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Preconception nutritional intake and lifestyle factors: first results of an explorative study

Sabina de Weerd^{a,b}, Eric A.P. Steegers^{a,b}, Mirjam M. Heinen^c, Sharon van den Eertwegh^c,
Rianne M.E.J. Vehof^d, Régine P.M. Steegers-Theunissen^{a,b,e,*}

^aDepartment of Obstetrics and Gynecology, Erasmus Medical Center Rotterdam, P.O. Box 2040, 3000 CA Rotterdam, The Netherlands

^bDepartment of Obstetrics and Gynecology, University Medical Center Nijmegen, P.O. Box 9101, 6500 HC Nijmegen, The Netherlands

^cDepartment of Nutrition and Dietetics, Arnhem-Nijmegen University of Professional Education, 6503 GL Nijmegen, The Netherlands

^dDepartment of Nutrition and Dietetics, University Medical Center Nijmegen, P.O. Box 9101, 6500 HC Nijmegen, The Netherlands

^eDepartment of Epidemiology and Biostatistics, University Medical Center Nijmegen, P.O. Box 9101, 6500 HC Nijmegen, The Netherlands

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Abstract

Objective: To describe nutritional intake and lifestyle factors in women planning pregnancy. **Study design:** A semi-quantitative, 1-month food frequency questionnaire and a questionnaire on health practices and personal views were filled out at home and verified by telephone interview. **Results:** One hundred and one women agreed to participate and data of 69 women were eligible for evaluation. Women planning pregnancy ($n = 46$) consumed significantly more saturated fats and proteins, less carbohydrates and higher median intakes of Vitamin A, thiamin, riboflavin, calcium, selenium, magnesium and iron than controls ($n = 23$; $P < 0.05$). However, the percentage of women planning pregnancy with intakes below recommended dietary allowances was 74% for iron, 59% for selenium, 48% for Vitamin A and 91% for copper. Ninety-six percent and 20% of them reported alcohol use and smoking, respectively. **Conclusions:** Nutritional intake of women in the preconception period appears to be inadequate. Efforts to increase awareness of a healthy diet and lifestyle before and throughout pregnancy should be continued.

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1. Introduction

The preconception period continues to gain recognition as an ideal opportunity to optimize the health of the mother-to-be. Important lifestyle factors that could be subject to intervention before pregnancy include prenatal alcohol use, smoking and malnutrition [1,2]. Moreover, poor maternal nutritional intake during pregnancy has been associated with offspring suffering from diabetes mellitus and cardiovascular diseases in later life [3]. Since a number of nutritional and lifestyle factors for poor pregnancy outcome are modifiable, obstetricians and other health care providers should aim to optimize women's health before conception. Recent data from national health surveys indicated that in the general population nutritional intake is suboptimal, and that virtually the entire Dutch population suffers to some extent from deficiencies of essential vitamins, minerals, and

trace elements [4,5]. As a poor nutritional status may lead to serious health problems [5], it may also have in (pre)pregnant women adverse consequences for maternal health and that of her offspring. Therefore, the quality of the maternal diet should receive special attention before a woman conceives [3,6].

Before well-defined nutritional interventions can be considered, however, the nutritional intake and habits in women of reproductive age, especially among those who are currently planning a pregnancy, need to be further explored. We evaluated the nutritional intakes and lifestyle factors in women currently planning pregnancy and in a control group of women of comparable age. The nutritional intakes were compared to both the Dutch recommended dietary allowances (RDA) and to the guidelines for adequate diet. In addition, we evaluated whether women planning pregnancy also prepare themselves for pregnancy by adjusting their nutritional intake and lifestyle. By asking women to rate their diet and lifestyle, their personal views and knowledge of health practices were also assessed.

* Corresponding author. Tel.: +31-24-3619132; fax: +31-24-3613505.
E-mail address: r.steegers@epib.umcn.nl (R.P.M. Steegers-Theunissen).

