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# Development of national dietary and lifestyle guidelines for pregnant women in Lebanon

Farah Naja[1,2] | Jennifer Ayoub[2] | Samar Baydoun[3] | Sahar Nassour[3] | Pamela Zgheib[4] | Lara Nasreddine[2]

[1]Department of Clinical Nutrition and Dietetics, Research Institute of Medical & Health Sciences (RIMHS), College of Health Sciences, University of Sharjah, Sharjah, United Arab Emirates

[2]Department of Nutrition and Food Sciences, American University of Beirut, Beirut, Lebanon

[3]Faculty of Agricultural and Food Sciences/ Faculty of Health Sciences, American University of Beirut, Beirut, Lebanon

[4]Mother, Child and School Health Unit, Ministry of Public Health, Beirut, Lebanon

**Correspondence**
Lara Nasreddine, Department of Nutrition and Food Sciences, American University of Beirut, P.O. Box 11-0236, Riad El-Solh, Beirut 1107 2020, Lebanon.
Email: ln10@aub.edu.lb

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## Abstract

Although a number of international diet and lifestyle guidelines during pregnancy (DLGP) exist in the literature, contextualization to low- and middle-income settings is less common. The aim of this study was to present the Lebanese DLGP and to describe the process followed for their development. A mixed-method approach was used including a review and synthesis of existing international DLGP and a consensus building nominal group technique (NGT) with a multidisciplinary group of experts (*n* = 11). During the meeting, participants identified the themes of the guidelines, formulated the wording of each themes' guideline and translated the guidelines to the Arabic language. Consensus was defined as an agreement of 80%. Reviewing the literature, a list of 17 main topics were found to be common themes for the DLGP. For the Lebanese DLGP, participants in the NGT meeting selected seven themes from this list: gestational weight gain, diet diversity, hydration, food safety, harmful foods, physical activity and breastfeeding. In addition, the group formulated three themes based on merging/modifying existing themes: supplementation, alcohol and smoking and religious fasting. Two context-specific new themes emerged: wellbeing and nutrition resilience. For each of the identified themes, the group agreed upon the wording of its guidelines and description. This study is the first from the Eastern Mediterranean Region to develop through consensus building, context and culture-specific dietary and lifestyle guidelines for pregnant women. Putting maternal nutrition at the heart of tackling malnutrition and its detrimental health outcomes is a core investment for a better maternal and child health.

**KEYWORDS**
consensus, lifestyle, nominal group technique, nutrition, pregnancy

Samar Baydoun and Sahar Nassour contributed equally to this work.

# 1 | INTRODUCTION

The first 1000 days of life (from conception through the child's second birthday) are recognized as a crucial period in the life cycle, representing a unique window of opportunity for 'developmental or metabolic programming' (Schwarzenberg & Georgieff, 2018). These early-life stages start with women's pregnancy, where the maternal body goes through various physiological changes to provide a nurturing environment for fetal development and support the increased maternal metabolic demands (Beluska-Turkan et al., 2019). Therefore, improving maternal nutrition and ensuring a healthy lifestyle are critical to cater for the maternal physiological changes, optimize fetal organogenesis and neural development and decrease the risk of non-communicable diseases (NCDs) later in life (Blake-Lamb et al., 2016).

During pregnancy, women were shown to be more determined to improve their dietary and lifestyle behaviours in order to foster their health status as well as that of their child (Pietrobelli & Agosti, 2017; World Health Organization, 2016a). Pregnant women were reported as motivated and proactive subjects, feeling responsible for their own health care choices and decisions, and often encouraged by the increased communication with their healthcare providers (Paz-Pascual et al., 2019; World Health Organization, 2016a). Hence, many countries developed national dietary and lifestyle guidelines as effective tools intended for use by healthcare providers, to counsel on prenatal care by linking scientific research to the needs and expectations of pregnant women (Australian Government National Health and Medical Research Council, 2013a; Brown et al., 2011; Health Canada, 2007; World Health Organization, 2016a). National guidelines were also shown to be essential means for policymakers given their contribution to efficient policy development and implementation (World Health Organization, 2016a).

Although a number of international diet and lifestyle guidelines during pregnancy (DLGP) are published in the literature, contextualization to low- and middle-income settings is less common (Verschueren et al., 2019). Women's pregnancies and behaviour can, in fact, be significantly affected by their social and cultural environment (Mukhopadhyay & Sarkar, 2009), hence the need for country-specific dietary and lifestyle guidelines that tailor for the local context in terms of the population's beliefs, traditions and social norms (Mukhopadhyay & Sarkar, 2009). Lebanon, a small country of the Eastern Mediterranean Region (EMR), has witnessed, during the past two decades, a nutrition transition away from the traditional Mediterranean diet towards a more Westernized diet and lifestyle (Nasreddine et al., 2019). This shift is associated with a double burden of malnutrition characterized by the coexistence of undernutrition, including stunting and micronutrient deficiencies, along with an escalating burden of overweight, obesity and associated NCDs (Nasreddine et al., 2018, 2019). In light of the high prevalence rates of malnutrition in the country, there have been attempts by the Lebanese government, as well as non-governmental organizations (NGOs) and academic institutions, to support infant and young child feeding practices and breastfeeding (Akik et al., 2015). However,

> **Key messages**
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> - This study is the first from the Eastern Mediterranean Region to develop diet and lifestyle guidelines during pregnancy (DLGP).
> - These guidelines are devised for women living in a nutrition transition context while building on available scientific evidence and taking long-term health consequences into account.
> - The DLGP can be used by healthcare providers during prenatal counselling while also serving as the seed for efficient policy development to foster maternal health during pregnancy.
> - Putting maternal nutrition at the heart of tackling malnutrition and its detrimental health outcomes is a core investment for better maternal and child health.

context-specific guidelines targeting the pregnancy period are lacking. In this context, the aim of this manuscript is to present the Lebanese DLGP and to describe the process that was followed for their development.

# 2 | METHODS

A mixed-method approach was used including a review and synthesis of existing international DLGP and a consensus building nominal group technique (NGT) with a multidisciplinary group of experts. The project was part of a collaboration between the Ministry of Public Health (MOPH) in Lebanon and the Faculty of Agricultural and Food Science at the American University of Beirut.

