

Effect of Dietary Patterns and, or Nutrition Strategies Reducing Risk in Adverse Maternal Health Occurrences during Pregnancy: A Systematic Review

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Abstract

Dietary patterns and nutrition strategies are essential to maintain optimal maternal health during pregnancy to prevent and minimize conditions that lead to complications. Previous studies found nutrition education and counseling effect on food habit modification, beneficial during pregnancy. In promoting health and reducing adverse maternal conditions during pregnancy, need increasing knowledge on diversities of dietary pattern consumption, modify attitude and practice. The present review conducted on effect of dietary patterns and/or nutrition interventions on health risks such as hypertension disorders in pregnancy or gestational hypertension or high blood pressure related to obesity or overweight, low haemoglobin, undernutrition and anaemia. Eighteen eligible studies identified. Studies on dietary patterns: Mediterranean or DASH diets, DASH diet vs Western diet with dietary counseling, combined nutrition counseling, advice and healthy diet. Healthy diet vs Western, Traditional or high-energy-foo; 2 healthy diets rich in fruit and vegetables. Two healthy diets combined with dietary counseling, nutrition messages compared with high-energy-food. The remaining 5 studies were nutrition education and health promotion model, dietary counseling and knowledge, attitude and practice with healthy diet, nutrition education with or without diet plan, then guided counseling with planned behaviour model. The studies reported positive impact on reduction of maternal adverse conditions, improved anthropometric, haemoglobin, undernutrition or malnutrition status. Study designs were 5 randomized controlled interventions, 11 prospective or longitudinal cohort studies and 2 systematic review.

Significance

Nutrition plays a major role in maternal and child health. Healthy dietary pattern with adequate nutrition education and counseling reduce health risks of mothers and their unborn babies and maintain the well-being. Adverse health risks such as gestational hypertension or pregnancy-induce hypertension (PIH) or high blood pressure, undernutrition, malnutrition, low haemoglobin or anaemia, obesity and overweight in pregnancy are global health issue that need attention. This may be due to poor quality diet and could lead to complications and death if adequate attention is not giving during antenatal care.

Creating awareness for nutrition education, counseling and dietary patterns with reproductive women is health importance. Significantly, nutrition education and counseling improve maternal health in pregnancy by promoting, protecting, maintaining health and well-being and preventing health risks. Conducting a systematic review on effect of nutrition strategies and, or dietary patterns will show evidence of reducing or preventing maternal adverse health. This could help health professionals in developing countries to adopt strategies during antenatal management to improve maternal health status.

Introduction

It is evident that nutrition education, counseling and advice with nutritional support promote healthy state during pregnancy.^{1,2} Poor diet intakes and lifestyle affect physiological functions causing hypertension, malnutrition, undernutrition, anaemia, high body mass index, overweight and obesity in pregnancy. Severe maternal conditions can lead to premature delivery, low birth weight, maternal -foetal deaths.^{3,4} Aside inadequate nutrient intake affecting health, the biological utilization, physiological and pathological status of the individual is considered. Pregnant women consuming inadequate nutritious diet could develop health issues. The health problems resulting in pregnancy may attributing to inaccessibility, unaffordability, unacceptability and seasonal changes of food items leading to insecurity. Evidences are that diversities of dietary patterns and nutrition strategies reduce *adverse maternal health conditions and prevent complications*.^{5,6,7}

In order to address most public health issues, behavioural counseling on dietary practices and nutrition education for females in reproductive age becomes necessary. Creating awareness on maternal-fetal risks relating to pre-pregnancy overweight that is potential for excessive gestational weight gain must need effective implementation to change individual's lifestyle.³⁵ There is a need to focusing on individual's knowledge level, attitude and practices through motivation to achieve better food choice. Globally, gestational hypertension and pre-eclampsia represent 5-15 % and 8-10% respectively, which is due to hormonal changes causing increase blood pressure that lead to maternal mortality.^{8,6} Mostly, hypertension during pregnancy is diagnosed as blood pressure above 140/90mmHg after 20 weeks gestation without protein in urine and oedema.^{9,6}