2. Materials and methods

2.1. Study design

This explorative study was a collaborative project between the Department of Obstetrics and Gynecology, Department of Epidemiology and Biostatistics, and Department of Nutrition and Dietetics of the University Medical Center Nijmegen in The Netherlands. Between January and June 2001, women of reproductive age in Nijmegen and surrounding regions were recruited through advertisements in local newspapers, posters at health clinics and day care centers, and by word of mouth. A research fellow in preconception care and two dietitians in training carried out the study. Women who were already pregnant, who were breastfeeding or who followed an ethnic diet (i.e. Turkish) were excluded.

2.2. Instruments

A validated semi-quantitative food frequency questionnaire (FFQ) was used to estimate the intake of energy, total and saturated fats, total protein, mono- and disaccharides, polysaccharides (complex carbohydrates) and vitamins, minerals and trace elements from foods consumed in the past month [7,8]. Information on demographic characteristics including age, height, weight, educational background, current profession, prior pregnancy, and lifestyle factors including alcohol and tobacco use, was obtained by a separate questionnaire. In this questionnaire, data were also collected on perceived health (scale range from 1–10), diet (vegetarian, calorie-restricted), past and current vitamin supplement use and satisfaction with body weight. Personal views were assessed by the following questions: whether women considered their dietary habits to be healthy (yes/no), what could be done to improve them (open-ended), and whether they completely agree, agree, disagree, or completely disagree with several statements such as “I should eat less fat”. Volunteers received the questionnaires and were asked to fill out and return them within 2 weeks. The completed and returned forms were verified by telephone interview. Participants were offered the opportunity to be informed about their evaluated nutritional intake and habits.

2.3. Statistical analysis

The data obtained by the FFQ was converted into standardized portions, weights and products using the Dutch nutrient database “NEVO” [9]. Subsequently, the report “Portion sizes, weights and food code numbers” [10] was used to calculate average daily dietary intake. The food codes were entered into the software program Becel-5 (Rotterdam, Netherlands, 1996) [11], which was used to calculate the intakes of macronutrients and retinol, β -carotene, ascorbic acid, tocopherol, cholecalciferol, thiamin, riboflavin, niacin, pyridoxine, biotin, potassium, calcium, phosphorus, iron, magnesium, zinc, selenium and copper

intake. The Becel-5 program could not calculate the dietary intakes of folate and cobalamin.

The median energy and nutrient intakes of women who were planning pregnancy and controls were calculated using SPSS 9.0 and 10.1. Demographic characteristics, total energy, macro- and micronutrient intakes of the two study samples were compared by the Mann–Whitney *U* and Kruskal–Wallis tests. Macronutrient intakes were calculated in percentages in order to adjust for total daily energy intake. The number of women planning pregnancy whose diet contained less than the minimum requirements or higher amounts than the maximum recommended intake for each nutrient as defined by the Dutch recommended dietary allowances (RDA) was calculated and reported in the tables. The RDA is the average requirement ± 2 S.D., defined as the level of intake that is adequate for almost the entire population [12,13]. Statistical significance was defined by $P \leq 0.05$.

3. Results

3.1. Characteristics of women

Among the 101 women who volunteered to participate, 72% completed and returned the questionnaires. Four women were excluded: one was pregnant, one post-menopausal, and two could not be reached by telephone to verify the answers of the questionnaires. This resulted in the evaluation of 69 women between 18 and 45 years of age, of which 46 were currently planning a pregnancy, and 23 who indicated not to be planning to conceive served as controls. Women who were planning pregnancy were significantly older than controls, median age 31.5 and 28.0 years, respectively. Half of them were planning a first pregnancy. Demographics and use of vitamin supplements were not significantly different between the groups (Table 1).

Table 1
Demographic and lifestyle characteristics of women planning pregnancy and controls

Characteristic	Women planning pregnancy (<i>n</i> = 46)	Control women (<i>n</i> = 23)
Age (years) ^a	31.5 (19–45)	28.0 (18–43) [*]
BMI ^a	23.2 (18.3–30.1)	21.9 (17.8–30.1)
Never pregnant (%)	50	65
Educational background (%)		
Low	2	–
Middle	38	30
High	60	70
Folic acid or multivitamin supplement use (%)	48	52 ^b

^{*} $P < 0.05$, Mann–Whitney *U* test; women planning pregnancy vs. controls.

^a Age and body mass index (BMI) are given as median (range).