## 2.1 | Review of the literature

An extensive review of the literature was conducted to identify international published dietary and lifestyle guidelines and recommendations for pregnant women, over the last two decades, between years 2000 and 2020. The review search strategy included the following electronic databases—PubMed, Medline, Cochrane, JSTOR, Google Scholar and ProQuest—and websites such as Google, but excluded commercial sites and blogs. The search terms included 'pregnant or pregnancy or conception or prenatal' AND 'dietary or diet or nutrition' AND 'lifestyle' AND 'guidelines or recommendations'. Relevant records published in English language were selected. Thematic analysis of the guidelines published in the literature was conducted by two researchers, and a comprehensive list of common themes was extracted.

## 2.2 | Consensus building: NGT

To build consensus on the priority themes and guidelines to be included in the Lebanese guidelines, the NGT was used and included researchers and health professionals using a multidisciplinary approach. The NGT is a highly structured technique that encompasses interaction among a small group of participants, encourages ideas to be generated, shared and clarified, and thematic classifications to be discussed and refined (Cantrill et al., 1996; Siegfried et al., 2017). Such technique is commonly used in medical and health service research and the development of guidelines, given its significance in strengthening the recommendations by harnessing the insights of experts in aspects for which published evidence is lacking or is not robust (Allen et al., 2004; Dicianno et al., 2020). Although a significant body of literature suggests using the Delphi technique for the development of guidelines, in this study, the NGT was used for the following reasons:

a. The interactive nature of the NGT offers the participants the opportunity for a discussion and group brainstorming (Manera et al., 2019). Given the breadth of topics covered by the guidelines and the specialized backgrounds of the participants (paediatrician, nurse, pregnancy fitness trainer, specialist in infant and young child feeding, nutritionist, researchers, obstetrics and gynaecologist, pharmacist, midwife and public health officer), an interactive nature of the process was deemed essential for participants to be implicated in all the discussions. Using emails (as in the case of the Delphi), participants may feel that their input is restricted to their respective fields of specialties.

b. Using the Delphi technique requires a high motivation level on behalf of the participants to respond to their emails (Health Knowledge, 2016). In Lebanon, participation and response rate using emails are less common, and response rate could constitute a barrier (Atallah et al., 2018; Bizri et al., 2020), a context that may raise concern of lack of contribution of participants. The latter cited as a main reason for using the NGT (Manera et al., 2019).

### 2.2.1 | Participants and setting

Researchers and health professionals from a range of disciplines were purposively sampled and invited to an experts' meeting to discuss and build consensus on the development of the first national dietary and lifestyle guidelines for Lebanese pregnant women. Every effort was made to include multi-sectorial participants from public, private, governmental and non-governmental sectors. The discussion was held in March 2020 at the American University of Beirut, Lebanon, and comprised 11 experts from a range of clinical and research backgrounds including a paediatrician, nurse, pregnancy fitness trainer, specialist in infant and young child feeding, nutritionist, researchers, obstetrics and gynaecologist, pharmacist, midwife and public health officer from MOPH. The sample size of the NGT ($n = 11$) is in line with the recommendation of less than 12 members per group (University of Arkansas/Division of Agriculture, 2009).

### 2.2.2 | Procedure

The NGT exercise was conducted for the following three purposes: (1) identification/selection of the themes to be included in the DLGP, (2) formulating the selected themes into guidelines and (3) translating the themes and their corresponding guidelines to the Arabic language. During these three phases, each participant was given the chance to speak, vote and propose ideas and discussions.

In preparation for the NGT exercise and debate, experts were provided with the list of themes extracted from the literature review. Participants were given the choice to select, merge, delete or propose new themes from/to the list. Experts were asked to record their views or ideas privately on each of the themes. This was followed by a group discussion of each of the individual themes for clarification and evaluation of its relevance as well as its specificity to the Lebanese context. Selection of the themes was conducted by seeking consensus, defined as 80% agreement among the participants (Dobson et al., 2019; Murphy et al., 1998). For each selected theme, further rounds of group discussion and voting on the formulation of the guidelines were held, followed by their translation to the Arabic language (see Appendix 1). For items that did not reach consensus, revision and repeat voting were performed. Results of the meeting were summarized by the moderator, and unanimous agreement was sought on the final draft. Figure 1 presents a summary of the NGT exercise used in our experts' meeting.

Following the consensus group meeting, the final draft of the guidelines was shared via email with the participants who were asked to submit any additional feedback and comments. The final approved draft and the order of the themes were circulated after all reviews were provided.

## 2.3 | Ethical considerations

The protocol of the study was approved by Institutional Review Board at the American University of Beirut (Protocol ID: NUT. FN. 12). Oral consent was obtained from all participants.

## 3 | RESULTS AND DISCUSSION

### 3.1 | Literature review

Based on the performed literature search, 14 internationally published guidelines were identified and reviewed. Based on this review, 17 different themes were extracted, including gestational weight gain (GWG), diet diversity/Mediterranean diet, folic acid, iron, omega-3 fatty acids, vitamin D, calcium, hydration, harmful foods, caffeine, smoking, alcohol, food safety, physical activity, breastfeeding, herbs and fasting (Table 1). The review showed that all of the identified 14 guidelines have tackled diet diversity, folic acid, iron, alcohol and hydration. Other common themes were related to GWG, caffeine, food safety and physical activity (93% of the guidelines). The
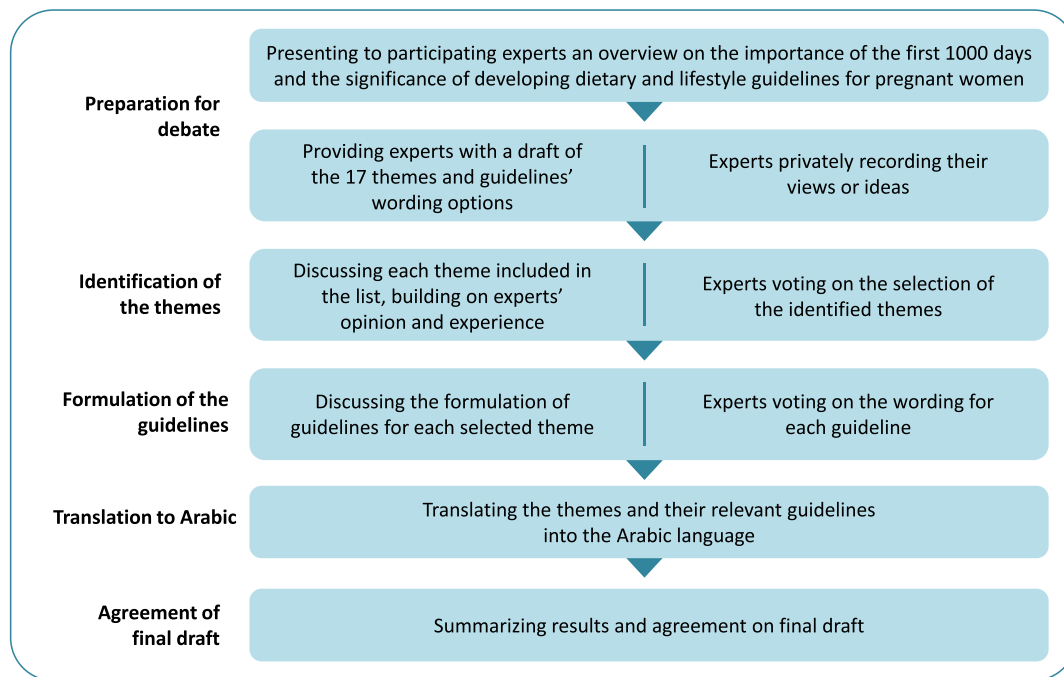
**FIGURE 1**  Outline of the steps followed in the consensus group meeting: Nominal group technique (NGT)