In Sub-Saharan Africa, pregnant women suffer from deficiencies of folate and iron because of inadequate nutritious diet leading to anaemia in pregnancy, morbidity, mortality and infections.¹⁰ World Health Organization (WHO) recommends nutrition education and counseling (NEC) adoption to increase healthy diets with fruit and vegetables to reduce health risks. (WHO, 2018). Fruit and vegetables contain minerals and vitamins that aid to reduce adverse conditions during pregnancy and birth outcomes.^{11,12} In order to upgrade knowledge of the inhabitants' in Iran, focusing on nutrition education campaign enable improvement in F&V consumption to reduce nutrition-related-problems.¹³

World Health Organization and other studies improving knowledge on diet planning on food diversities, create awareness on sources of iron, folate, plant and animal food to reduce anaemia during pregnancy.^{14,15} It is evident, pregnant women with excessive vomiting or bleeding after 24 weeks gestation, may develop undernutrition, weight loss and anaemia. These conditions could cause premature delivery and low birth weight but intake of diversities of nutritious diet could improve their haemoglobin above 10.5g/dl and gain weight.¹⁶ Moreover, high-energy diets intake among African women in urban areas, contribute to obesity and overweight before becoming pregnant. This cause excessive weight gain during 1st trimester.

Women need encouragement to take diets rich in F&V to reduce weight and complications in pregnancy.¹⁷ WHO recommends that health caregivers in clinics and communities implement effective nutrition advice, education and counseling in the antenatal management.¹ Implementation of NEC in developing countries during antenatal care is inadequate or irregular. Therefore, reinforcing NEC and dietary interventions effectively could reduce health risks during pregnancy.^{18,19} Committing to dietary pattern and nutrition interventions as measures to reduce or prevent health risks in pregnancies need further investigation.

Literature Search Method

Literature searched from PubMed, Google Scholar and other similar reviewed studies conducted on dietary patterns, nutrition strategies and health risks during pregnancy. Selected study designs were randomized control trails (RCTs), cohort observational or prospective, quantitative and qualitative variables. Effect of randomized control trials on dietary approaches took minimum of 3 months, maximum less than one year and cohort observation took less than one year or more. Searched on dietary patterns interventions of DASH or Mediterranean, healthy diet with F&V and related factors of overweight, high body mass index, hypertension, anaemia, undernutrition and malnutrition selected. Nutrition education and counseling interventions promoting healthy diet to reduce health problems were included. The search was restricted to articles published in English language. Titles, abstracts and full text relevant to the study reviewed with other cross-references screened for further search.

Eligibility Criteria

This was based on dietary patterns and, or nutrition strategy reducing health risk during pregnancy with birth outcomes. Studies included randomize control trial, quasi-experiment and prospective, longitudinal or observational cohort. Target population included pregnant women at 16 years or above aged 18, gestational age below 20 weeks and above, with problems such as hypertension, anaemia, obesity or overweight, low haemoglobin, undernutrition and malnutrition. High blood pressure defined above 140/90 mmHg. Obesity and overweight definition according to WHO is measurement from 40kg/m². Dietary patterns captured healthy diet, Mediterranean, DASH and traditional diet with fruit and vegetables.

Study interventions included healthy diets vs western foods, nutrition education and counseling, nutrition education or dietary counseling, diet planned and behaviour change model. Exclusion were non-pregnant women, pregnant teenagers, chronic diseases, non-intervention or intervention studies of dietary supplements or placebo (e.g. vitamin C, vitamin E, calcium, potassium, garlic, soy protein), or energy foods less than 600 kcal/day, exercise as co-intervention, study designs of case control, retrospective cohort and clinical trials.

Evaluation Of Studies Results

Reported study outcomes based on the following distinctions: i) difference between intervention and control groups with change from baseline to endline; ii) difference within groups from baseline to follow-up. iii) Differences between groups that considered change in values from baseline and endline adjusting cofounding characteristics to give meaningful comparison results. Differences considered as significant if the P-value less than 0.05.