^b Multivitamins only.

Table 2
Questionnaire items pertaining to alcohol intake and smoking

Question ^a	Women planning pregnancy, <i>N</i>	Control women, <i>n</i>
Do you smoke?		
Yes	5	2
No	37	18
Sometimes	4	3
Please mark which tobacco products		
Cigarettes	7	4
Cigars	2	1
Marijuana	–	–
How many cigarettes daily? ^b	5.5 (1–20)	8.5 (0–22)
Did you smoke during your last pregnancy? ^c		
Yes	2	–
No	3	–
How many cigarettes daily?	2–5	–
Do you drink alcohol?		
Yes	12	4
Sometimes	21	8
Rarely	11	8
Never	2	3
How often do you drink alcohol?		
1–3 times per month	20	11
1–2 days per week	12	6
3–4 days per week	3	–
5–6 days per week	4	1
7 days a week	1	–
How many glasses of alcohol weekly?		
1–3 per week	10	4
4–6 per week	5	1
7–10 per week	5	1
More than 10 per week	–	–
Did you drink during your last pregnancy? ^c		
yes	5	1
No	15	6
If so, how many glasses daily? ^b	5 (1–5)	–

^a Not all questions were applicable to all women.

^b Median (range).

^c Of the 23 women who had been pregnant previously.

Seven of all women reported to consume an alternative diet, of which five were vegetarian, one vegan, and one woman ate only biological products. Nine women planning

pregnancy (20%) and five controls (22%) reported to smoke. Almost all of the women planning pregnancy reported some degree of alcohol use (Table 2), and 11% of them consumed an average of 7–10 glasses of alcohol per week. Additional data on alcohol intake and smoking are shown in Table 2.

3.2. Nutritional intake (FFQ)

The intake of nutrients in women who were planning pregnancy, controls, and the recommended dietary allowances (RDA) for the Dutch population of women aged 22–50 years are shown in Table 3. Median energy intake of women planning pregnancy and controls exceeded RDA by more than 300 kcal per day, 2387 and 2407 kcal per day, respectively. All but one of the women planning pregnancy consumed an excessive amount of saturated fats and only two control women consumed diets containing less than 10% saturated fat daily (Table 3). Median daily protein intake was significantly higher among women planning pregnancy than controls (16% versus 14%; $P \leq 0.05$). Total daily intake of complex carbohydrates was significantly lower among women planning pregnancy than controls, 44 and 48%, respectively. The average daily consumption of fruits (1.5 pieces) and vegetables (2.5 servings) was below the recommended daily portions for both study groups. The low intake of complex carbohydrates was due to a low consumption of bread, with an average of 4.5 slices daily (recommended: 5–7 slices), as well as of potatoes, rice and pastas (2.5 spoonfuls instead of the recommended 3–5 per day).

Women planning pregnancy had significantly higher median dietary intakes of the micronutrients vitamin A (retinol + [β -carotene/6]), thiamin, riboflavin, calcium, selenium and magnesium than controls (Table 4). The number of women planning pregnancy who had a deficient intake, i.e. who did not meet the minimum RDA for each micronutrient, is also shown in Table 4. Daily intake of Vitamin A was below RDA in 48%. Cholecalciferol intake was deficient in 26%, dietary iron intake deficient among 74% and selenium intake deficient among 59% of women planning pregnancy. Less than 10% met the RDA

Table 3
Daily median energy intake (Kcal) and fat, protein and carbohydrate intake (en%) among women planning pregnancy and controls

Macronutrient	RDA	Women planning pregnancy (<i>n</i> = 46), median (range)	>RDA ^a , <i>N</i> (%)	Control women (<i>n</i> = 23), median (range)	>RDA ^a , <i>N</i> (%)
Energy (kcal)	2071	2387 (1350–3305)	33 (72)	2407 (1475–4115)	16 (70)
Fat (en%)	20–40	39 (30–54)	16 (39)	36 (28–49)	4 (17)
Saturated fat (en%)	≤10	15 (10–26)	45 (98)	13 (8–22)*	21 (91)
Protein (en%)	10 (≤25)	16 (12–21)	0 (0)	14 (10–18)*	0 (0)
Carbohydrates (en%)	≥40	44 (33–54)	11 (24)	48 (37–62)*	4 (17)
Mono-/disaccharides (en%)	15–25	19 (12–31)	8 (17)	23 (4–47)*	3 (13)

RDA: recommended dietary allowance for Dutch non-pregnant women aged 22–50 years [12]. en%: Percent of total energy intake.

