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Research report

Dietary behaviour of pregnant versus non-pregnant women

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Abstract

This study investigates dietary behaviour and the perceived role of food for health of pregnant versus non-pregnant women. Data were collected between 15 January 2003 and 15 March 2003 in Belgium. One hundred and forty-eight pregnant and 130 non-pregnant women aged between 20 and 40 years completed a self-administered questionnaire about their dietary behaviour and nutritional attitudes. Both sub-samples match with respect to individual factors such as relevant socio-demographics and general food perceptions. Pregnant women report higher consumption of fruits, which results in a better score for fibre intake. They also report higher consumption of beef and dairy products, as well as a higher fat intake. No difference in fish consumption between pregnant and non-pregnant women is observed. In line with recommendations, pregnant women report reduced consumption of food products with heightened safety-related risks, lower use of alcohol and tobacco, and safer food handling practices. Reduced intake of raw vegetables for food safety reasons is not compensated by higher intake of cooked vegetables. Pregnant women also report a lower frequency of moderate physical activity. Most differences in food choice by pregnant versus non-pregnant women pertain to the avoidance of specific, potentially harmful food groups. A substantial share of pregnant women does not follow upon recommendations with respect to alcohol use and exposure to tobacco. Personal medical sources for pregnant women and personal social sources for non-pregnant women are reported as the most attended sources of diet-related information. The perceived role of food for health is not different between pregnant and non-pregnant women, and there were no significant interaction effects between pregnancy and presence of children, which indicates that the observed differences in dietary behaviour can be attributed to the state of being pregnant.

Keywords: Attitude; Belgium; Consumer; Diet; Food; Health; Safety; Pregnancy

Introduction

It is widely recognised that current dietary behaviour is often poorly in line with health recommendations. Therefore, it is often desirable to try to change unhealthy behaviour from a public health perspective. However, many studies showed that it is very difficult to effectively change consumers' food choices and dietary behaviour (Glasgow, Lichtenstein, & Marcus, 2003). The extent to which nutrition education programmes can facilitate dietary change is likely to be influenced by behavioural characteristics such as the habit persistence in diets, perception of health risks, expectancies and motivation for dietary change (Bhargava & Hays, 2004). Triandis (1977) defined habits as situation–behaviour sequences that are or have become automatic, so that they occur without self-instruction. Habit plays an important role in the context of food choice as consumption of food is frequently performed (Saba & Di Natale, 1999). However, specific events or changes in life can also have a major impact upon these habits. For example, when people become part of a couple, their diets change (Paisley, Sheeshka, & Daly, 2001). At this stage in life women may be adjusting their food intake to coincide with those of their partners (Anderson, 2001). Another crucial event or change in life may pertain to pregnancy. In general, pregnancy occurs in early adulthood when many women are still forming their adult dietary patterns, and thus food patterns are less likely to be bound by strong habits.

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During pregnancy, women are more conscious of food and health issues (Anderson, 2001). Pregnancy is a critical period during which good maternal nutrition is a key factor influencing the health of both mother and child. Following an appropriate diet will provide the necessary amounts and varieties of nutrients to ensure an optimal health for both the mother and the baby. Pregnant women require more energy and nutrients to meet the demands of the developing foetus, and can select suitable servings of foods to meet their increased needs (Kaiser & Allen, 2002).

Given the importance of pregnancy in people's lifecycle, some diet and lifestyle health risks involved, and the fact that specific dietary recommendations are issued, being pregnant can be assumed to lead to different food choices, which makes pregnant women an interesting target group for communication and information on current and future nutritional choices. To gain insight into the most effective way to induce dietary changes, it is important to analyse whether pregnant women have different beliefs, behaviour and dietary patterns as compared to non-pregnant women. The question rises if these differences result in a more healthy diet, and if this diet is better in line with food recommendations.

