: 22/1282 and 22/735	Birth weight (gr): 3098.4 ± 576.6 and 3042.28 ± 601.74 Low birth weight (<2500 g): 186/1282 and 134/735 Very low birth weight (<1500 g): 45/1282 and 25/735 IUGR: 24/1282 and 38/735 5. minute Apgar score <7: 23/1282 and 28/735 NICU admission:130/1282 and 114/735 Fetal death: 10/1282 and 9/735 Neonatal death: 4/1282 and 2/735	Yes: 8/8

					Ablatio placenta: 10/1282 and 4/735 Placenta previa:1/1282 and 6/735		
Demiröz (2008) [34] Aydın	2008	Cross-sectional (hospital records with a questionnaire)	14–19 (70) 20–39 (87)	16.81 ± 1.56 24.99 ± 4.49	Gestation age (week): 38.38 ± 3.73 and 38.08 ± 3.56) Hemoglobin value: 11.37 ± 1.35 and 11.54 ± 1.86 Anemia: 52/70 and 12/74 Preterm birth: 10/70 and 12/87 Cesarean section: 6/70 and 13/87	Birth weight (gr): 2832.0 ± 681.99 and 3041.85 ± 597.26 1. minute Apgar score: 8.37 ± 1.13 and 8.32 ± 1.20 Low birth weight: 14/70 and 9/86 Very low birth weight (<1500 g): 2/70 and 4/87 Congenital anomaly: 1/70 and 1/87 Neonatal death: 4/70 and 1/86	Yes: 6/8
Edirne et al. (2010) [35] Van	2008–2009	Cross-sectional (birth records with a questionnaire)	15–18 (211) 19–43 (1661)	Mean: 22.1	Cesarean section: 48/211 and 520/1661 Preterm birth: 60/211 and 244/1661 Inadequate prenatal care: 60/211 and 292/1661	Birth weight (gr): 2830 ± 470 and 3050 ± 430 Low birth weight: 37/211 and 140/1661	Yes: 5/8
Eren et al. (2015) [36] İstanbul	2005–2010	Retrospective cross-sectional (hospital records)	13–18 (998) 20–35(1493)	17.10 26.73	Cesarean section: 315/998 and 576/1493 PPROM: 54/998 and 35/1493 Preterm birth: 95/998 and 75/1493 Preeclampsia: 47/998 and 44/1493 GDM: 9/998 and 68/1493	Low birth weight (< 2.500 g): 135/998 and 160/1493 IUGR: 39/998 and 52/1493 5. minute Apgar score <7: 18/998 and 17/1493 Intrauterine death: 8/998 and 23/1493	Yes: 6/8
Ergen et al. (2017) [37] İstanbul	2014–2017	Retrospective cross-sectional (hospital records)	13–16 (145) 17–19 (1655) 20–21 (1585)	15.60 ± 0.6 18.38 ± 0.7 20.25 ± 0.4	Hemoglobin value: 9.78 ± 1.27; 10.08 ± 1.27 and 9.95 ± 1.21 Gestation age (week): 36.83 ± 2.97; 37.51 ± 2.46 and 38.16 ± 2.37 Cesarean section: 450/1800 and 469/1585 Preterm birth: 266/1800 and 35/1585 PPROM: 223/1800 and 135/1585 Preeclampsia:52/1800 and 94/1585 Episiotomy: 1270/1800 and 1109/1585 Postterm birth: 99/1800 and 138/1585	Low birth weight (<2.500 g): 245/1800 and 208/1585 Very low birth weight (<1500 g): 62/1800 and 43/1585 IUGR: 68/1800 and 86/1585 NICU admission: 120/1800 and 159/1585	Yes: 8/8
Görkem et al. (2017) [21] Çorum	2010–2014	Retrospective cross-sectional (hospital records)	12–19 (1774) 20–35 (16542)	18.3 ± 0.9 26.6 ± 4.3	Hemoglobin value: 11.7 ± 1.4 and 11.08 ± 1.7 Cesarean section: 605/1774 and 7682/16542 Major perineal trauma: 37/1774 and 163/16542	Birth weight (gr): 3116.6 ± 523.3 and 3236.3 ± 512.3 Low birth weight (<2.500 g): 169/1774 and 1078/16542 NICU admission: 580 /1774 and 5997/16542 Macrosomia: 37/1774 and 752/16542	Yes: 6/8
Şirin-Gül and Okumuş (2018) [38] Batman	2014	Case-control (hospital records with a questionnaire)	<20 (150) 20–29 (150)	17.86 ± 1.08 23.93 ± 1.80	Cesarean section: 52/150 and 65/150 Preterm birth: 16/150 and 15/150 PPROM: 16/150 and 18/150 Preeclampsia: 28/150 and 32/150 Postpartum hemorrhage: 4/150 and 22/150 Placenta previa: 8/150 and 6/150 Placental abruption: 11/150 and 5/150 Polyhydramniosis: 7/150 and 15/150 Oligohydramniosis: 20/150 and 51/150	Low birth weight: 30/150 and 28/150 Fetal distress: 26/150 and 41/150 IUGR: 30/150 and 25/150 Stillbirth: 4/150 and 4/150 Fetal anomaly: 4/150 and 12/150	Yes: 8/10
İleri et al. (2020) [39] İzmir	2009–2014	Retrospective case-control (hospital records)	12–17 (282) 20–35 (320)	16.4 ± 0,9 26.1 ± 4.8	Gestation age (week): 37.9 ± 2.4 and 38.4 ± 2.4 Cesarean section: 101/282 and 178/320 Preterm birth: 55/282 and 35/320 GDM: 6/282 ve 28/320 Preeclampsia: 21/282 and 9/320 Inadequate prenatal care:198/282 and 46/320 Polyhydramniosis: 6/282 and 13/320 Oligohydramniosis: 40/282 and 43/320	Birth weight (gr): 3053 ± 543 and 3160 ± 623 1. minute Apgar score: 7.0 ± 0.9 and 7.3 ± 0.7 5. minute Apgar score: 7.9 ± 0.6 and 8.0 ± 0.4 Fetal distress: 75/282 and 59/320 IUGR: 29/282 and 16/320 Fetal Anomaly: 0/282 and 3/320 Macrosomia: 10/282 and 26/320	Yes: 8/10
İnalöz et al. (2017) [22] Erzurum	2008–2012	Retrospective cross-sectional (hospital records)	9–19 (256) 20–29 (772)	17.93 ± 1.31 24.98 ± 2.89	Gestation age (week): 34.92 ± 4.59 and 35.71 ± 4.25 Cesarean section: 97/256 and 508/772 Preterm birth: 113/256 and 301/772 Preeclampsia: 41/256 and 85/772 Eclampsia: 5/256 and 5/772 Dystosia: 6/256 and 12/772 Breech presentation:19/256 and 48/772 Maternal death: -/256 and 2/772	Birth weight (g): 2430.42 ± 872.48 and 2667.77 ± 871.83 Congenital anomaly: 25/256 and 41/772	Yes: 6/8
Kamalak et al. (2016) [26] Karaman	2010–2011	Retrospective cross-sectional (Beck Depression Inventory-II	18 ≥ age (105) 19≤ age (105)	17 ± 1 25 ± 9	Pregnancy depression: 40/105 and 5/105	–	Yes: 8/8
Kaplanoglu et al. (2015) [40] Adıyaman	2013–2014	Retrospective cross-sectional (hospital records)	15–19 (233) 20–35 (202)	18.05 ± 1.17 (15–19)	Gestation age (week): 36.96 ± 2.1 and 37.6 ± 2.0 Cesarean section: 46/233 and 48/202	Birth weight (gr): 3035.5 ± 444.2 and 3164.7 ± 416.6 1. minute Apgar score: 7.1 ± 1.3 and 7.4 ± 1.3	Yes: 6/8

Table 1 (*Continued*)