significance of calcium was tackled by 86% of the published guidelines and vitamin D and harmful foods by 79%, whereas smoking and breastfeeding were addressed by 64% of the guidelines. The significance of omega-3 fatty acids and the consumption of herbs was included in 57% of the reviewed guidelines, and the least common theme included fasting (14%).

## 3.2 | Themes and guidelines

Of the 17 themes derived from the literature, seven themes were selected during the expert meeting ('gestational weight gain', 'diet diversity', 'hydration', 'food safety', 'harmful foods', 'physical activity' and 'breastfeeding'), eight themes were merged/modified ('folic acid', 'iron', 'omega three fatty acids', 'smoking', 'alcohol', 'caffeine' and 'fasting'), and two were eliminated ('herbs' and 'calcium'). In addition, two new themes emerged during the discussion ('wellbeing' and 'nutrition resilience'). As such, the Lebanese DLGP consisted of 12 themes. The themes and guidelines for which consensus was reached in the nominal group meeting are presented in Table 2.

### 3.2.1 | GWG

Consensus was reached to include this theme at 90.9% from the first round of voting. For the formulation of the guideline, the group did not reach consensus from the first voting process (63.6% consensus), and many preferred the use of positive words. Accordingly, the

following guideline was selected: 'Maintain a healthy weight gain during pregnancy: It's not about eating for two' (90.9% consensus). Given the lack of national or regional weight gain recommendations during pregnancy, that of the Institute of Medicine (IOM) will be adopted in this guideline (Institute of Medicine and National Research Council, 2009). In addition, the need to address adolescent pregnancy was raised by the attendees who suggested to include this topic under the 'special considerations' section within this theme.

GWG is included in most of the available DLGP worldwide (Table 1), given its potential impact on pregnancy and birth outcomes. Inadequate GWG was in fact reported to heighten the risk for low birthweight (LBW), preterm births and impaired fetal growth, whereas excess GWG was identified as a risk factor for gestational hypertension, gestational diabetes mellitus, preeclampsia, complicated deliveries, macrosomia (Siega-Riz et al., 2009) and adverse cardiometabolic profile in the offspring (Gaillard et al., 2015). In addition, a convincing body of evidence shows that excessive GWG in all body mass index (BMI) categories is a strong predictor of post-partum weight retention, which itself is associated with increased risk of adverse health outcomes in subsequent pregnancies including hypertension, diabetes and stillbirth (Nasreddine et al., 2020). In Lebanon, a previous cohort study conducted by our group showed that only 33.9% of pregnant women fell within the adequate GWG range based on the IOM guidelines, whereas 21.3% and 44.9% had inadequate or excessive GWG, respectively (Abdulmalik et al., 2019). Excessive GWG was also shown to be an independent predictor of post-partum weight retention in Lebanese women (Nasreddine et al., 2020).

**TABLE 1** Summary of the reviewed international dietary and lifestyle guidelines for pregnant women

| Country/organization Common themes | Australia (Australian Government National Health and Medical Research Council, 2013b, 2020) | Canada (Government of Canada, 2018, 2019) | USA (IFICF & AAPA) (International Food Information Council Foundation and American Academy of Physician Assistants (AAPA), 2016) | USA (OWH) (Office on Women's Health/US Department of Health & Human Services, 2019) | UK (British Nutrition Foundation, 2018) | Sweden (Swedish Food Agency, 2020; The Swedish National Food Administration, 2008) | Unicef (Unicef) | Nova Scotia/Canada (Nova Scotia Department of Health and Wellness, 2013) | New Zealand (New Zealand Government Ministry of Health, 2017) |
|---|---|---|---|---|---|---|---|---|---|
| Gestational weight gain | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | - | ✓ | ✓ |
| Diet diversity | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Folic acid | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Iron | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Omega-3 fatty acids | - | - | ✓ | ✓ | ✓ | ✓ | - | - | ✓ |
| Vitamin D | - | ✓ | ✓ | ✓ | ✓ | ✓ | - | ✓ | ✓ |
| Calcium | ✓ | ✓ | ✓ | ✓ | ✓ | - | - | ✓ | ✓ |
| Harmful foods | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | - | ✓ | ✓ |
| Alcohol | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Caffeine | - | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Food safety | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Herbs | - | ✓ | ✓ | ✓ | ✓ | ✓ | - | ✓ | ✓ |
| Hydration | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Smoking | - | ✓ | - | ✓ | - | - | ✓ | - | ✓ |
| Physical activity | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | - | ✓ | ✓ |
| Breastfeeding | ✓ | ✓ | - | - | - | ✓ | ✓ | ✓ | - |
| Fasting | - | - | - | - | ✓ | - | - | - | - |