Summary Of Findings

Relevant studies include titles, abstracts and full text extracted by first author's name, publication year, country, study designs, study length, participants' age, gestational age and sample size. The search criteria were dietary patterns, nutrition strategies, maternal health risks and pregnancy outcomes. Data extraction from PubMed, Google Scholar and related reviewed studies. Study designs involved 5 randomized controlled trials, 11 prospective or longitudinal cohort and 2 systematic reviews. Publications from 2006 to 2020 in USA, Australia, Boston, Canada, Denmark, Netherlands, India, Norway, Finland, Ethiopia and Cairo. Participants were pregnant women aged 16 years and above. Sample size between 100 to over 55,000, from a period of 3 days, 3, 6 and

and 24 months. Literature searched 25 articles, excluded 7 for undetailed information on titles and abstract or chronic conditions and rejected 4 duplicates of dietary patterns on hypertension with diabetes during pregnancy or food supplements. The relevant articles were 18, comprised of dietary patterns or nutrition strategies. For an overview of the screening criteria, see Figure 1.

Eligible studies investigated were 18. All the studies measured significant improvement in specific health problem in intervention and control groups. The review investigated a decreased in health risks with 9 dietary patterns, 5 nutrition strategies with dietary pattern and 4 nutrition strategies promoted healthy diet. Studies conducted in 4 developing countries, two systematics and 12 from developed nations, communities and health facilities showed specific effect of dietary patterns or nutrition strategies.

Relevant Discussions

Effect of Dietary Patterns on Maternal Health Problems

Three of seven studies investigated effect of high Mediterranean, DASH, healthy diet and seafood-vegetables, found odds risk below 0.8 reduced hypertension in pregnancy.^{20,21,22} Out of the remaining studies, a healthy diet reduced hypertension disorders in pregnancy (HDP) by odds 0.72 compared with energy food, which increased odds by 1.21.²³

A high or low Mediterranean diet respectively lowered risk by 47% of HDP and increased pre-pregnancy BMI by 22%, while western, traditional or high-energy food increased risk of high blood pressure at 20 and 30 weeks gestation.^{24, 25, 26}

Different nutrition interventions showed positive effect on reduction in undernutrition, anaemia, excessive weight gain and high blood pressure.^{27, 15, 32, 28} It aid decreased intake of energy-foods to reduce obesity or high body mass index.⁷ It also improve food portions, haemoglobin level and normal weight gain during pregnancy.^{29,30,31,32}

Effect of Dietary Patterns and Counseling on Anthropometric Status

Interventional effect of nutrition education or dietary counseling on dietary practices improved weight and reduced excessive weight or BMI. One study increased knowledge on daily food quantity.²⁹ The remaining respectively reduced excessive gestational weight gain by 42.7% and 13.9%, with mean weight reduction of 51.05±7.26kg while another improved haemoglobin and reduced anaemia in intervention vs control group.^{15,30,32}

A study found that DASH diet intake was ineffective in early pregnancy against HDP, but had a decreased effect on obesity before pregnancy and subsequent gestational weight gain.²⁸ A meta-analysis on effective combination of NEC with nutritional support found an improved weight gain during pregnancy.³¹

Effect of Nutritional Education-Counseling on Dietary Intake and Practices

Three studies conducted on dietary counseling and nutrition education among pregnant women during antenatal visits, enabled upgrading of knowledge on nutrition health benefits and modified dietary practices.^{7,15,30} One study showed impact of nutrition education with health promotion model to improving dietary practices on intake of food diversities among pregnant women. Systematic reviewed studies conducted on nutrition education messages and counseling found promoting effective dietary practices to improve weight gain and reduced risk of anaemia.^{29,31}

Effect on Haemoglobin Level, Anaemia and Undernutrition

A study reported on significant beneficial effect of nutrition education messages and counseling on food quality, quantity and undernutrition. This showed mean body weight of 51.05±7.26kg, haemoglobin status at 9.65±0.97 and 7.85±1.58 with reduction in anaemia prevalence from

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96.3% to 78.7% and 96.0% at post nutrition education and non-nutrition education, p-value <0.001.³²

In addition, a nutrition education on source of iron food and diet planned respectively found significant mean haemoglobin level of 0.56±0.40gm/dl and 0.16±0.82/dl in intervention and control groups.¹⁵ The study also improved knowledge by 8.26±4.57 and 1.05±6.59 respectively and anaemia from 40gm/dl to 82gm/dl, p-value <0.002.¹⁵

Another study reported on undernutrition at base-line prevalence of 47.3% and adopting guided counseling with theory of planned behaviour reduced to 30.6% at endline.²⁷ This also showed a changed of 16.7% in intervention than 43.8% to 39.8% in control group.²⁷