Publication City	Data collection year	Study design / data source	Age (Sample size)	Mean / median age, year (SD)	Data on maternal health (adolecent and control)	Data on baby health (adolecent and control)	Quality score
					PPROM: 25/233 and 9/202 Preterm birth: 40/233 and 19/202 GDM: 9/233 and 8/202 Preeclampsia: 14/233 and 8/202 Postpartum hemorrhage:20/233 and 16/202	5. minute Apgar score: 7.5 ± 1.2 and 8.2 ± 1.2 NICU admission: 34/233 and 17/202 IUGR: 23/233 and 8/202 Low birth weight: 31/233 and 18/202	
Kara et al. (2017) [20] İstanbul	2014–2015	Case-control (psychiatrist interview with a questionnaire)	14–19 (85) 21–41 (50)	21.8 ± 6.46 (14–41)	Restlessness and distress: 23/85 and 23/50	–	Yes: 8/10
Karaaslan (2018) [41] Hakkâri	2016–2017	Retrospective case-control (hospital records)	15–19 (55) 20–25 (55)	Mean: 17.8 22.6	Hemoglobin value: 11.74 ± 1.42 and 12.18 ± 1.30 Cesarean section: 21/55 and 9/55 Preterm birth: 5/55 and 1/55 Preeclampsia: 8/55 and 3/55 CPD/ obstructed labour: 7/55 and 4/55 Breech presentation: 3/55 and 1/55 Placental abruption:1/55 and 0/55	Birth weight (g): 2904.36 ± 511.04 and 3143.75 ± 450.53 Fetal Distress: 6/55 and 2/55 Stillbirth: 1/55 and 0/55 Fetal anomaly: 4/55 and 1/55	Yes: 8/10
Karabulut et al. (2013) [42] Denizli	2010	Retrospective cross-sectional (hospital records)	15–19 (296) 20–35 (4957)	18.5 ± 1.1 26.7 ± 3.9	Cesarean section: 106/296 and 2577/4957 GDM: 2/296 and 79/4957 Preterm birth: 44/296 and 595/4957 Inadequate prenatal care: 32/296 and 500/4957	Birth weight (g): 3142 ± 571 and 3235 ± 839 Low birth weight: 34/296 and 357/4957	Yes: 8/8
Karataşlı et al. (2019) [7] İzmir	2013–2016	Retrospective cross-sectional (hospital records)	12–15 (101) 16–19 (3611) 25–30 (13501)	Median: 15 (12–15) 18 (16–19) 27 (25–30)	Cesarean section: 36/3712 and 263/13501 Preterm birth: 678/3712 and 3351/13501 Preeclampsia: 91/3712 and 474/13501 GDM: 42/ 3712 and 607/13501 Breech presentation: 142/3712 and 542/13501 Placental abruption: 10/3712 and 41/13501 Placenta previa: 5/3712 and 57/13501 Hyperemesis gravidarum: 77/3611 and 377/13501	Birth weight (g): 2934 ± 537.2/101; 3021 ± 629.3/3611 and 3112 ± 681.6/13501 5. minute Apgar score <7: 141/3712 and 472/13501 NICU admission: 326/3712 and 1224/13501 Stillbirth: 52/3712 and 201/13501	Yes: 8/8
Kaya et al. (2017) [8] Düzce	2015–2017	Retrospective case-control (hospital records)	≤19 (83) 20–35 (100)	17.5 ± 0.7 27.8 ± 5.3	Gestation age (week): 37.92 ± 2.33 and 38.75 ± 1.99 Hemoglobin value: 11.38 ± 1.36 and 11.10 ± 1.41 Cesarean section: 37/83 and 43/100 Preterm birth: 12/83 and 4/100 GDM: 1/83 and 0/100 Preeclampsia: 10/83 and 4/100 CPD/ obstructed labour: 10/83 and 8/100 Malpresentation: 5/83 and 3/100 Placental abruption: 2/83 and 0/100	Birth weight (gr): 3040 ± 521 and 3084 ± 562 NICU admission: 11/83 and 14/100 Fetal Distress: 9/83 and 5/100 IUGR: 8/83 and 7/100 Macrosomia: 4/83 and 0/100 Fetal anomaly: 2/83 and 0/100	Yes: 5/10
Keser et al. (2015) [23] Osmaniye	2013–2015	Retrospective cross-sectional (hospital records)	10–19 (539) 20–35 (644)	17.6 ± 1.21 26.77 ± 3.94	Hemoglobin value: 11.11 ± 1.43 and 11.19 ± 3.85 Cesarean section: 155/539 and 310/644 Preterm birth: 175/539 and 128/644 Preeclampsia: 12/539 and 11/644 GDM: 24/539 and 59/644	Birth weight (gr): 3086 ± 511 and 3195 ± 497 1. minute Apgar score: 8.70 ± 1.19 and 8.85 ± 0.83 5. minute Apgar score: 9.75 ± 1.15 and 9.86 ± 0.83 Stillbirth:6/539 and 3/644	Yes: 6/8
Keskin Kurt et al. (2014) [24] Hatay	2010–2014	Retrospective case-control (hospital records)	10–19 (300) 20–24 (300)	16.7 ± 1.2 21.8 ± 4.3	Hemoglobin value: 9.8 ± 2.1 and 11.1 ± 2.7 Preterm birth: 25/300 and 13/300 PPROM:13/300 and 12/300 Preeclampsia: 3/300 and 2/300 Eclampsia: 1/300 and -/300	Birth weight (gr): 2350±564 and 2900±348 1. minute Apgar score: 7.5 ± 1.3 and 8.2 ± 0.5 5. minute Apgar score:8.7 ± 1.5 and 8.9 ± 1.0	Yes: 8/10
Kırbaş et al. (2016) [43] Ankara	2008–2009	Retrospective case-control (hospital records)	15–19 (582) 20–34 (2920)	17.9 (14–19) 25.4 (20–34)	Gestation age (week): 38.2 ± 2.8 and 39.5 ± 2.1 Cesarean section: 165/582 and 910/2920 Preterm birth: 63/582 and 137/2920 PPROM:16/582 and 48/2920 Preeclampsia: 49/582 and 153/2920 Eclampsia: -/582 and 4/2920 GDM: 4/582 and 32/2920 CPD/ obstructed labour: 72/582 and 308/2920 Malpresentation: 14/582 and 58/2920 Postpartum hemorrhage: 13/582 and 75/2920 Ablasio placenta: 5/582 and 31/2920 Placenta previa: 2/582 and 22/2920	Birth weight (gr): 3031.2 ± 541.5 and 3172.2 ± 506.5 1. minute Apgar score <7: 40/582 and 117/2920 5. minute Apgar score <7: 30/582 and 137/2920 Low birth weight(1500–2500gr): 86/582 and 223/2920 Very low birth weight (<1500 g): 6/582 and 28/2920 Fetal distress: 41/582 and 158/2920 NICU admission: 37/582 and 107/2920 Macrosomia: 14/582 and 99/2920 Perinatal (stillbirth or neonatal) death: 6/582 and 25/2920	Yes: 10/10