**TABLE 1** Continued

| Common themes | The academy of Nutrition & Dietetic (Procter & Campbell, 2014) | Uganda- clinical practice (Ministry of Health, 2010) | Ireland- clinical practice (Institute of Obstetricians and Gynaecologists/Royal College of Physicians of Ireland/Directorate of Clinical Strategy and Programmes/Health Service Executive, 2016) | WHO (World Health Organization, 2016b) | Latvia- clinical practice (Meija & Rezeberga, 2017) |
|---|---|---|---|---|---|
| Gestational weight gain | ✓ | ✓ | ✓ | ✓ | ✓ |
| Diet diversity | ✓ | ✓ | ✓ | ✓ | ✓ |
| Folic acid | ✓ | ✓ | ✓ | ✓ | ✓ |
| Iron | ✓ | ✓ | ✓ | ✓ | ✓ |
| Omega-3 fatty acids | ✓ | - | ✓ | - | ✓ |
| Vitamin D | ✓ | - | ✓ | ✓ | ✓ |
| Calcium | ✓ | ✓ | ✓ | ✓ | ✓ |
| Harmful foods | ✓ | - | ✓ | - | ✓ |
| Alcohol | ✓ | ✓ | ✓ | ✓ | ✓ |
| Caffeine | ✓ | ✓ | ✓ | ✓ | ✓ |
| Food safety | ✓ | ✓ | ✓ | - | ✓ |
| Herbs | - | - | ✓ | - | - |
| Hydration | ✓ | ✓ | ✓ | ✓ | ✓ |
| Smoking | ✓ | ✓ | ✓ | ✓ | ✓ |
| Physical activity | ✓ | ✓ | ✓ | ✓ | ✓ |
| Breastfeeding | - | ✓ | ✓ | ✓ | ✓ |
| Fasting | - | - | ✓ | - | - |

Abbreviations: AAPA, American Academy of Physician Assistants; IFICF, International Food Information Council Foundation; OWH, Office on Women's Health; UK, United Kingdom; US; United States of America; WHO, World Health Organization.

**TABLE 2** The 12 identified themes for the Lebanese DLGP and their respective guidelines and consensus outcomes

| Themes and guidelines | Vote 1 | | Vote 2 | |
|---|---|---|---|---|
| | % of votes | Consensus (√ ≥ 80%) | % of votes | Consensus (√ ≥ 80%) |
| Gestational weight gain | 90.9 | √ | | |
| ° Maintain a healthy weight gain during pregnancy: It's not about eating for two. | 63.6 | √ | 90.9 | √ |
| Diet diversity | 100 | √ | | |
| ° Enjoy the diversity of the Lebanese Mediterranean diet by consuming these foods daily. | 73 | No | 100 | √ |
| Supplementation: Know your supplements | 81.8 | √ | | |
| ° *Iron:* You are advised to take daily iron supplements. Consult with your physician for individualized iron supplement intake. | 81.8 | √ | | |
| ° *Folic acid:* Do not forget your daily folic acid supplements. | 63.6 | √ | 81.8 | √ |
| ° *Vitamin D:* Get regular exposure to sunlight for a short period of time. Contact your physician for supplementation if you are vitamin D deficient. | 54.5 | No | 90.9 | √ |
| ° *Omega-3:* If you do not consume seafood, consult with your physician regarding the need for omega-3 fatty acid supplementation. | 45.5 | No | 81.8 | √ |
| Hydration | 100 | √ | | |
| ° Stay hydrated; drink plenty of safe water, around 8–12 cups of fluids per day. | 54.5 | No | 81.8 | √ |
| Limiting harmful foods | 100 | √ | | |
| ° Limit foods that are high in calories, sugar, artificial sweeteners, saturated fats, salt and caffeine. | 81.8 | √ | | |
| Alcohol and smoking | 36.4 | No | 90.9 | √ |
| ° Abstain from alcohol and all forms of smoking during pregnancy, including cigarettes, arguileh (waterpipe), E-cigarette, vape and secondhand smoking. | 100 | √ | | |
| Food safety | 100 | √ | | |
| ° Prepare and consume safe food using proper food handling and storage. | 81.8 | √ | | |
| Physical activity | 81.8 | √ | | |
| ° Enjoy an active lifestyle: Aim for at least 20–30 minutes of moderate intensity, safe exercise on most days of the week, such as walking, aerobic and stretching exercises. | 81.8 | √ | | |
| Breastfeeding | 100 | √ | | |
| ° Prepare for breastfeeding; it is your baby's optimal food. | 45.5 | No | 91.9 | √ |
| Religious fasting | 81.8 | √ | | |
| ° Always consult with your physician in case you decide to fast (Ramadan or Lent). | 72.7 | No | 81.8 | √ |
| Wellbeing | 45 | No | 82 | √ |
| ° Take care of yourself: Eat well, sleep well, feel well. | 82 | √ | | |
| Nutrition resilience | 36 | No | 82 | √ |
| ° Consider your guidelines when coping with exceptional circumstances. | 82 | √ | | |

### 3.2.2 | Diet diversity/Mediterranean diet

The need to include the diet diversity theme was agreed upon by all experts (100% consensus). For the guideline formulation, the following was agreed upon (100%): 'Enjoy the diversity of the Lebanese Mediterranean diet by consuming these foods daily: vegetables and fruits, whole wheat grains, milk and dairy products, legumes, lean meats, eggs, and unsalted nuts and seeds'. The need to address vegetarian pregnant women emerged, and the group agreed to incorporate this topic under the 'special considerations' section of this theme. The need to tackle low intakes of dairy products such as among women with lactose intolerance has also emerged under the 'special considerations' section, with the group recommending that calcium supplementation should be addressed in this section for these subgroups.

The consumption of a balanced diet that ensures dietary diversity is a key strategy in optimizing nutrient intakes during pregnancy (Koletzko et al., 2019). Maternal diet and its composition play a crucial role early in pregnancy on organ development and differentiation, whereas in late pregnancy, it can be a major modulator of fetal growth rate and brain development (Jansson, 2016). In the proposed DLGP, the focus will be placed on the promotion of diet diversity in line with the traditional Lebanese diet, a variant of the Mediterranean dietary pattern (Naja, Hwalla, 2015). The Lebanese diet, which is embedded in the local culture and tradition, was previously shown to be associated with healthier nutrient intakes as well as lower risk of obesity and cardiometabolic risk in the Lebanese population (Matta et al., 2016).

### 3.2.3 | Supplementation: Know your supplements

A total of 81.8% of attendees voted to group all supplements in one theme titled 'Supplementation: Know your supplements'. When formulating the guideline, the group agreed to include individual statements for each supplement (Table 2).

Compared with the modest rise in energy requirements, the requirements for several micronutrients increase to a much larger extent during pregnancy (Koletzko et al., 2019). Particular attention should therefore be paid to micronutrient intakes during this crucial period, given the well-established link between maternal micronutrient deficiencies, increased prenatal complications and adverse outcomes on fetal growth and child development (Christian & Stewart, 2010). In Lebanon, the burden of micronutrient deficiencies is persistent among women of reproductive age. According to the World Health Organization (WHO) country estimates, the prevalence of anaemia among Lebanese women of reproductive age ranged from 27% in 2011 (World Health Organisation, 2015a) to 31.2% in 2016 (The World Bank, 2021). A study conducted in primary healthcare centres in Lebanon showed that 16% of women of reproductive age were anaemic, 27.2% were iron deficient, and 25.1% had folate deficiency (Al Khatib et al., 2006), whereas higher estimates were reported from a rural setting, with 45.4% having anaemia and 43.3% having iron deficiency anaemia (Asmar et al., 2018).