Effect on Birth Outcome

Two studies reported on birth outcomes. A *nutrition education* with nutritional support upgraded knowledge on diet that decreased anaemia, increased birth weight to 105g and reduced 19% of premature birth than applied NEC only.³¹ On the other hand, DASH diet intake showed 0.59 odds risk reduction in premature birth in intervention than 1.55 in control group.³³

Summary

References	Study design, Age, Sample size	Nutrition Strategies	Dietary Patterns	Method/ Duration	Results /Information																								
1. Jarman et al, 2018 Alberta, Canada;	Prospective cohort, 1545 pregnant women, Above 16 years, 17 -27weeks gestation.	None	1. healthy diet 2. Meat, refined carbohydrate, 3. Beans, cheese 4. Salad/tea/ coffee	Food frequency questionnaire (FFQ), 12 months	High healthy diet intake lowered gestational hypertension (GH) 93(6%) by odds 0.6																								
2. Ikem, et al., 2019. Denmark	Prospective longitudinal Cohort 55,138 women 12 & 30 weeks pregnant	None	1. Western diet, 2. Seafood, vegetables, fish	Interview-questionnaire, 6 & 18 months	Seafood/vegetables & fish decreased GH by 0.86 odds. Western-diet increased GH by 1.18 odds																								
3. Girard & Olude, 2012	Systematic review 3877 publications	Nutrition education & counselling (NEC)	Dietary practices + iron-folic acid (IFA) supplementation	2010-2011	Health-education messages, NEC & nutrition support improved weight-gain (0.45kg, intervention), (0.15kg, control) groups, 30% reduction risk in anaemia.																								
4. Garg, et al., 2006. India	Randomize control trial 100 pregnant women	Nutrition education	None	Nutrition messages 10-16 weeks 24-hour recall, FFQ	Mean body weight = (51.05±7.26kg). Mean haemoglobin increased Post-NE=9.65±0.97 Non-NE=7.85±1.58, p<0.001) Anaemia prevalence reduction, PNE=96% NNE=78.7%																								
5. Piirainen, et al, 2006. Britain-Finland	Prospective cohort study. 209 pregnant women.	Dietary counseling, practices & advice	Randomized intervention (healthy diet) Control (dietary habit/food-diary)	Three-day food records 12 weeks intervention	A difference of 0.5% intake of PUFA and 0.8% reduction intake of SFA in intervention group																								
6. Fulay, et al, 2018. Boston	longitudinal cohort -1760 pregnant women, Mean SD age 32.2 ± 4.9 years	None	DASH diet	FFQ -11.1 weeks gestation.	Mean DASH score: 24.0, SD: 5.0 not associated with pregnancy outcomes -0.19kg weight reduction. p ≤ 0.05																								
7. Goodarzi-Khoigani, et al., 2018. Iran	Randomized Clinical Trial Pregnant women: 6–10 weeks	Nutrition education & nutrition plan	3-days dietary record	16 weeks intervention Gestation 6–10 weeks & 34–36 weeks.	Mean-standard deviation (SD) of food portions <table border="1"> <thead> <tr> <th></th> <th>Food</th> <th>Intervention improved</th> <th>Control</th> </tr> </thead> <tbody> <tr> <td>grain</td> <td></td> <td>10.40(1.96)</td> <td>12.70(1.93)</td> </tr> <tr> <td>vegetable</td> <td></td> <td>3.88(1.33)</td> <td>2.96(0.91)</td> </tr> <tr> <td>fruit</td> <td></td> <td>4.02(0.05)</td> <td>3.95(0.91)</td> </tr> <tr> <td>dairy</td> <td></td> <td>2.33 (0.68)</td> <td>2.11(0.45)</td> </tr> <tr> <td>meat</td> <td></td> <td>3.17(0.68)</td> <td>2.96 (0.67)</td> </tr> </tbody> </table>		Food	Intervention improved	Control	grain		10.40(1.96)	12.70(1.93)	vegetable		3.88(1.33)	2.96(0.91)	fruit		4.02(0.05)	3.95(0.91)	dairy		2.33 (0.68)	2.11(0.45)	meat		3.17(0.68)	2.96 (0.67)