Kuyumcuoğlu et al. (2012) [50] Diyarbakır	2010	Case-control (hospital records with a questionnaire)	15–18(51) 19–38 (96)	17.7 ± 3.3 28.8 ± 4.3	Gestation age (week): 36.6 ± 1.8 and 38.1 ± 1.5 Cesarean section: 5/51 and 46/96	Birth weight (g): 2953.5 ± 552.9 and 3536.9 ± 566.4 1. minute Apgar score: 4.9 ± 1.3 and 6.5 ± 1.5 5. minute Apgar score: 7.4 ± 1.1 and 8.4 ± 0.9	Yes: 8/10
Melekoğlu et al. (2013) [44] Adana	2008–2011	Retrospective cross-sectional (hospital records)	13–18 (80) 19–43 (102)	16.68 ± 0.88 29.09 ± 5.93	Gestation age (week): 36.55 ± 3.46 and 37.37 ± 3.07 Hemoglobin value: 10.75 ± 1.48 and 11.69 ± 1.17 Anemia: 32/80 and 13/102 Preterm birth: 30/80 and 22/102 Cesarean section: 31/80 and 58/102 Preeclampsia: 25/80 and 15/102	Birth weight (gr): 2796.69 ± 812.34 and 2892.60 ± 747.80 1. minute Apgar score (mean): 6.96 ± 2.29 and 7.43 ± 1.66 5. minute Apgar score (mean): 8.41 ± 2.0 and 8.71 ± 1.39 1. minute Apgar score <7: 35/80 and 36/102 5. minute Apgar score <7: 12/80 and 11/102 IUGR: 16/80 and 10/102 Fetal distress: 16/80 and 9/102 Fetal anomaly: 13/80 and 6/102 Macrosomia: 3/80 and 2/102	Yes: 6/8
Özdemirci et al. (2016) [45] Ankara	2012	Retrospective case-control (hospital records)	16–19 (313) 20–35 (418)	18.77 ± 0.59 26.9 ± 4.81	Gestation age (week): 39.96 ± 2.09 and 38.95 ± 1.34 Preterm birth: 29/313 and 10/418 Cesarean section: 73/313 and 134/418 GDM: 1/313 and 18/418 Gestational hypertension: 3/313 and 1/418	Birth weight (gr): 3169.8 ± 506.4 and 3361.2 ±484.8 Low birth weight: 25/313 and 21/418 Very low birth weight (<1500 g): 3/313 and 4/418 Stillbirth:1/313 and 5/418 Macrosomia: 11/313 and 30/418	Yes: 10/10
Sak et al. (2017) [18] Urfa	2015–2016	Retrospective cross-sectional (hospital records)	14–18 (26) 19–38 (50)	17.2 ± 1.07 28.88 ± 6.02	Gestation age (week): 34.85 ± 4.62 and 37.20 ± 2.19 Cesarean section: 16/26 and 13/50 Preterm birth: 10/26 and 12/50 GDM: 0/26 and 2/50 Preeclampsia: 5/26 ve 4/50 Breech presentation: 5/26 and 2/50 Placenta previa: 1/26 and 3/50	Birth weight (gr): 2490.76 ± 855.91 and 2880.62 ± 570.90 1. minute Apgar score: 5.35 ± 2.40 and 6.38 ± 2.03 5. minute Apgar score: 6.96 ± 2.96 and 8.10 ± 2.26 IUGR: 1/26 and 2/50 Fetal anomaly: 2/26 and 0/50 Macrosomia: 0/26 and 1/50	Yes: 6/8
Seçkin et al. (2016) [46] İstanbul	2014	Retrospective cross-sectional (hospital records)	14–19 (300) 20–35 (320)	16.72 ± 1.21 28.68 ± 4.14	Gestation age (week): 38.34 ± 2.19 and 38.14 ± 2.93 Needing blood transfusions:10/300 and 10/320 Cesarean section: 54/300 and 131/320 Preterm birth: 39/300 and 44/320 PPROM: 10/300 and 19/320 Preeclampsia: 17/300 and 10/320	1. minute Apgar score <7: 31/300 and 64/320 5. minute Apgar score <7: 29/300 and 36/320 Low birth weight (<2.500 g): 97/300 and 87/320 IUGR: 14/300 and 18/320 Fetal anomaly: 2/300 ve 9/320 Macrosomia: 10/300 and 21/320 Stillbirth: 3/300 and 9/320	Yes: 6/8
Soysal et al. (2019) [47] İstanbul	2012–2015	Retrospective cross-sectional (hospital records)	16–19 (172) 20–24 (160)	Median: 17 (16–19) 21 (20–24)	Hemoglobin value: 11.08 ± 1.73 and 11.54 ± 1.41 Anemia: 66/172 and 42/160 Cesarean section: 37/172 and 45/160 Preterm birth: 43/172 and 23/160 PPROM: 14/172 and 8/160 Preeclampsia /eclampsia: 11/172 and 5/160 GDM: 3/172 and 3/160 CPD: 7/172 and 4/160 Malpresentation: 13/172 and 14/160 Inadequate prenatal care: 128/172 and 85/160 Postpartum hemorrhage: 2/172 and 4/160	Fetal distress: 14/172 and 18/160 IUGR: 10/172 and 7/160 Fetal anomaly: 6/172 and 5/160 Stillbirth: 3/172 and 4/160	Yes: 8/8
Temur et al. (2016) [48] Diyarbakır	2013–2014	Retrospective cross-sectional (hospital records)	14–19 (1314) 20–45 (1850)	18 ± 1.1 28.7 ± 5.8	Gestation age (week): 37.6 ± 2.5 and 38.6 ± 2.3 Preterm birth: 489/1354 and 446/1850 Cesarean section: 228/1354 and 520/1850	Birth weight (gr): 3000 ± 50 and 3200 ± 50 1. minute Apgar score: 7.6 ± 1.1 and 8.0 ± 0.9 5. minute Apgar score: 9.5 ± 1.3 and 9.8 ± 0.8	Yes: 6/8

CPD: Cephalopelvic disproportion; PPROM: Preterm premature rupture of membranes; GDM: Gestational diabetes mellitus; NICU: Neonatal intensive care unit; IUGR: Intrauterine growth restriction.

Inclusion and exclusion criteria

Studies published and fully accessible in Turkish and English in Turkey during the years 2008–2020 were included in the research. The studies contained in this systematic review and meta-analysis met the following criteria of PICOS: Participants: Adolescents. Exposure: Pregnancy. Comparison: pregnant women age 20 and over. Main outcomes in terms of maternal health were caesarean delivery, preterm labor, early membrane rupture, preeclampsia/gestational hypertension, eclampsia, cephelopelvic incompatibility/dystocia, anemia, postpartum hemorrhage, breech presentation/presentation abnormality, episiotomy/perineal trauma and inadequate prenatal care. Main outcomes in terms of infant health were birthweight, perinatal baby death (intrauterine death or stillbirth and neonatal death), fetal distress, Apgar scores in the first and fifth minute, low birthweight/intrauterine growth retardation and admittance to the neonatal intensive care unit. Additional outcomes in terms of maternal health were gestational diabetes, depression/uneasiness/distress, hemoglobin values, gestational age (weeks), placental abruption, placenta previa, oligohydramnios and polyhydramnios. Additional outcomes in terms of infant health were fetal anomaly and macrosomia. These outcomes were include and presented in this systematic review as reported in the studies. In addition, results regarding violence, socio-cultural and economic problems of adolescent pregnancy were not reported in the studies included, and these outcomes were presented in this study. Study design: Retrospective cross-sectional and case-control studies.

Identification of studies for inclusion

The scanning for this study was performed in January 2020. The scan of the literature was carried out in the electronic data bases PubMed, Clinical Key, Science Direct, Web of Science, Google Akademik, Ulusal Tez Merkezi, Dergi park, Ulakbim, Türk Medline and Türkiye Klinikleri. The scans in the international databases were made based on the key phrases “adolescent pregnancy or teenage pregnancy” and “Turkey” in accordance with Medical Subject Headings (MeSH); the national databases were scanned for the phrase “adolesan gebelik” (adolescent pregnancy) in accordance with Turkish Scientific Terms (TST). Example for a PubMed scan: ("pregnancy in adolescence"[MeSH Terms] OR ("pregnancy"[All Fields] AND "adolescence"[All Fields]) OR "pregnancy in adolescence"[All Fields] OR ("adolescent"[All Fields] AND "pregnancy"[All Fields]) OR ("teenage"[All Fields] AND "pregnancy"[All Fields]) OR "teenage pregnancy"[All Fields]) "adolescent pregnancy"[All Fields]) AND ("turkey"[MeSH Terms] OR "turkey"[All Fields])) AND ("2010/04/09"[PDat]:"2020/04/05"[PDat]) AND "humans"[MeSH Terms] AND English[lang] AND "adult"[MeSH Terms]). Additionally, the reference lists of the included studies were also checked.

Study selection

The articles that were eligible for inclusion in our study were independently chosen by two of the authors, who eliminated articles that had been repeated in the scan, making their selection based on heading, abstract and full text. Articles that had been published in Turkish and English were included. After the selection, the three authors met together to decide upon the studies that could be taken into the analysis on the basis of full texts. At the same time, some studies were eliminated in the data extraction and analysis stages because of a lack of suitable data.