Pregnant women are among the most vulnerable population groups to iron deficiency, given the increased iron needs to supply the growing fetus and placenta as well as to increase the maternal red cell mass (Fisher et al., 2020). It has been proposed that anaemia during pregnancy may increase the risk of LBW (Figueiredo et al., 2019), preterm birth (Rahmati et al., 2020) and perinatal mortality (Smith et al., 2019). Compared with non-pregnant women, for whom the daily iron requirements are set at 18 mg/day, iron requirements during pregnancy increase to 27 mg/day (Institute of Medicine [US] Panel on Micronutrients, 2001). Hence, there may be a need for iron supplementation during this period of the life cycle, with higher doses being administered to women with established anaemia (Institute of Medicine, 1990). There is also a crucial need to achieve adequate folate status during pregnancy in order to support maternal and offspring health and prevent neural tube defects (De-Regil et al., 2015; World Health Organisation, 2015b). All women of reproductive age are recommended to consume at least 400 μg of folic acid per day from supplements or fortified foods, in addition to consuming a varied diet that includes folate-rich foods (Hanson et al., 2015). Women who intend to get pregnant should be encouraged to consume this dose for at least 2–3 months prior to conception (Greenberg et al., 2011; Institute of Medicine, 1998). Demands for folate increase substantially during pregnancy to support fetal growth and development and sustain the accelerated single-carbon transfer reactions involved in nucleotide synthesis and cell division (Greenberg et al., 2011; Institute of Medicine, 1998). To ensure that women maintain adequate folate stores during pregnancy, the IOM recommends the intake of 600 μg of folic acid for pregnant women. The ingestion of folate supplements should be maintained during at least the first 16 weeks of gestation (World Health Organisation, 2015b) and preferably throughout pregnancy (Greenberg et al., 2011; Institute of Medicine, 1998). Vitamin D status during gestation has also received increasing attention, because adequate vitamin D is needed to maintain maternal calcium homeostasis and hence foster optimal skeletal development in the fetus (Dawodu & Wagner, 2012; Harvey et al., 2014). Maternal vitamin D deficiency may result in osteopenia in the newborn and rickets and reduced bone density in childhood (Bischoff-Ferrari, 2011), although other studies have suggested its potential link to LBW (Gernand et al., 2013), neonatal hypocalcaemia and cardiac failure (Maiya et al., 2008). Vitamin D deficiency is highly prevalent among Lebanese women, being estimated at 61.7% (Khalife et al., 2017). Apart from the fact that dietary vitamin D intake does not exceed 2–4 μg per day (Gannagé-Yared et al., 2005), sun exposure may be suboptimal for some women for cultural reasons related to clothing and dress codes as well as social norms (Gannage-Yared et al., 2008). Supplementation throughout pregnancy may therefore be needed among vitamin D-deficient women in Lebanon.

Despite the geographic position of Lebanon on the Mediterranean shores, the consumption of fish is low in the country, particularly among women of reproductive age (18.2 g per day, with 73.6% consuming <2 servings of fish per week) (Nasreddine et al., 2006). Adequate consumption of fish, or supplementation with

omega-3 long-chain fatty acids, was reported to lower the risk of early preterm birth prior to 34 weeks of gestation. For women with a low consumption of fish, omega-3 fatty acid supplements may be recommended (National Institute of Health, 2020).

Under the 'special considerations' section for this theme, participants agreed to add the recommendation to increase awareness regarding the use of complementary and alternative medicine (CAM) during pregnancy. CAM, including herbal supplements, use is prevalent in the general Lebanese population (Naja, Alameddine, et al., 2015). Acknowledging that CAM use, such as herbal products, may lead to serious side effects that may compromise fetal growth (Steel et al., 2015), increasing awareness on the potential harmful impacts of CAM use during pregnancy was deemed important.

### 3.2.4 | Hydration

After extensive discussion, the voting resulted in 81.8% consensus on the following guideline for this theme: 'Stay hydrated; drink plenty of safe water, around 8–12 cups of fluids per day'.

During pregnancy, physiological changes lead to an increase in daily water requirements, and hence, adequate fluid intake is needed to cater for maternal needs as well as fetal growth requirements. Available studies conducted in various countries in the world have shown that pregnant women have insufficient fluid intake, hence increasing the risk of dehydration in this crucial period of the life cycle (Bardosono et al., 2016; McKenzie et al., 2017). Insufficient fluid intake during pregnancy was suggested to be associated with spontaneous abortion, preterm births and LBW (Savitz et al., 1995). It was also suggested that chronic hypovolaemia resulting from insufficient water intake may be among the main risk factors for the development of diabetes (Thornton, 2014).

### 3.2.5 | Limiting harmful foods

With regard to the guideline formulation, discussions regarding the terms 'Avoiding' and 'Limiting' took place, and the latter was selected; a consensus of 81.8% was reached for the following guideline: 'Limit foods that are high in calories, sugar, artificial sweeteners, saturated fats, salt and caffeine'.

The need to limit these types of food is backed up by the available scientific evidence. Like other countries of the EMR, Lebanon is undergoing the nutrition transition with its characteristic shifts in diet towards Western and obesogenic dietary patterns, which are high in energy, fat, saturated fat, added sugars and salt (Nasreddine et al., 2019). Regular consumption of high-energy foods may result in excessive energy intake during gestation, which, through developmental programming, may lead to long-term health outcomes in the child including obesity, diabetes, hyperlipidaemia and the metabolic syndrome (Campisano et al., 2019; Eckert et al., 2015). Another area of concern is the potential link between the consumption of foods that are high in fat, sugar or salt with adverse effects on both mother and

child, including disturbing the hormonal and metabolite milieu and impacting insulin sensitivity, adiposity and glucose tolerance (Koletzko et al., 2019; Musial et al., 2017).