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8. Martin, et al., 2015.	Prospective cohort US-North Carolina -3143 pregnant women. 19-44 yrs 26-29 wks	Dietary counseling - dietary patterns	DASH diet	Interviews and self-administered questionnaires FFQ 1995-2000 2001-2005	Mean DASH scores = 24.3 ± 4.9. Odds Ratio High DASH Low DASH 0.59 Low preterm - 1.55 - High preterm
9. Ramkripa, et al., 2019	A systematic review 9103 studies Cohort and randomized control trial -pregnant women	None	Healthy dietary patterns	1980 - 2017	Lowered risk of HDP
10. Schoenaker, et al., 2015. Australia	Observational-Longitudinal Study 3582 pregnant women	None	Mediterranean diet	FFQ, 2003-2012	High Mediterranean diet reduced risk of developing HDPs in 305(8.5%) pregnancies -RR, 0.58; 95% CI, 0.42, 0.81).
11. Schoenaker, et al., 2016. Australia	Longitudinal Study 3378 pregnant women 25-30 years	None	Mediterranean dietary score	-FFQ 2003-2012.	273(8.6%) adhered to low Mediterranean diet associated with higher risk of HDP OR: 1.41, 1.18, 1.56, BMI 1-kg/m ² increased by 22%.
12. Timmermans, et al., 2011 Dutch-Netherlands	Prospective study -3187 pregnant women	None	-Low Mediterranean -Traditional diet.	Semi-quantitative -FFQ - 3 months	High intake Traditional diet increased SBP by 1.8, 2.3, 2.6 mmHg -low Mediterranean diet increased SBP by 1.1, 2.2, 1.3 mmHg,(early, mid & late pregnancies - DBP decreased by 1.3, 1.6, 2.4mmHg respectively
13. Timmermans, et al., 2012 Dutch-Netherlands	Prospective cohort study	None	High Mediterranean - Western/Traditional diets	Semi-quantitative FFQ	High Mediterranean diet decreased 12.8% blood pressure compared to 8.7% of high Traditional diet
14. Timmermans et al., 2012. Dutch-Netherlands	Prospective cohort study	None	Healthy diet Western-high energy diet Traditional diet,	Semi-quantitative FFQ	High healthy diet reduced GH -Western or high-energy diet or Traditional diet increased risk of developing GH.
15. Brantsaeter et al., 2009. Norway	Cohort Study, 23,423 nulliparous 15,17-22 gestations	None	- High Plant food - High energy-food	-FFQ 2007-2008	Plant food decreased risk (OR 0.72, 0.62; 0.85), Energy-food increased risk (OR 1.21; 1.03, 1.42),
16. Abdel-Aziz, et al., 201. Cairo	Randomize study 200 primigravidae 20-30 years	Dietary/ Nutrition counseling	-Healthy diet	-Follow up at ANC 2015-2016	Gestational weight gain 42.7%=intervention 13.7%= control group - improved healthy diet intake, Knowledge, Attitude, Practice -P-value< 0.001.
17. Sunuwar,	-Quasi-	-Nutrition education	Semi-structured	-Follow-up	Nutritional knowledge on anaemia &