Data extraction

A data extraction instrument devised by the researchers was used in obtaining study data. This data extraction instrument served to obtain data related to the studies included in the systematic review and meta-analysis in terms of where and when the studies were conducted, the method, data sources, sample sizes and age ranges treated, the mean/median age of the mothers and other information on the impact of adolescent pregnancy on maternal and infant health. The data extraction process was carried out by two of the authors independently under the supervision of the senior author. No data extraction was made from studies that treated adult and advanced-age pregnancies. Furthermore, wherever continuous variables appearing in studies on early adolescent and adolescent groups prevented compilation, only data belonging to late adolescence were extracted. Data on maternal and baby health were extracted as reported in the studies.

Methodological quality assessment of the studies

The articles included in this systematic review were examined by two of the authors and checked by the senior researcher for their methodological quality. The IJB Critical Appraisal Checklist for Analytical Cross-sectional and Case-control Studies published by the Joanna Briggs Institute was used in the quality assessment [17]. The first of the checklists used consisted of eight, the second of 10 items. The assessments were made on the basis of a response to each item of Yes, No, Unclear or Not applicable. The results of the assessment were presented on the basis of the total number of items considered as a “*Quality Score*” in Table 1.

Data synthesis

The meta-analysis was performed using Review Manager 5.3 (The Nordic Cochrane Center, Copenhagen, Denmark) for data analysis. Heterogeneity between studies was assessed using Cochran’s Q test and Higgins’ I^2, with I^2 greater than 50 % considered to indicate significant heterogeneity. The Odds Ratio was calculated for categorical variables and Mean Difference was calculated for continuous variables. All tests were calculated from two-tailed tests, and a p value of less than 0.05 was considered statistically significant.

Findings of fetal mortality, intrauterine mortality, neonatal death and postpartum infant death were collected under the heading “perinatal mortality.” Findings of low birthweight (<2.500 g) and intrauterine growth retardation were collected under the heading “low birthweight/intrauterine development retardation,” and in studies where both of these findings were present, only the “low birthrate” finding of the study was included in the analysis.

Findings in articles included in the meta-analysis regarding cephelopelvic disproportion, failed labor, non-progressive labor and dystocia were compiled as “cephelopelvic disproportion/dystocia,” while breech presentation and abnormal presentation findings were analyzed under “breech presentation/abnormal presentation.” Again, findings regarding the need for a blood transfusion, anemia and low hemoglobin levels were compiled in the meta-analysis under the heading “anemia,” preeclampsia and gestational hypertension findings were placed under the heading “preeclampsia/gestational hypertension,” findings on depression, unrest and distress under the heading “depression/unrest/distress” and findings on episiotomy and perineal trauma were treated under “episiotomy/perineal trauma.”

Results

Literatur search results

A total of 10,812 records were obtained at the start of the scan. With the exclusion of the records that were repeats, the review

carried out according to heading and abstract yielded the full texts of 159 articles. From among the full texts, a total of 38 articles that indicated the results of comparisons of adolescent and adult pregnancies and studies on maternal and infant health were selected for the meta-analysis. Remarks on the process of article selection are shown in Fig. 1.

Characteristics of included study

Of the published studies, 25 were in English and 13 in Turkish. Twenty-three of the studies were cross-sectional and 15 were case-control; data for 30 were obtained from hospital records, five by hospital records with a questionnaire, one by birth records with a questionnaire, one with Beck Depression Inventory-II and one by psychiatrist interview with a questionnaire. It was noted that the study data had been collected over the period 2005–2018 and published over the period 2008–2020. The studies had been performed in 25 different provinces of Turkey and in seven regions.

The total sample size included in the review and meta-analysis was 80,249 (adolescents: 20,768; control: 59,481). It was observed that the sample sizes in the adolescent groups varied between 26 [18] and 3875 [19], and between 50 [18,20] and 16,542 [21] in the control groups.

The ages of the adolescents in the studies ranged between 9–19 and 20–49 in the control groups. The minimum age limit of the adolescents accepted into one study [22] was 9, 10 in two studies [23,24], and not specified in another two studies [25,26] (Table 1).

Quality assessment results of the studies

The quality assessment scores for the cross-sectional studies were yes: 8/8 in eight studies, yes: 6/8 in 14 studies, and yes: 5/8 in one study. The quality assessment scores for the case-control studies were yes: 10/10 in five studies, yes: 8/10 in eight studies, and yes: 5/10 in two studies (Table 1). Eighteen of the studies reviewed (47.4 %) fulfilled all the criteria and exhibited a low risk of bias. In 22 (57.9 %) of the entire volume of studies of both kinds, no confounding/contributing factors had been described.

Results of meta-analysis of effects of adolescent pregnancy on maternal health and pregnancy outcomes

Nineteen correlational results were found in this systematic review and meta-analysis regarding the effects of adolescent pregnancy on maternal health and pregnancy. Findings on the effect of adolescent pregnancy on the mode of delivery were reported in thirty-three studies [5–8,18,19,21–25,27–48]. The pooled results of these studies show that cesarean was performed at a lower rate in adolescent pregnancies (OR: 0.70, $p < 0.001$) (Table 2).

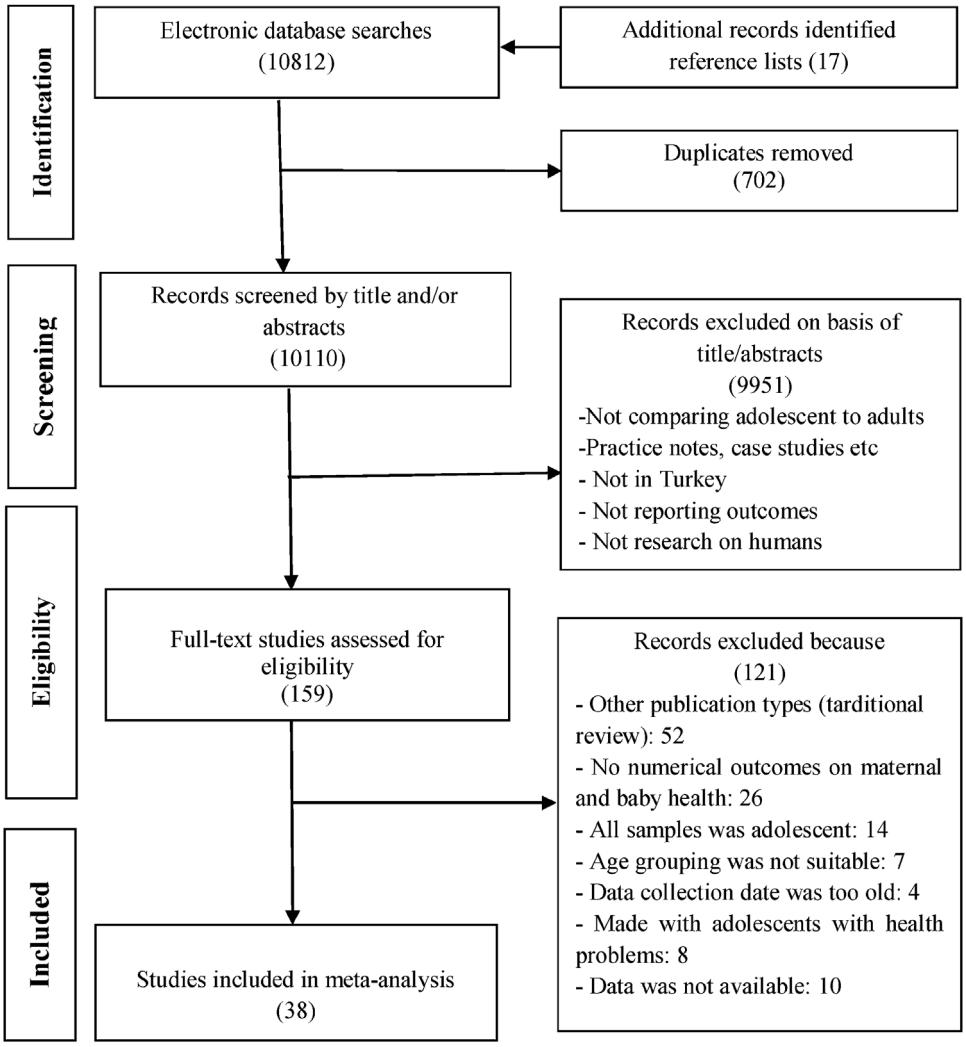

Fig. 1. PRISMA flow diagram of the search process.