Dose–response relationships between caffeine intake and adverse pregnancy outcomes including LBW and miscarriage have been proposed by some systematic reviews (Greenwood et al., 2014; Rhee et al., 2015). The WHO indicated that caffeine intake of 300 mg/day in pregnant women was associated with increased risk for intrauterine growth retardation (CARE Study Group, 2008), whereas the European Food Safety Authority determined a maximum level of caffeine intake of 200 mg/day during pregnancy (EFSA Panel on Dietetic Products & Allergies, 2015). In fact, compared with non-pregnant women, maternal caffeine metabolism is significantly slower during pregnancy, with 1.5–3.5 times longer half-life needed for caffeine elimination (Rhee et al., 2015). This increases fetal exposure to this substance, given that caffeine can be easily transmitted across the placental barrier (Fortier et al., 1993). The immature fetal liver produces low levels of enzymes needed for caffeine metabolism, thus increasing the risk of adverse outcomes including LBW (Bakker et al., 2010).

Despite the increasing consumption of artificial sweeteners, their long-term impact on health is poorly understood, and current intake recommendations are still unclear, especially for pregnant women (Azad et al., 2016). A growing body of evidence suggests that chronic consumption of artificial sweeteners may in fact increase rather than decrease the risk of obesity and metabolic diseases (Swithers, 2013). Cohort studies have reported associations between consumption of these sweeteners during pregnancy and preterm delivery (Halldorsson et al., 2010; Petherick, Goran, et al., 2014), allergic diseases (Maslova et al., 2013) and increased BMI and overweight risk among the offspring (Azad et al., 2016).

### 3.2.6 | Alcohol and smoking

Two attendees suggested to keep 'Smoking' as an independent theme but group 'Alcohol' and 'Caffeine' with 'Harmful Foods'. Only 36.4% of the participants agreed to this suggestion; hence, consensus was not reached. Another proposal was presented, whereby 'Alcohol' and 'Smoking' would be merged under one theme 'Alcohol and Smoking'. After discussion, a second round of voting was taken, and consensus was reached at 90.9%. For the formulation of the guideline, the following was unanimously agreed upon (100% consensus): 'Abstain from alcohol and all forms of smoking during pregnancy, including cigarettes, arguileh (waterpipe), E-cigarette, Vape and secondhand smoking'.

Alcohol drinking during pregnancy is a leading cause of birth defects and developmental disabilities, with the fetal alcohol syndrome being one of its most severe outcomes (DeJong et al., 2019). Alcohol drinking is in general under-reported in research, due to the prevalent cultural and social norms in some countries, particularly in Muslim communities (Alhashimi et al., 2018). A national cross-sectional study conducted among Lebanese mothers of 0- to

2-year-old children estimated the prevalence of alcohol drinking during pregnancy at 3.3% (Zgheib, 2014). However, a prospective study conducted among Lebanese pregnant women (n = 117) showed that more than 11% of participating women engaged in potentially high-risk drinking for the baby (Maalouf et al., 2011). Therefore, as in many other countries in the world, alcohol use in pregnancy remains a public health priority in Lebanon. As women are often motivated to make lifestyle changes during their pregnancy, it is crucial to provide them with the needed knowledge and awareness and to ensure proper dissemination of the recommendations.

Maternal smoking during pregnancy is another major public health concern (Knopik, 2009), given its association with LBW (Ricketts et al., 2005), heightened risk of stillbirth (Salihu et al., 2008), altered cardiorespiratory responses (Huang et al., 2006) and increased wheezing and asthma (Janson, 2004) as well as several neurodevelopmental disorders, including increased evidence of attentional deficits (Dong et al., 2018), impaired learning and memory and cognitive dysfunction (Mortensen et al., 2005). Despite the large literature suggesting adverse health outcomes in children exposed to maternal smoking during pregnancy, many pregnant women still engage in this practice (Dong et al., 2018). In Lebanon, a national cross-sectional survey estimated the prevalence of maternal smoking during pregnancy at 15.3% (Zgheib, 2014). Another study conducted on women from 23 healthcare centres in Lebanon showed that 23% of participants reported smoking during pregnancy (cigarette or arguileh) (Chaaya et al., 2004).

### 3.2.7 | Food safety

The importance of having 'Food Safety' as a theme on its own was agreed by all experts (100% consensus), and the guideline for the theme was voted for by 81.8%: 'Prepare and consume safe food using proper food handling and storage'.

It is imperative to raise awareness on safe ways to prepare and consume foods to decrease the risk of food-borne illnesses such as listeriosis, salmonellosis and toxoplasmosis, which can induce spontaneous abortion, premature birth, severe fetal damage and stillbirth (Robert-Koch-Institut, 2011; Schöneberg, 2008). Although, in many developed countries, improved surveillance and regulatory standards have reduced the availability of contaminated foods in retail outlets and restaurants, this may not be the case in Lebanon, a country that still suffers from a high burden of food-borne illnesses (Kharroubi et al., 2020). Unpasteurized milk and its products, raw meat, smoked fish, soft cheeses and vegetables and salads may transfer listeriosis (Lamont et al., 2011; Oliveira et al., 2010). Raw animal-based foods and soft-cooked eggs may also transmit salmonellosis, whereas toxoplasmosis may be transmitted through raw or not fully cooked meats from pork and lamb and potentially from beef (Bojar & Szymanska, 2010; Elsheikha, 2008). Pregnant women are therefore advised to avoid the consumption of raw animal-based foods, including raw or not thoroughly cooked meat, salami, raw ham, raw fish, raw seafood, unpasteurized milk and raw eggs, as well as foods made of

these products (Koletzko et al., 2019). Recent studies in Lebanon have also documented prevalent food contamination with *Escherichia coli* and *Staphylococcus aureus* (Kharroubi et al., 2020), which highlights the urgency to tackle food safety and safe preparation of food among pregnant women in the country.

### 3.2.8 | Physical activity

Physical activity was considered by most participants to be an important theme (81.8% consensus). Two participants suggested adding 'Sleep' to this theme, but only 18% agreed to this grouping. Although this suggestion did not reach consensus, it shed the light on the importance of mental and physical wellbeing during pregnancy, which led to the emersion of a new theme entitled 'Wellbeing'.

As for the formulation of the guideline, 81.8% of participants selected 'Enjoy an active lifestyle: aim for at least 20-30 minutes of moderate intensity, safe exercise on most days of the week'. Based on traditional and cultural norms, pregnant women are often advised to avoid or reduce their levels of physical activity because of the belief that physical activity may increase the risk of miscarriages, preterm deliveries and intrauterine growth retardation (Schramm et al., 1996). However, the scientific evidence that has accumulated during the last two decades have provided solid counterarguments to these misconceptions, showing that physical activity during pregnancy has numerous beneficial effects for both mother and offspring (American College of Obstetricians and Gynecologists [ACOG], 2002). Several studies have shown that physical activity may be associated with significant improvements in maternal and fetal outcomes (Mottola, 2013) while also showing that physical activity during pregnancy may reduce excessive GWG and decrease the incidence of gestational diabetes (Streuling et al., 2011). Within the description of this theme, the group agreed to list a few examples of the types of exercises that are considered safe for pregnant women, such as walking, aerobic and stretching exercises. Such recommendations are in line with those of the ACOG (2020).