et al., 2019. Nepal	experiment -Pregnant women aged 15-49 mild-moderate anaemia	-diet plan	questionnaire	every 4 weeks for 10 weeks 2017- 2018	iron-rich-foods, showed 66.0%(intervention) 24.1% (control group) =40gm/dl to 82gm/dl. P-value = 0.002
18. Demilew et al., 2020. West Gojjam Ethiopia	Cluster-randomize control -694 pregnant women(6wks)	Guided counseling	Structured questionnaire	4-counseling sessions 2018-2019.	Undernutrition prevalence=16.7% reduction in intervention

Assessment On Specific Effects

References	Dietary Patterns	Nutrition Strategies	Outcomes																					
Effect on Maternal Health Problems																								
Ikem, et al., 2019	Seafood, vegetables	None	Prevalence of 14% GH decreased by odds ratio 0.86																					
Jaman et al., 2018	Healthy diet score	None	Developing GH, 93(6%) lowered by odds 0.6 (95% CI)																					
Ramkripa et al., 2019	Dietary patterns	None	Reduced risk of HDP																					
Brantsæter, et al., 2009;	Dietary patterns	None	<table border="1"> <thead> <tr> <th></th> <th>Pre-eclampsia</th> <th>Healthy diet</th> <th>Energy diet</th> </tr> </thead> <tbody> <tr> <td>OR</td> <td></td> <td>0.72; 95% CI: 0.62, 0.85 decreased risk</td> <td>1.21; 95% CI: 1.03, 1.42 increase risk</td> </tr> </tbody> </table>				Pre-eclampsia	Healthy diet	Energy diet	OR		0.72; 95% CI: 0.62, 0.85 decreased risk	1.21; 95% CI: 1.03, 1.42 increase risk											
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Schoenaker, et al., 2015;	High Mediterranean diet	None	42% lower risk of developing HDPs																					
Schoenaker, et al., 2016	Low Mediterranean diet	None	HDP(OR:1.41;95%CI:1.18,1.56) = 22% high pre-pregnancy BMI																					
Timmermans, et al., 2011-2012	High traditional diet&low Mediterranean diet	None	High BP (20.5 &30.4wks)																					
Effect of Nutritional Education-Counseling and Dietary Patterns Practices on Anthropometric, Haemoglobin, Anaemia & Undernutrition Status																								
Sunuwar, et al., 2019	Iron diet plan	Nutrition education	<table border="1"> <thead> <tr> <th>Improvement</th> <th>Intervention</th> <th>Control</th> <th>P-value</th> </tr> </thead> <tbody> <tr> <td>Mean Haemoglobin</td> <td>0.56±0.40gm/dl</td> <td>0.16±0.82gm/dl</td> <td>= 0.002</td> </tr> <tr> <td>Knowledge</td> <td>8.26±4.57</td> <td>1.05±6.59</td> <td><0.001</td> </tr> </tbody> </table>				Improvement	Intervention	Control	P-value	Mean Haemoglobin	0.56±0.40gm/dl	0.16±0.82gm/dl	= 0.002	Knowledge	8.26±4.57	1.05±6.59	<0.001						
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Garg, et al., 2006	Dietary practices	Nutrition counseling	Mean body weight reduction =51.05±7.26 kg																					
Fulay, et al., 2018	DASH diet score	None	Pregnancy complications ≠ Mean DASH score (24.0, SD: 5.0) = 0.19 (95% CI: 0.05, 0.34), P ≤ 0.05 kg higher GWG.																					
Piirainen, et al., 2006;	Food products	Dietary counseling	Health benefits of 0.5%(PUFA) difference, 0.8% lower (SFA) in intervention group																					
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Girard & Olude, 2012	Diversity foods	NEC	Improved Weight gain	NEC (intervention)	(control)																			
				0.45kg	0.15kg																			

				Anaemia (30%)			
Demilew, et al. 2020	None	Guided Counseling & Theory of planned behaviour		Prevalence of under-nutrition	intervention	control	p-value
				Baseline	47.3%	43.8%	0.28
				Endline	30.6%	39.8%	< 0.00
				Difference	16.7% (reduction)		
Garg, et al., 2006	Dietary practices	Nutrition counseling	Increased diet quality & quantity & 96.3% anaemia prevalence reduced				
				Strategies	Post NE	Non NE	
				Anaemia	78.7%	96%	
				Mean hemoglobin	9.65±0.97	7.85±1.58,	
Effect on Birth Outcomes							
Girard & Olude, 2012	Nutrition support most significance	NEC=no significance	Birthweight raised = 105g, preterm delivery reduced = 19%				
Martin, et al., 2015	DASH diet	None		Odds risk	High adherence	Low adherence	
				Preterm birth	0.59;	1.55;	
					95%CI:0.40,0.85	95% CI:1.07, 2.24	