Table 2
Meta-analysis results of categorical variables related to the effects of adolescent pregnancies on maternal and baby health.

Variables	Study number	Adolecent Event / Total	Control Event / Total	Odds Ratio M-H, Random/ Fix, %95 (CI)	Heterogeneity			Test for overall effect: Z / p
					Tau^2	Chi^2 / df / P	I^2 (%)	
Maternal outcomes								
Cesarean section	33	5146/20250	19968/58860	0.70 (0.58–0.85)	0.25	485.35/32/ <0.001	93	3.62/<0.001
Preterm birth	29	3443/17741	6304/40805	2.12 (1.64–2.72)	0.39	467.39/28/ <0.001	94	5.82/<0.001
Preterm premature rupture of membranes	13	552/9563	515/16562	1.49 (1.19–1.86)	0.08	25.21/12/0.01	52	3.46/<0.001
Preeclampsia/gestational hypertension	29	616/16809	1602/34088	1.03 (0.75–1.42)	0.54	197.45/28/ <0.001	86	0.18/0.86
Eclampsia	8	27/6921	39/12861	2.05 (0.67–6.25)	1.46	20.01/7/0.006	65	1.26/0.21
Gestational diabetes mellitus	16	206/13209	1135/32658	0.35 (0.23- 0.520.23–0.52)	0.37	56.97/15/ <0.001	74	5.11/<0.001
Anemia	10	492/6303	248/5931	2.60 (1.56–4.32)	0.54	63.89/9/<0.001	86	3.67/<0.001
Cephalopelvic disproportion/ dystosia	13	250/5948	838/12549	1.30 (0.92–1.85)	0.21	35.02/12/0.001	66	1.49/0.14
Breech presentation/ malpresentation	11	314/9150	785/24414	1.39 (1.00–1.92)	0.13	24.13/10/0.007	59	1.97/0.05
Postpartum hemorrhage	8	90/3495	271/8504	0.66 (0.41–1.06)	0.28	19.06/7/0.008	63	1.72/0.09
Ablasio placenta	9	46/5466	120/20205	1.16 (0.80–1.69)	–	9.30/8/0.32	14	0.75/0.43
Placenta previa	7	19/5301	107/20395	0.52 (0.31–0.88)	–	4.72/6/0.58	0	2.45/0.01
Oligohydramniosis	4	140/1037	236/1843	0.93 (0.47–1.85)	0.40	21.13/3/<0.001	86	0.20/0.84
Polyhydramniosis	4	27/1037	85/1843	0.52 (0.33–0.81)	–	0.82/3/0.84	0	2.90/0.004
Episiotomy/perineal trauma	4	2613/5162	1716/19163	4.14 (0.76–22.49)	2.93	748.48/2/ <0.001	100	1.64/0.10
Depression/restlessness/distress	3	77/290	38/255	1.94 (0.29–12.91)	2.60	29.45/2/<0.001	93	0.69/0.49
Inadequate prenatal care	4	418/961	923/7098	2.91 (1.00–8.52)	1.16	92.14/3/<0.001	97	1.95/0.05
Maternal mortality	1	0/256	2/772	0.60 (0.03–12.56)	–	–	–	0.33/0.74
Neonatal outcomes								
Low birth weight (< 2500 g)/ intrauterine growth restriction	25	1965/14080	3181/41699	2.06 (1.59–2.68)	0.34	262.06/24/ <0.001	91	5.41/<0.001
Very low birth weight (< 1500 g)	6	232/4574	193/7043	1.38 (0.72–2.64)	0.46	33.26/5/<0.001	85	0.98/0.33
Neonatal intensive care unit admission	9	1306/9822	7657/35982	1.18 (0.90–1.54)	0.12	69.61/8/<0.001	89	1.18/0.24
Fetal distress	14	507/5538	646/9338	1.78 (1.22–2.59)	0.35	66.79/13/ <0.001	81	2.98/0.003
1. minute low Apgar score (Apgar score <7)	4	220/4837	343/7217	1.01 (0.59–1.73)	0.25	21.93/3/<0.001	86	0.03/0.98
5. minute low Apgar score (Apgar score <7)	7	757/10829	1029/22946	1.10 (0.82–1.47)	0.10	28.65/6/<0.001	79	0.61/0.54
Fetal anomaly	14	78/2177	100/4083	1.62 (0.90–2.91)	0.58	29.83/13/0.005	56	1.62/0.11
Perinatal baby death (stillbirth or neonatal)	14	177/12421	375/25878	1.09 (0.73–1.64)	0.25	32.69/13/0.002	60	0.43/0.67
Intrauterine death or stillbirth	12	163/11769	337/22872	1.13 (0.66–1.92)	0.46	41.76/11/ <0.001	74	0.43/0.66
Neonatal death	3	10/1429	4/2041	4.99 (0.72–34.68)	1.79	5.14/2/0.08	61	1.62/0.10
Macrosomia	11	100/7454	9074/25618	0.54 (0.43–0.67)	–	15.38/10/0.12	35	5.57/<0.001

Findings on the effect of adolescent pregnancy on preterm labor were reported in twenty-nine studies [5–8,18,19,22–25,27,28,30–32,34–37,39–48]. The pooled results based on these studies showed that the incidence of preterm labor in adolescent pregnancy was twice that experienced in adult pregnancy (OR: 2.12, $p < 0.001$) (Table 2). Again, 20 studies provided data on average gestational age (weeks) [18–20,22,27,28,30,31,34,36,37,39,40,43–46,48–50]. These data showed that the duration of pregnancy was shorter in adolescent pregnancies (MD: -0.86 weeks, $p < 0.001$) (Table 3).

Findings on the effect of adolescent pregnancy on preeclampsia/gestational hypertension were reported in twenty-nine studies included in the meta-analysis [5–8,18,19,22–25,27–32,36–41,43–47,49,51]. According to the calculations made on the basis of these results, it was observed that adolescent pregnancy did not affect the prevalence of preeclampsia/gestational hypertension (OR: 1.03, $p = 0.86$). Likewise, the researchers in eight studies [19,22,24,25,27,31,32,43] treated the effect of adolescent pregnancy on eclampsia and found that the prevalence of eclampsia was similar in both groups (OR: 2.05, $p = 0.21$) (Table 2).

The effect of adolescent pregnancy on the prevalence of gestational diabetes was reported in sixteen studies [7,18,19,23,25,30–32,36,39,40,42,43,45,47,51]. The pooled results of these reports showed that there was a lower prevalence of gestational diabetes in adolescent pregnancies as compared to adults (OR: 0.35, $p < 0.001$) (Table 2).

The effect of adolescent pregnancy on early membrane rupture was reported in thirteen studies [19,24,27,29,31,32,36–38,40,43,46,47]. The pooled results of these studies indicated that early membrane rupture was 1.5 times more prevalent in adolescent pregnancies (OR: 1.49, $p < 0.001$) (Table 2).

There were eleven studies on adolescent pregnancy and breech presentation/abnormal presentation [7,8,18,19,22,28,30,32,41,43,47]. The pooled results showed that the prevalence of breech presentation/abnormal presentation in adolescent pregnancy was similar to what was observed in adults (OR: 1.39, $p = 0.05$) (Table 2).

In another thirteen studies that reported on the correlation between adolescent pregnancy and cephalopelvic disproportion/dystocia [6,8,9,22,27,28,30–33,41,43,47], no significant difference could be found between the two groups (OR: 1.30, p = 0.14). Results pertaining to the correlation between adolescent pregnancy and the prevalence of postpartum hemorrhage were reported in eight studies taken into the meta-analysis [25,29,31,32,38,40,43,47], where the two groups studied were found to be similar in terms of this variable (OR: 0.66, p = 0.09) (Table 2).