### 3.2.9 | Breastfeeding

The importance of breastfeeding was acknowledged in the first round of voting (100% consensus). Regarding the guideline's formulation, 91.9% of the attendees voted for the following: 'Prepare for breastfeeding; it is your baby's optimal food'.

Breastfeeding should be encouraged, supported and protected. Breastfeeding is associated with several benefits for the mother and her child and is universally recommended as the optimal method of infant feeding (Prell & Koletzko, 2016). In addition to its positive impact on growth and development, recent studies suggest that breastfeeding and early nutrition constitute an important determinant of NCD risk later in life (Khanna et al., 2007; Singhal, 2016). Several studies have suggested that compared with infant formula, breastfeeding was associated with healthier weight gain during the

first year of life and beyond (Li et al., 2012; Lindholm et al., 2020). Breastfeeding was also linked with a modest risk reduction for overweight and obesity later in childhood and adulthood by approximately 10% (Horta et al., 2015; Moss & Yeaton, 2014; Poorolajal et al., 2020; Umer et al., 2015; Yan et al., 2014). Based on available evidence, the WHO has recommended exclusive breastfeeding for the first 6 months of life (World Health Organization, 2002).

Available data in Lebanon show that despite a relatively high initiation rate of breastfeeding (41.5%), the prevalence rate of exclusive breastfeeding at 6 months is low, estimated at 12.3% (Chehab et al., 2020). In a national survey, inadequate breastfeeding knowledge was identified as a determinant of short breastfeeding duration among Lebanese women (Zgheib, 2014). Breastfeeding decisions are embedded and continuously being made, within a woman's cultural and social context, and these decisions appear to be made prenatally (Dykes, 2006). Based on the theory of planned behaviour, breastfeeding intention is an immediate precursor to breastfeeding behaviour, and in turn, intention is influenced by maternal knowledge and awareness related to breastfeeding (Kavanagh et al., 2012; Sheeham & Schmied, 2011). Hence, the inclusion of breastfeeding in the DLGP and tackling its benefits, ways to prepare for it and potential barriers and challenges that may be encountered by the lactating mother may help in encouraging Lebanese women to breastfeed their infant.

### 3.2.10 | Religious fasting

Consensus was reached at 81.8% to present 'Religious Fasting' as an independent theme. As for the guideline formulation, consensus was reached (81.8% during the second round of voting) on the following: 'Always consult with your physician in case you decide to fast (Ramadan or Lent)'.

Lebanon includes large Muslim and Christian communities, within which religious fasting is commonly practised (Henley, 2016). Despite being exempt, many pregnant Muslim women practise fasting during the month of Ramadan, abstaining from eating and drinking from sunrise until sunset (Glazier et al., 2018). It has been suggested that exposure to a restricted or suboptimal diet during gestation may affect fetal development and can carry lifelong health impacts on the offspring (Glazier et al., 2018). Although the effects of Ramadan fasting during pregnancy on the health status of the child have been investigated (Awwad et al., 2012; Petherick, Tuffnell, et al., 2014), conflicting results were reported, and sample sizes were often too small to allow for generalization of findings (Glazier et al., 2018). A recent systematic review and meta-analysis of observational studies and randomized controlled trials, including 18,920 pregnant women, concluded that Ramadan fasting does not adversely influence birthweight, although there is insufficient evidence related to the potential effects of fasting on other perinatal outcomes (Glazier et al., 2018). Less data are available on the potential impact of Lent fasting on pregnancy outcomes. This type of fasting, which is based on abstaining from animal source foods, was previously shown to

negatively affect maternal nutritional status and dietary patterns, including significant decreases in the average number of meals and diet diversity scores (Desalegn et al., 2018). Given the lack of clear guidance on fasting during pregnancy, women are advised to seek advice from their physician and health practitioners regarding the safety of Ramadan or Lent fasting (Glazier et al., 2018).

### 3.2.11 | Wellbeing

This was a new theme that emerged within the meeting. A total of 82% of attendees agreed on the following guideline: 'Take care of yourself: Eat well, sleep well, feel well'.

Psychological wellbeing during pregnancy is increasingly recognized as a crucial factor that may impact pregnancy and birth outcomes (Urech et al., 2010). Pregnancy, which was once portrayed as a time of greater emotional wellbeing for women, is now acknowledged to be associated with anxiety and other mood disorders, with some women being more vulnerable than others (Cohen et al., 2010; Staneva, 2013). Low psychological wellbeing and prenatal maternal stress are associated with numerous adverse outcomes, such as fetal growth restriction, LBW and increased risk for preterm delivery (Alder et al., 2007; Lopez Bernal, 2007). Some studies have also shown that maternal stress and anxiety may be associated with increased arterial blood pressure and pre-eclampsia as well as decreased uterine blood flow (Field et al., 2006; Hernández-Valencia et al., 2007). In addition, women with high anxiety, stress or depressive symptoms during pregnancy are more likely to experience mood disorders in the post-partum period, which carries negative consequences on infant development (Schetter & Tanner, 2012). For instance, post-partum depression and anxiety syndromes were found to be associated with early breastfeeding cessation, lower rates of exclusive breastfeeding and reduced breastfeeding initiation, duration and intensity (Wouk et al., 2017). It is therefore crucial to raise awareness among pregnant women of the importance to address mental wellbeing during pregnancy by seeking professional help when needed and by instilling lifestyle practices. Such lifestyle practices include, in addition to adequate sleep and optimal diet, maintaining an active lifestyle.

### 3.2.12 | Nutrition resilience

Another theme that emerged during the meeting was 'Nutrition Resilience'. Given that the country has been facing frequent emergency conditions (a refugee crisis, an economic meltdown and the global pandemic), the group agreed on the need to address resilience using the following guideline: 'Consider your guidelines when coping with exceptional circumstances'.