Relevance And Limitations Of Literature Review

Reported nine studies on healthy dietary patterns improved maternal health status while other 9 studies on nutrition strategies modified food habit, improved knowledge and practices to maintain healthy lifestyle. One study found that DASH diet had no association with HDP, gestational diabetes, premature delivery or birth size but a positive effect on weight reduction related to obesity.²⁸ Individual weekly reinforcement on dietary practices, nutrition education or counseling showed beneficial effect on health during pregnancy. Studies on dietary practices and nutrition strategies showed effective reduction in excessive gestational weight gain that could decreased poor birth outcomes.^{30,31,32} Dietary counseling and nutrition education served as preventive measures in medicine: protecting, promoting and maintaining healthy lifestyle and well-being. Therefore, implementation of dietary counseling with health promotion could modify understanding for healthy living and effective behavioural change during pregnancy. A Cochrane systematic review and meta-analysis supported that healthy dietary patterns decrease HDP, gestational diabetes mellitus, premature birth and low birth weight (Kibret, et al., 2018). This systematic reviewed showed significant effect of dietary patterns or nutrition strategies on maternal health problems with P-value < 0.001 to < 0.05 which is a strong scientific evidence. Further investigation needed for how food portions intake could have impacts on pregnancy outcomes. Most of the studies conducted in developed countries related to well-educated people could not be generalized. Further research need investigation into situations in developing countries to understand effect of inadequate resources and food insecurity on dietary intake and adverse pregnancy or birth outcomes.

Conclusion

Data reviewed showed the need for further research to establish universal nutrition strategies on healthy dietary intake to improve women's health and pregnancy outcome. Studies showed healthy dietary patterns reduced high blood pressure, pregnancy induced hypertension, excessive weight gain, anaemia and improved weight gain in underweight pregnant women while energy-food diets increased health risk in pregnancy and birth complications. This systematic review revealed the relevance to adopt dietary management and nutrition strategies in clinical practices as public health concern. A Cochrane database systematic review suggested that dietary patterns implementation in clinical management of pregnant women is essential.¹¹

Declarations

I declare that I have not received any support for funding.

This systematic review had no conflict of interest.

Articles reviewed sought ethical approval (include appropriate approvals or waivers). Not Applicable

Consent to participate (include appropriate consent statements). Not Applicable

Consent for publication (consent statement regarding publishing an individual's data or image). Not Applicable

Availability of data and material (data transparency) has been included in a table form in this reviewed article.

ORCID Code obtained after registration for a new author's manuscript for submission.

Authors' contributions not applicable.

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Figures

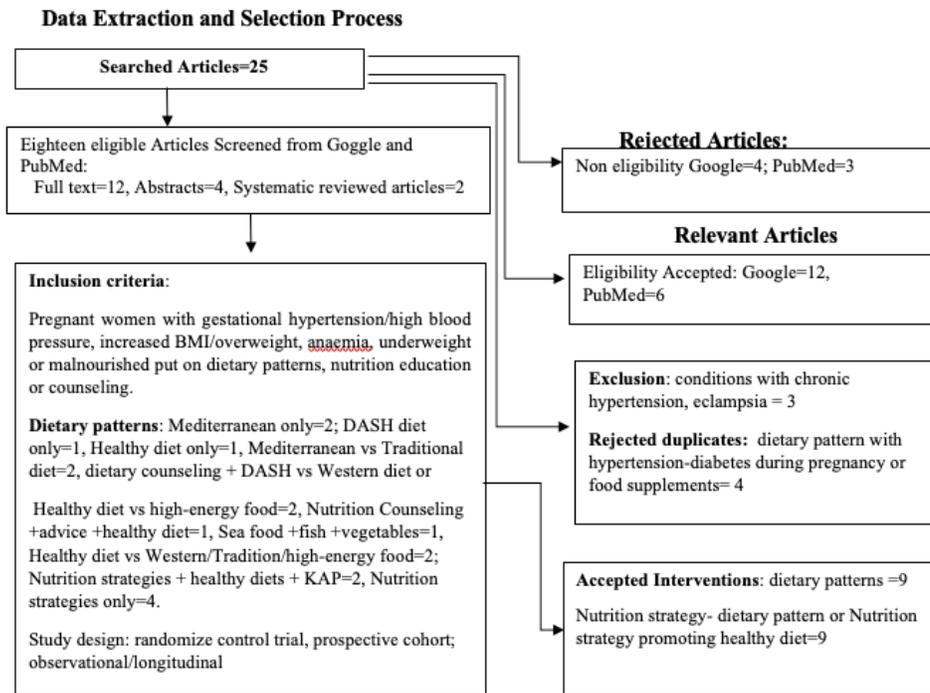


Figure 1

Flow chart showing screening process for eligible and non-eligible articles.