Nine of the studies reviewed reported results on the prevalence of placenta abruption [7,8,25,31–33,38,41,43], while seven investigated placenta previa [7,18,25,31,32,38,43]. The meta-analysis of these results revealed that both groups investigated were similar in terms of the prevalence of placenta abruption (OR: 1.16, p = 0.43) while placenta previa was less common in adolescent pregnancies (OR: 0.52, p = 0.01). Another four of the studies reported data on oligohydramnios and polyhydramnios [29,30,38,39]. While the pooled results of these studies indicated that both groups were similar in terms of the prevalence of oligohydramnios (OR: 0.93, p = 0.84), it was noted that polyhydramnios was less prevalent in adolescent pregnancy (OR: 0.52, p = 0.004) (Table 2).

Four studies reported results on episiotomy/perineal trauma [21,25,31,36]. These data showed that the likelihood of episiotomy/perineal trauma in adolescent pregnancy was 4 times higher, but this effect was found not to be statistically significant (OR: 4.14, p = 0.10) (Table 2).

In ten studies reviewed, data was provided on low hemoglobin levels or the prevalence of anemia [5,6,19,25,28,31,34,44,46,47]. The pooled results based on these data indicated that the prevalence of low hemoglobin levels or anemia was twice as much in adolescent pregnancies (OR: 2.60, p < 0.001) (Table 2). Again, another 15 studies reported data on hemoglobin levels in pregnant women [5,6,8,21,23,24,28–30,33,37,41,44,47,49]. The pooled results of these studies indicated that hemoglobin levels were lower in adolescent pregnancies compared to adults (MD: -0.53 g/dl, p = 0.004) (Table 3).

In four studies where insufficient prenatal care was examined in adolescent pregnancies [35,39,42,47], it was seen that the probability of adolescents receiving insufficient prenatal care was approximately 3 times more than in adults. This difference however was not statistically significant (OR: 2.91, p = 0.05). In another three studies where results concerning depression/uneasiness/distress in adolescent pregnancies were reported [6,20,26], the pooled results showed no significant difference between the two groups (OR: 1.94, p = 0.49) (Table 2).

Only one of the studies reviewed in this systematic review reported a results on maternal mortality [22]. Analysis made with this data showed that there was no difference between the adolescent and adults groups (OR: 0.60, p = 0.74) (Table 2).

Results of the meta-analysis of effects of adolescent pregnancy on infant health

Twelve correlational results were found in this systematic review and meta-analysis regarding the effects of adolescent pregnancy on infant health. Twenty-five studies revealed the results of their examination of the effect of adolescent pregnancy on the frequency of low infant birthweight/intrauterine growth retardation [8,18,19,21,25,27,29–32,34–40,42–47,49,51]. The pooled results of these studies showed that the prevalence of low infant birthweight/intrauterine growth retardation among babies of adolescent mothers was approximately twice that of other infants (OR: 2.06, p < 0.001). Another six research articles revealed the results of an examination of the prevalence of very low birthweight in babies of adolescent mothers [25,29,34,37,43,45]. The meta-analysis based on the pooled results of these studies showed that babies born of adolescents were similar to those of adults in terms of the prevalence of very low birthweight (OR: 1.38, p = 0.33) (Table 2).

Twenty-eight studies taken into the meta-analysis indicated mean birthweight figures for babies of adolescent mothers [5–8,18,19,21–25,28–31,33–35,39–45,48–50]. Based on these results, it was found that the mean birthweight of babies of adolescents were statistically and significant lower than the infants of adults (MD: -0.36 g; p < 0.001) (Table 3). Again, results on the prevalence of macrosomia were reported in 11 studies [8,18,19,21,30,32,43–46,51]. The findings showed that the prevalence of macrosomia among infants of adolescents was statistically and significantly lower than among the infants of adults (OR: 0.54, p < 0.001). In fourteen of the studies taken into the meta-analysis, the effect of adolescent pregnancy on fetal distress was examined [6,8,19,28,30–33,38,39,41,43,44,47], and it was noted that the prevalence of fetal distress was higher among infants of adolescents (OR: 1.78, p = 0.003) (Table 2).

Seventeen studies examined in this study provided results on mean Apgar scores in the 1 st minute among infants of adolescents [5,6,18,19,23,24,28,30,31,33,34,39,40,44,48–50]. The pooled results indicated that the mean Apgar scores of babies of adolescents in the 1 st minute were lower than those of infants of adults (MD: -0.43, p < 0.001). In another 16 studies [5,6,18,19,23,24,28,30,31,33,39,40,44,48–50] that provided the 5th-minute Apgar scores of babies of adolescents, pooled results showed that these 5th-minute Apgar mean scores were lower among the infants of adolescents (MD: -0.36, p < 0.001) (Table 3).

Four of the studies revealed the results about Apgar score of <7 at the 1th-minute [19,43,44,46] and seven studies pointed to a prevalence of low 5th-minute Apgar scores [7,19,25,36,43,44,46]. The pooled results of these studies indicated a prevalence of low 1 st and 5th minutes Apgar scores among the babies of adolescents that was similar to that among the babies of adults (OR: 1.01, p = 0.98 and OR: 1.10, p = 0.54) (Table 2).

In nine studies included in the systematic review, data was provided on the admittance of newborns of adolescents into the intensive care unit [5,7,8,21,25,31,37,40,43]. The results showed that there was no significant difference between the groups in terms of admittance of the newborn into the intensive care unit (OR: 1.18, p = 0.24) (Table 2).

Fourteen studies taken into the meta-analysis provided reports on the prevalence of perinatal baby death, intrauterine death or stillbirth and neonatal death [7,19,23,25,27,31,34,36,38,41,43,45–47] and 14 studies reported on the prevalence of fetal abnormalities among the infants of adolescents [5,8,18,22,27,28,31,38,39,41,44,46,47,51]. The results of the meta-analysis failed to show any significant difference with respect to these factors (Table 2).

Comparison of early and late adolescent groups in terms of maternal and infant health outcomes

In three of the investigated studies, data were available according to the age groups of adolescents [7,25,37]. In addition, it was examined the variation of some primary and secondary outcome variables of the study according to early and late adolescent groups in this meta-analysis. The meta-analysis of these results revealed that both groups investigated were similar in terms of the prevalence of anemia (OR: 1.34, 95 %: 0.73 to 2.43, Z = 0.95, p = 0.34) [25], gestational diabetes (OR: 1.12, 95 %: 0.22–5.82, Z = 0.14, p = 0.89, I^2 = 0%) [7,25], hiperemezis: (OR: 0.22, 95 %: 0.01–3.65, Z = 1.05, p = 0.29) [7], preeclampsia (OR: 1.24, 95 %: 0.68–2.26, Z = 0.70, p = 0.49, I^2 = 7%) [7,25,37], eclampsia (OR: 2.80, 95 %: 0.13–58.71, Z = 0.66, p = 0.51) [25], postpartum hemorrhage (OR: 2.27, 95 %: 0.66–7.82, Z = 1.30, p = 0.19) [25], ablatio placenta (OR: 1.61, 95 %: 0.30–8.63, Z = 0.56, p = 0.58, I^2 = 0%) [7,25], placenta

previa (OR: 0.57, 95 %: 0.08–4.15, Z = 0.56, p = 0.57, I^2 = 46) [7,25], birth weight (gr): (MD: -181.76 g, %95 CI: -388.01–24.48, Z = 1.73, p = 0.08, I^2 = 76) [7,25], low birth weight (OR: 2.21, 95 %: 0.94–5.21, Z = 1.81, p = 0.07, I^2 = 85) [25,37], very low birth weight (OR: 1.60, 95 %: 0.86–2.96, Z = 1.49, p = 0.14, I^2 = 0) [25,37], 5. minute Apgar score <7 (OR: 2.63, 95 %: 0.66–10.41, Z = 1.38, p = 0.17, I2 = 77) [7,25], fetal death or stillbirth (OR: 2.32, 95 %: 0.23–22.97, Z = 0.72, p = 0.47, I^2 = 73) [7,25] and perinatal baby death (fetal/neonatal death or stillbirth) (OR: 2.71, 95 %: 0.20–37.39, Z = 0.74, p = 0.46, I^2 = 81) [7,25].