Research showed that pregnant women do change behaviours during pregnancy. Anderson, Campbell, and Shepherd (1993) concluded that pregnant women made a conscious effort to improve their food intake in line with health advice. However, the results of this study suggested that pregnant women are not motivated to alter their dietary habits because of an increased level of knowledge about diet and nutrition. More likely, they are either influenced by social pressure from doctors and family members, which implies that information from these personal sources could provide valuable support for dietary change. In other studies, it was found that dietary behaviour during pregnancy is characterised by specific food cravings or food aversions (Bayley, Dye, Jones, DeBono, & Hill, 2002) or determined by specific psychological variables (Bowen, 1992). In the study of Lewallen (2004), the most predominant changes in the behaviour of pregnant women concerned food choice and eating habits. Most women tried to consume more fruit and vegetables, and identified many foods to be eaten less or avoided completely during pregnancy (Lewallen, 2004). Yet another study in India showed that pregnant women alter their dietary behaviour by including or excluding certain food items because of their pregnancy (Andersen, Thilsted, Nielsen, & Rangasamy, 2003).

Given the importance of dietary behaviour during pregnancy, and given the absence of specific studies on this issue in European countries, our objective is to examine how dietary and other healthy lifestyle behaviours of pregnant women differ in comparison with non-pregnant women. First, dietary guidelines for pregnant women are briefly reviewed. Next, the research method and empirical findings are presented and discussed.

Dietary guidelines during pregnancy

Dietary and nutritional guidelines for pregnant women are based on the Food Guide Pyramid. A higher intake of meat, fish and eggs is recommended because of the need for additional protein (Ortega, 2001) and consumption of red meat, such as beef, is particularly recommended as an important source of iron (Fe) (Kaiser & Allen, 2002). An increased fish consumption during pregnancy is advised because adequate supply of polyunsaturated fatty acids influences the formation of structures of the nervous system and retina of newborn infants (Ortega, 2001; Verbeke, Sioen, Pieniak, Van Camp, & De Henauw, 2005). Pregnant women are also recommended to eat more fruit and vegetables in order to realise a higher fibre intake and to increase the intake of dairy products because these are a good source of calcium, phosphorus and riboflavin, which are needed for the development of foetal bony structure and teeth as well as for the mother (Anderson, 2001; Anderson et al., 1993; Eschleman, 1996; Ortega, 2001).

Safe food handling is also an important aspect of good nutritional practices to prevent food-related diseases in pregnancy such as listeriosis and toxoplasmosis (Gilbert, 2002). To reduce the risk of listeriosis and toxoplasmosis, pregnant women are recommended to avoid raw or undercooked fresh meat and chilled ready-to-eat food that is not freshly prepared (e.g. cold meats, salads, soft cheeses and pâté). They should also peel and wash raw fruit and vegetables thoroughly before consumption to remove contaminating soil (Brundage, 2002; Gilbert, 2002). Pregnant women are recommended not to eat liver because of high vitamin A levels, which has been associated with miscarriages and teratogenic effects (Ortega, 2001).

Other key components of a health promoting lifestyle during pregnancy include moderate exercise (Morris & Johnson, 2005), the avoidance of alcohol (Brundage, 2002), the avoidance of active and passive exposure to tobacco smoke (Lindbohm, Sallmén, & Taskinen, 2002) and other harmful substances (Kaiser & Allen, 2002).

Women who exercise during pregnancy have reduced risks of gestational diabetes, hypertensive disease, pre-eclampsia and preterm birth (Chasan-Taber et al., 2004; Weissgerber, Wolfe, & Davies, 2004). The American College of Obstetricians and Gynaecologists recommends pregnant women to perform 30 min of exercise per day for women without pregnancy complications or pre-existing medical conditions (Lewallen, 2004).

Women who are or may become pregnant are recommended to avoid alcohol consumption, because of its relationship with foetal alcohol syndrome (FAS) (Eschleman, 1996). A safe level of alcohol intake has not yet been established at any stage during pregnancy (American Academy of Pediatrics, 2000). Maternal active smoking reduces birth weight and fertility, and it increases the risk of abnormal placentation, spontaneous abortion, preterm delivery and perinatal mortality (Brundage,

2002). Research has indicated that smokers are more at risk of poor intake of antioxidants and other nutrients during pregnancy than non-smoking women (Mathews, Yudkin, Smith, & Neil, 2000). A recent study suggests that smoking during pregnancy may have long-term negative consequences on offspring adult intelligence (Mortensen, Michaelsen, Sanders, & Reinisch, 2005).