* $P < 0.05$, Mann–Whitney *U* test; women planning pregnancy vs. controls.

^a Number (%) of women with an unbalanced diet, i.e. either exceeding the maximum or below the RDA, are shown.

Table 4

Median daily intake of vitamins and minerals from diet among women planning pregnancy and controls

Micronutrient	RDA	Women planning pregnancy (<i>n</i> = 46), median (range)	<RDA ^a , <i>N</i> (%)	Control women (<i>n</i> = 23), median (range)	<RDA ^a , <i>N</i> (%)
Vitamins					
Retinol + [β -carotene/6] (μ g)	800	836 (332–1828)	22 (48)	628 (353–1302)*	15 (65)
Cholecalciferol (μ g)	2.5–5.0	3.9 (0.9–6.8)	12 (26)	4.0 (0.7–6.4)	5 (22)
Tocopherol (mg)	9.3	13.9 (5.2–29.8)	9 (20)	15.7 (6.8–34.0)	4 (17)
Thiamin (mg)	1.1	1.4 (0.8–2.4)	6 (13)	1.1 (0.6–2.1)*	9 (39)
Riboflavin (mg)	1.1	1.8 (0.9–2.9)	4 (9)	1.4 (0.8–3.0)*	6 (26)
Niacin (mg)	13.0	16.7 (9.5–28.8)	10 (22)	14.9 (6.7–22.1)	6 (26)
Pyridoxine (mg)	1.1	1.9 (1.0–2.6)	1 (2)	1.8 (1.0–2.6)	2 (9)
Ascorbic acid (mg)	70	142 (49–349)	4 (9)	115 (50–385)	4 (17)
Minerals					
Iron (mg)	15.0	13.6 (8.9–30.7)	34 (74)	11.5 (6.2–25.8)	18 (78)
Calcium (g)	1.0	1.3 (0.6–2.5)	10 (22)	1.0 (0.4–2.0)*	12 (52)
Selenium (μ g)	50–150	48 (25–74)	27 (59)	40 (25–55)*	18 (78)
Copper (mg)	1.5–3.5	1.2 (0.6–1.7)	42 (91)	1.2 (0.6–2.0)	20 (87)
Zinc (mg)	9.0	10.7 (7.0–17.6)	7 (15)	10.0 (5.9–15.4)	9 (39)
Magnesium (mg)	250–300	370 (249–604)	1 (2)	318 (151–679)*	1 (4)

RDA: recommended dietary allowance for Dutch non-pregnant women aged 22–50 years [13].

* $P < 0.05$, Mann–Whitney U test; women planning pregnancy vs. controls.^a Number (%) of women with a deficient micronutrient intake, i.e. below the RDA, are shown.

for copper. The overall intake of thiamin, riboflavin, niacin and pyridoxine, as well as of Vitamin C was adequate among most women planning pregnancy and controls.

3.3. Personal views

Personal views on health and nutrition did not differ significantly between the two subsets of women. Among all women, 23% of women reported to be unsatisfied with their body weight, 37% was satisfied and rest ambivalent. Over one-third of all women were currently trying to lose weight. For health and well being, 74% of women gave themselves an excellent rating of 8 or higher on a 10-point scale, and another 17% gave themselves a 7. The lowest rating, reported by 3% of women, was 4. A vast majority of women (77%) answered that they felt their eating habits are healthy. When asked what they would do if they were to improve their diet, 36% of women reported that they would eat less candy or other snacks, 24% would eat more vegetables, 20% would eat more fruit, and 14% would eat less fatty products such as fries, pizza or Chinese food. Only 32% of women agreed with the statement 'I should eat less fat', and 57% agreed with the statement 'I should eat less saturated fats'.