The results of the meta-analysis showed that preterm birth (OR: 2.91, 95 %: 2.01–4.21, Z = 5.68, p < 0.001, I^2 = 58 %) [7,25,37], early membrane rupture (OR: 5.22, 95 %: 3.60–7.57, Z = 8.70, p < 0.001) [37], intrauterine growth retardation (OR: 2.45, 95 %: 1.38–4.35, Z = 3.07, p = 0.002, I^2 = 0) [25,37], admission to intensive care unit (OR: 2.65, 95 %: 1.96–3.57, Z = 6.36, p < 0.001, I^2 = 25) [7,25,37] and neonatal death (OR: 14.40, 95 %: 2.00–103.50, Z = 2.65, p = 0.008) [25] was more common in early adolescent pregnancies than in late adolescents. Again, one study [37] reported that the duration of pregnancy was shorter and hemoglobin levels are lower in early adolescent pregnancies than in late adolescents (respectively, MD: -0.68 week, %95 CI: -1.18 to -0.18, Z = 2.68, p = 0.007; MD: -0.30 g, % 95 CI: -0.52 to -0.08, Z = 2.73, p = 0.006). The pooled results of these studies showed that there was lower prevalence of episiotomy (OR: 0.53, 95 %: 1.10–2.11, Z = 2.55, p = 0.01, I^2 = 0) [25,37], cesarean section (OR: 0.64, 95 %: 0.42 to 0.95, Z = 2.20, p = 0.03, I^2 = 11) [7,25,37] and postterm birth (OR: 0.11, 95 %: 0.02 to 0.80, Z = .18, p = 0.03) [37] in early adolescent pregnancies as compared to late adolescents.

Discussion

This systematic review and meta-analysis presents the pooled results of 38 studies conducted in Turkey on adolescent pregnancy and its effects on maternal and infant health. The data point to 19 factors concerned with the effect of adolescent pregnancy on maternal health and pregnancy and 12 factors with respect to infant health. The results of the meta-analysis are valuable in that they reveal outcomes related to the effect of adolescent pregnancy on maternal and infant health in a developing country such as Turkey, which is important information specific to the country itself and which may also be used in comparisons with other countries. These results may also contribute to the improvement of healthcare for adolescents and adolescent women who are pregnant.

Effects of adolescent pregnancy on maternal health and pregnancy outcomes

It was found in this study that the cesarean section birth rate among adolescents was statistically lower. Similar results have been reported in previous studies [14,52]. This finding may be associated with the fact that some women in the control groups had multiple experiences of childbirth by cesarean section. Based on this finding, it can be said that there is a need for further studies of primipara birth outcomes in both groups.

It was seen in this systematic review and meta-analysis that preterm births were approximately twice the number among adolescents and that the duration of pregnancy (in weeks) was shorter. Studies carried out in the different healthcare systems of both developed and developing countries similarly indicate that pregnant adolescents are at risk of preterm labor and delivery [12–14]. It was also reported in the literature that pregnant adolescents were more likely to be at risk of preterm delivery due to prostaglandin stimulation as a result of a short cervix (<25 mm), small uterus volume and immature cervical blood flow and that anemia related to nutritional deficiencies may contribute to this risk [12,13]. Accordingly, this knowledge must be kept in mind during the antenatal monitoring of pregnant adolescents.

Our meta-analysis showed that pregnant adolescents and adults were similar in terms of the prevalence of preeclampsia/gestational hypertension and eclampsia. Similar results were reported in some studies in the literature [11–13]. On the other hand, there were studies that report the contrary [9,14,53]. Moraes et al. [54] report that the likelihood of adolescent mothers developing eclampsia was forty times greater in the age group 20−24. It is also stated that the prevalence of preeclampsia and eclampsia was higher in pregnant adolescents and that this can be associated with inadequate prenatal care, an increase in metabolic rate, disadvantaged socioeconomic conditions and level of education.

Our study findings indicated that the prevalence of gestational diabetes among pregnant adolescents was less than among adult women. Many previous studies have reported similar findings [11,14]. These results are valuable since they provide guidance into how pregnant adolescents can be monitored and provided care.

It was seen in the meta-analysis that there was more of an incidence of early membrane rupture among pregnant adolescents. Many studies in the literature support this finding [53,55]. It was furthermore asserted that the higher rate of sexually transmitted infections among adolescents may increase the risk of early membrane rupture [15].

Our study indicated that the incidence of breech presentation/abnormal presentation and cephalopelvic disproportion/dystocia was similar in adolescents and adults. Likewise, Moraes et al. [54] reported that there was no significant difference between adolescents and adults in terms of cephalopelvic disproportion or an unsuccessful progress of labor. Contrary to these data, Rupakala et al. [53] have stated that cephalopelvic disproportion and obstructed labour were significant indications for cesarean section in teenage mothers. These outcomes may be associated with differences in diagnostic processes and the need for more scientific data.

The likelihood of episiotomy/perineal trauma among pregnant adolescents in our study was four times greater but it was observed that this effect was not statistically significant. Korencan et al. [13] have reported similar results. Socolov et al. [52] report that episiotomy rates were higher in adolescent pregnancies compared to adults but that first- and second-degree perineal trauma rates were lower while 3rd- and 4th-degree perineal trauma rates were similar in the two groups. In Turkey however, this outcome was thought to be associated with the routine practice of performing episiotomies on primiparae.

Our study indicated that adolescents and adults were similar in the incidence of breech presentation/abnormal presentation. Similarly, Shrim et al. [56] report that abnormal presentation rates were similar among adolescent and adult groups. Liran et al. [57] revealed that breech presentation was more common in adolescent pregnancies. This may be explained by the fact that this group is more likely to experience preterm labor. The inconsistencies between study results furthermore can be associated with the differences in practices implemented during the diagnostic process.

The results of this systematic review and meta-analysis showed that hemoglobin counts were lower among pregnant adolescents and the incidence of anemia was greater. Similarly, many studies demonstrated that there has been a 2−3-fold increase in the prevalence of anemia among pregnant adolescents [12,13]. This result suggests a failure to meet the nutritional needs of pregnancy, especially at a time of life where adolescents are in a stage of growth and development. Other factors involved may be low socioeconomic status and nutritional behaviors. Because of this, it

Table 3
Meta-analysis results of continuous variables related to the effects of adolescent pregnancies on maternal and baby health.

Variables	Study number	Adolecent	Control	Mean Difference IV, Random, 95 % (CI)	Heterogeneity			Test for overall effect: Z / p
					Tau^2	Chi^2 / df / P	I^2 (%)	
Maternal outcomes								
Hemoglobin value (gr/dl)	15	5729	21411	−0.53 (-0.88;-0.17)	0.45	557.31/14/<0.001	97	2.90/0.004
Gestation age (week)	20	10882	16062	−0.86−0.86 (-1.22;-0.51)	0.54	402.46/19/<0.001	95	4.78/<0.001
Neonatal outcomes								
Birth weight (gr)	28	16462	52311	−0.36 (-0.44;-0.28)	0.04	350.01/27/<0.001	92	8.85/<0.001
1. minute Apgar score	17	7515	8452	−0.43 (-0.67;-0.20)	0.20	515.33/16/<0.001	97	3.68/<0.001
5. minute Apgar score	16	7445	8365	−0.36 (-0.53;-0.19)	0.09	331.01/15/<0.001	95	4.11/<0.001

is vital that this risk is taken into consideration during the antenatal, intrapartum and postpartum provision of healthcare services to pregnant adolescents.

This meta-analysis indicated that adolescents and adults were similar in terms of the prevalence of postpartum hemorrhage. This information was supported by Zhang et al. [14], while Oyeyemi et al. [58] reported that the risk of postpartum hemorrhage was higher in adolescents. These results indicate that there is a need for more comprehensive studies.