The concept of 'resilience' and its practical application in nutrition and food security are gaining increasing attention, particularly in regions that witness natural disasters or human-induced political crises (Food and Agriculture Organization of the United Nations, 2014). Lebanon is unfortunately a country that experiences a high frequency

of political unrest, financial instability and conflict. The recent financial meltdown experienced by the country is one of the multifaceted challenges that the population is subjected to, with its serious ramifications on food and nutrition security (UNHCR, 2020). This difficult financial situation is further complicated by the COVID-19 pandemic, with its far-reaching ramifications on the economic welfare and financial self-sufficiency of many families in the country. Amidst this chaotic turmoil, it is crucial that the developed DLGP be adaptable to difficult and emergent situations: It can involve making adjustments in choices related to food utilization; the types of foods to be consumed can be adjusted to favour affordable ones, without jeopardizing the nutrition quality of the diet as a whole (Naja & Hamadeh, 2020). The developed DLGP will enhance awareness among pregnant women on the importance of showing resilience in face of a crisis and maintaining a healthy lifestyle including eating diets that are high in fruits and vegetables, getting some physical activity when possible, trying to maintain a healthy weight and getting an adequate amount of sleep (Naja & Hamadeh, 2020).

## 3.3 | Strengths and limitations

To our knowledge, this study is the first from the EMR to develop through a consensus building exercise, dietary and lifestyle guidelines for pregnant women. The study, however, has few limitations. The selection of participants for the nominal group workshop was not based on objective criteria or randomization. It was rather based on professional opinions with respect to the length of experience of these participants in relevant areas and their involvement in teaching, research or advocacy in maternal nutrition, and they all brought a significant level of expertise to the discussion and consensus building exercise. In addition, the priority themes and guidelines presented in this paper for inclusion in the DLGP are based on a thorough review of currently available literature, but in a number of instances, there is still a scarcity of data. Progress in scientific evidence over time may lead to future updates and revisions of these guidelines. Another limitation is the fact that the literature review undertaken in this study was restricted to the English language.

## 4 | CONCLUSION

This study has identified the priority themes to be included in the dietary and lifestyle guidelines for pregnant women in Lebanon. These guidelines are devised for women living in a low-middle income country, undergoing the nutrition transition, while building on available scientific evidence and taking long-term health consequences into account. The study responds to the need for improving maternal nutrition as a strategy for enhancing, not only their health but also the health and development of the next generation. Putting maternal nutrition at the heart of tackling malnutrition and its detrimental health outcomes is a core investment for successfully achieving the sustainable development goals of the United Nations (Godfrey, 2017).

Given that the results of consensus methods are, in many instances, considered as first step towards the formulation of the final guidelines (Manera et al., 2019), the developed guidelines in this study will be put at the disposition of the Lebanese MOPH, as preliminary guidelines for which approval of a larger body of experts is recommended in the future.

## CONFLICTS OF INTEREST

The authors declare that they have no competing interests.

## CONTRIBUTIONS

LN and FN conceptualized and supervised the study. FN and JA coordinated the project. LN, FN, JA, SB, SN and PZ contributed to the methodology. FN and JA analysed and interpreted the data. SB, SN, PZ and JA conducted the database searches, selected and retrieved the relevant papers and carried out data extraction. LN, FN and JA designed the first draft of the manuscript. LN and FN revised the manuscript for intellectual content. All authors read and agreed to the final manuscript to be submitted to this journal.

## DATA AVAILABILITY STATEMENT

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

## ORCID

*Farah Naja* 🔟 https://orcid.org/0000-0002-8861-3498
*Jennifer Ayoub* 🔟 https://orcid.org/0000-0003-4866-5856
*Lara Nasreddine* 🔟 https://orcid.org/0000-0003-3707-8218

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## APPENDIX A

The 12 identified themes for the Lebanese DLGP and their respective guidelines, in Arabic language

المواضيع الاثني عشر

زيادة الوزن أثناء الحمل
- حافظي على زينصحي أنت لا تتناولين الطعام عن شخصين: زيادة وزن صحية أثناء الحمل.

تنوع النظام الغذائي
- من خلال تناول هذه الأطعمة المتوسطي اللبناني الغذائي النظام بتنوع استمتعي يوميا.

المكملات: تعرفي على المكملات الغذائية الخاصة بك
- ديدحكبالخاصة الحديد مكملات على للحصول طبيبك استشيري. ينصح بتناول مكملات الحديد اليومية.
- لا تنسكيكليفولفال الفوليك حمض من اليومية مكملاتك.
- تعرضتيقصير لفترة الشمس لأشعة د فيتامين من نقص من تعانين كنت إذا د الفيتامين مكملات على للحصول طبيبك مع تواصلي منتظمفيتامين بشكل ي من ..المنزل.
- 3 أوميغا: إذا كنت لا تتناولين الأسماك والمأكولات البحرية، استشيري طبيبك فيما يتعلق بالحاجة إلى مكملات أوميغا 3 اليومية.

المرطبات
- شرب المياه يوميا من السوائل؛ اشربي الكثير من المياه النظيفة، حوالي 8–12 أكواب من السوائل وماء.

الحد من الأطعمة الضارة
- حد من تناول الأطعمة التيفيينيكافيوالكافيين والملح، الدهون المشبعة، المحليات الاصطناعية، السكر، على سعرات حرارية عالية تحتوي ي.

الكحول والتدخين
- الامتناع عن تناول الكحول من عنمنخينللتدخللتعرض (السلبي والتدخين الإلكترونية والسجائر والأرجيلة السجائر ذلك في بما الحمل، أثناء التدخين أنواع ي عن الغير الناتج).

سلامة الغذاء
- إعداد واستهلكيكالطعام من الآمن للحمل تناول وتختزميسليبشكلكالأغذية ين.

النشاط البدني
- استمتعي،المشي تمارين ممارسة ذلك في بما الأسبوع أيام معظم خلال والآمنة الشددة المعتدلة التمارين من دقيقة 20–30 يقل ما لا إلى اهدفي: نشيط حياة بأسلوب ي. ددمتالتمارين الهوائية، وتمارين.

الرضاعة الطبيعية
- أطعمي لطفلكاستعدبدليحل. الطبيعية للرضاعة ي ألما وه.

الصوم الديني
- استشيريالكبيبطبك تصومي أن قررت حال في دائما طبيبك يري (الصوم أو رمضان).

الرفاهية
- اعتنيدجيدةبحالة واشعري نام جيدا، الطعام تناولي: بنفسك ي.

مرونة التغذية
- اعرفياستثنائيةفةالغذائية والصحية إرشاداتك ي. مع التعامل عند الاستثنائية الظروف.