4. Discussion

In this explorative study we evaluated nutritional intakes and other lifestyle factors in women of reproductive age and the impact of pregnancy planning. To our knowledge, nutritional intakes of women planning pregnancy have not been evaluated previously. Our preliminary results

reflect that an inadequate diet, rich in saturated fats and marginal in a number of essential micronutrients, is very common among women of reproductive age. Overall, pregnancy planning appears not to significantly affect nutritional intake, alcohol use and smoking habits. These data of an imbalance of macro- and micronutrients are supported by others that studied nutritional intakes retrospectively 3 months before pregnancy in a population of Latinas and white non-Latinas [14].

Although virtually all of the women planning pregnancy exceeded the upper limit for saturated fat intake, not even one-third of them acknowledged that they should eat less fats and only half agreed that they should eat less saturated fats. Therefore, we conclude that the women in our study overrated the adequacy of their diets and did not seem to have the knowledge about the contents of foods that they consume. In accordance with data of Dutch women planning pregnancy, less than half of women planning pregnancy reported to take folic acid or another vitamin supplement to reduce the risk of a neural tube defect [15]. The suboptimal intake of several micronutrients and possible implications for the course and outcome of pregnancy, in particular of iron and copper, should be addressed. The deficient iron intake of the majority of potential mothers places these women at risk for developing iron deficiency anemia during pregnancy, resulting in increased risk of complications as preterm delivery, low birth weight and fetal death [16]. As iron supplementation in early pregnancy is not routinely practiced, women should be advised to increase their intake of iron-rich foods, preferably of green leafy vegetables, before entering pregnancy. Maternal copper deficiency has been shown in animal studies to cause brain defects, connective tissue abnormalities, intra-uterine growth

retardation, birth defects and fetal death [17]. In human pregnancy, however, the relation between deficient copper intake and adverse pregnancy outcome, has not been clarified so far. Likewise, the impact of most maternal nutritional deficiencies on prenatal development remains to be further investigated.

All women should be advised to abstain from drinking in the periconceptional period and throughout pregnancy, since even as little as one drink per week has been associated with adverse effects [18]. In our study, the number of women planning pregnancy who reported some degree of alcohol use (96%) was much higher than the reported 49% in the previously mentioned study [14] and the 53.3% recently reported among US women of child-bearing age [19]. Although a significant number of women may limit or quit alcohol intake as soon as they are aware of their pregnancy, most of them will not realize that they are pregnant in the first most important weeks of embryonic development.

The validity of the nutritional data is always an issue of discussion. However, we used a validated and highly reproducible FFQ and evaluated this data on group level [7,8]. A FFQ was used above the 24 h recall or food diary method because it covers a longer period (1 month) and may therefore give a better approximation of habitual diet [20]. Moreover, subjects were motivated to participate, reflected by the fact that the majority would like to be informed about their evaluated diet. Nevertheless, overreporting of healthy nutritional habits and an underestimation of undesirable habits cannot be completely ruled out. Such reporting bias may be especially common among women planning pregnancy. It turned out from telephone interview that some women did indeed underreport snack consumption and overestimated their fruit intake in the questionnaires. In order to obtain a population of women of reproductive age preconceptionally, we had to rely on advertisements and active recruitment. Both groups of women were highly educated as compared to the general population, which limits the degree to which our data may be extrapolated to the general population. It cannot be ruled out that highly educated women are more concerned about their nutritional habits and were therefore more willing to participate.

5. Conclusions

These preliminary results suggest that women who are planning to conceive are not necessarily preparing themselves for pregnancy by taking dietary or other health promotion measures. Although they have a higher daily intake of several vitamins and minerals compared to other women of reproductive age, overall micronutrient intakes are often below RDA and unhealthy behaviors such as a high saturated fat intake, smoking and alcohol use are even more prevalent among women planning to conceive. In order to educate women about the nutritional requirements

of pregnancy and the implications of nutritional status on pregnancy outcome, the adverse effects of smoking and alcohol use and the protective effect of folic acid supplements, we should continue efforts to provide preconception counseling. Future research on dietary practices among women planning pregnancy should focus on women with a lower education and should relate nutrition and other health practices to subsequent pregnancy outcome to assess their impact.

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