In terms of the prevalence of placental abruption, both adolescents and adults showed similar results in this study, but placenta previa was less common in adolescent pregnancies. Similarly, Rexhepi et al. [12] and Zhang et al. [14] reported that adolescent and adult groups exhibited similar outcomes in terms of placental abruption and placenta previa. This complication may be associated with the higher incidence of cesarean delivery among adults.

In this meta-analysis, the prevalence of oligohydroamnios was similar in both groups, while polyhydroamnios was less common among pregnant adolescents. The higher prevalence of polyhydroamnios among pregnant adults may be associated with the higher incidence of gestational diabetes in this group.

It was found in our study that adolescents and adults were similar in term of receiving inadequate prenatal care. Previous studies also reported that the rate by which pregnant adolescents, especially in low-income and developing countries, benefit from prenatal healthcare services was lower than country averages [9,12–14]. Accordingly, it can be said that there is a need for more diligence in monitoring pregnant adolescents when providing antenatal care services.

Outcomes of depression/uneasiness/distress have been reported in a few studies taken into the meta-analysis, and it was found that the results were similar for the two groups. The result of this result in the meta-analysis may be a product of the scant number of studies in Turkey on the emotional problems of adolescents.

WHO indicates adolescent pregnancy as one of the important factors leading to maternal death [1]. However, there were not enough studies reporting the effect of adolescent pregnancies on maternal mortality and sufficient evidence could not be presented on this subject in this systematic review.

The effects of adolescent pregnancy on infant health

It was seen in this systematic review and meta-analysis that the prevalence of low birthweight/intrauterine growth retardation among the babies of pregnant adolescents was approximately twice that of the other group. It was also observed in this context that the birthweight of these babies were lower than the babies of pregnant adults. Similar outcomes were reported in previous studies [11,13]. Moraes et al. [54] indicated that pregnant adolescents gave birth to babies with low birthweight because they themselves were in a period of biological growth and need to share nutrients with the fetus. At the same time, it is also asserted that the high incidence of low birth rate among the babies of pregnant adolescents can be associated with the higher rate of preterm births occurring in this population.

It was seen in our study that the difference between the lower Apgar mean scores of the babies of adolescents in the first and fifth minutes and the scores of the babies of adults exhibited statistical significance. However, the incidences of Apgar score of <7 in the 1th and 5th-minutes were similar in the both groups. Korencan et al. [13] and Zhang et al. [14] reported that the incidence of an Apgar score of <7 in the first and fifth minutes among the infants of adolescents was similar to what was noted among the infants of adults. These results are important in that they point to the necessity of closely monitoring infants of adolescents in the early postpartum period.

It was observed in the meta-analysis that the incidence of fetal distress was 1.8 higher among the infants of adolescents. Other studies similar stated that fetal distress was the most common indication for cesarean section among infants of adolescents [9,53]. Contrary to this finding, Korencan et al. [13] reported that pregnant adolescents and adults were similar in terms of fetal distress. This knowledge is valuable in that it points to the need for a closer monitoring of pregnant adolescents during intrapartum care services.

Our study also found that there was similarity in the admittance of babies of adolescents and adults into the NICU. Previous studies provided data to the contrary however, suggesting that this can be associated with the high rate of preterm births among adolescents [9,11,56]. This finding is valuable as it indicates the need for making healthcare teams and equipment ready and available during adolescent childbirth.

This systematic review and meta-analysis indicated that pregnant adolescents and adults were similar in terms of the incidence of fetal abnormalities. Korencan et al. [13] reported data that were consistent with this finding. In contrast however, some studies revealed that the incidence of fetal abnormality was higher in adolescent pregnancies compared to adult pregnancies [11,56]. The differences in these findings may be related to the specifics of the different sample groups.

The adolescent and adult groups were similar in terms of perinatal baby death, intrauterine death or stillbirth and neonatal death in our study. On the contrary, Rupakala et al. [53] and Zhang et al. [14] stated that the risk of perinatal death was higher in the babies of adolescents. Also, Moraes et al. [54] set forth the data that the neonatal mortality rate was higher for the babies of very young adolescents (10–15 years of age) compared to infants of mothers between the ages of 20−24.

The meta-analysis showed that the lower incidence of macrosomia among the babies of adolescents was statistically significant. Previous research provided similar findings [13,57]. These findings

may be explained by the low incidence of gestational diabetes among pregnant adolescents.

Comparison of early and late adolescent groups in terms of maternal and infant health outcomes

In this systematic review, the mother-infant outcomes of the early and late adolescent age groups were compared with the data of three studies. The results showed that preterm birth, early membrane rupture, intrauterine growth retardation, admission to intensive care unit and neonatal death was more common in early adolescent pregnancies than in late adolescents. Also, Moraes et al. [54] reported that the risk of adverse obstetric and perinatal outcomes increases especially in mothers younger than 16 years. However, more scientific evidence is needed on this subject.

Strengths and limitations

The strengths of the study were the current and high quality assessment scores of the studies examined in this systematic review and meta-analysis, the availability of extensive screening resources. Again, the strengths of the study were that the sample size examined in the study was large, data was determined by reliable methods, the subject was examined with different dimensions, and the results obtained were supported by previous studies. To be included only of studies made in Turkey to this systematic review and meta-analysis created a limitations. In some studies examined in our study, the lower limit of adolescent age was 13, 14, 15 and 16. This situation, namely the exclusion of very young adolescent girls, can create an analysis bias. This situation indicates that there is a need for studies comparing very young adolescents and late adolescents. In our study, analyzes were made based on the findings of three studies that additionally have data on very young adolescents and late adolescents, and their results were reported. Although these results have not presented strong evidence, they migth provide an opinion on this issue. In addition, in the very few studies, there were data on psychological problems, and results regarding socio-cultural and economic problems and violence were not reported.

Implications for health policy

The results of the meta-analysis reveal outcomes related to the effect of adolescent pregnancy on maternal and infant health in a developing country such as Turkey, which is important information specific to the country itself and which may also be used in comparisons with other countries. These results may also contribute to the improvement of healthcare for adolescents and adolescent women who are pregnant. Prevention of adolescent pregnancies is an important issue that needs to be addressed at national and international level and with inter-sectoral cooperation. Adults and young people at all levels of society should be educated and individualized protective measures should be taken, especially for adolescents at high risk. It migth be particularly common that educators and healthcare professionals counsel and monitor to young adolescents and their families. Considering these findings when providing adolescents with monitoring and perinatal care services will contribute to improving the health of adolescents and their infants. There is furthermore a need for more comprehensive studies that will contribute to the literature by including updated data and investigations into other related factors, especially for very young adolescents.

Conclusions

The results of this systematic review and meta-analysis revealed that preterm labor, early membrane rupture, anemia, inadequate prenatal care, low birthweight, intrauterine growth retardation and fetal distress are more prevalent in adolescent pregnancies. Moreover, the analysis showed that pregnant adolescents and adults exhibited similar outcomes in terms of preeclampsia/gestational hypertension, eclampsia, breech presentation/presentation abnormality and cephalopelvic disproportion/dystocia, episiotomy/perineal trauma, postpartum hemorrhage, placental abruption, oligohydroamnios and depression/unrest/distress, 1th and 5th-minutes Apgar score of <7, admittance into the NICU, fetal abnormality and perinatal baby mortality. Also, the systematic review set forth the conclusion that the incidence of birth by cesarean section, gestational diabetes, placenta previa, polyhydroamnios and macrosomia was lower compared with adults. These findings support the reports provided in the field literature of many different countries. Health professionals might make use of this information in the follow-up and care of adolescent pregnant women and their babies.

Authors' contributions

Study design: ZK, DKÇ, RD. Data collection: ZK, DKÇ, RD. Data analysis: ZK, DKÇ. Study supervision: ZK. Manuscript writing: ZK, DKÇ, RD. Critical revisions for important intellectual content: ZK. All authors read and approved the final manuscript.

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Ethics (and consent to participate)

Not applicable as this is systematic review.

Declaration of Competing Interest

The authors report no declarations of interest.

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