In Belgium specifically, pregnant women are informed about food during pregnancy through a leaflet distributed by their gynaecologist or their hospital, or through the website of 'Child and Family' (Kind & Gezin), which is an organisation resorting under the Flemish Ministry of Welfare, Public Health and Family. Guidelines included are to eat a healthy diet based on the Flemish Food Pyramid (Public Health Institute, 2005), and to avoid raw meat, organ meat, raw fish, raw eggs, raw milk, raw milk cheese and alcohol. Pregnant women are also instructed to wash their hands before eating, to clean raw vegetables very carefully, and to sufficiently reheating any pre-prepared food.

Methods

Consumer survey

Dietary behaviour and nutritional attitudes were investigated by using a self-administered questionnaire that contained items about four different themes: dietary behaviour, attitude, use of information sources and socio-demographic characteristics. Data were collected between 15 January 2003 and 15 March 2003. Of the 412 respondents recruited, 316 returned the questionnaire; 38 respondents were excluded from the analyses due to incomplete answers, which yielded a valid sample of 278, or a valid response rate of 67.5%. The valid sample was composed of 148 pregnant and 130 non-pregnant women, aged between 20 and 40, from different regions, education levels and family sizes. Pregnant women were recruited via eight gynaecologists, midwifes and physiotherapists in East- and West-Flanders (i.e. two provinces in Flanders, Belgium). The control sample of non-pregnant women was matched with the sample of pregnant women for age, education level and presence of children. The non-pregnant women were recruited in the street or door by door in the same geographical area and during the same period as for the pregnant women sample. Participants were given written informed consent through a letter accompanying the questionnaire, including information about the objectives of the study, data handling procedures, and contact details of the investigators for any further information.[1]

[1]Apart from asking about pregnancy, body-weight and length, no sensitive biomedical data were collected and stored. Furthermore, all questionnaires were completely anonymised and non-identifiable throughout data collection, storage and handling. As a result, no information is available about attrition rates for the different samples, or for the different intermediaries who assisted in distributing and collecting the questionnaires.

Table 1
Demographic characteristics of the samples

	Pregnant women ($n = 148$)	Non-pregnant women ($n = 130$)	p-value
Age, mean (SD)	27.7 (3.7)	27.9 (5.9)	0.748[a]
Education beyond the age of 18 years (%)	67.6	68.5	0.873[b]
Presence of children (% yes)	35.1	40.8	0.334[b]

[a]Independent samples t-test.
[b]Chi-square association test.

There are no significant differences in the mean age between the group of pregnant and non-pregnant women ($p = 0.748$), hence eliminating potential bias related to age. Similarly, no significant differences were found for education level ($p = 0.873$) or presence of children ($p = 0.334$) (Table 1). The total sample is biased towards higher education (>18 year) (67.9%) in comparison with the Belgian population (36.4%) (NIS, 2003). This bias towards higher education is consistent in both sub-samples, hence not infringing upon between-sample comparisons. It should be noted that the samples were not randomly selected, which limits generalisation to the overall population.

Questionnaire

The perceived role of food for health was measured by means of a four-item construct on a scale from 1 to 5 (Verbeke, 2005). The scores of the four items resulted in a Cronbach's alpha of 0.60, which indicated sufficient internal consistency and allowed adding up the scores into one single construct. The item with the highest corrected item-total correlation was "the food I eat determines my personal health".

For daily fibre and fat intake, respondents completed a questionnaire developed by the Flemish Public Health Institute (2005). A separate validation study in 189 adults showed good test–retest reliability (using a two-week interval) for fibre intake (ICC = 0.66) and for fat intake (ICC = 0.75), and good validity against three-day diaries for fibre intake (gamma = 0.70) and for fat intake (gamma = 0.51). The resulting scores for fibre intake were grouped into three categories: too low (score $\leqslant$20 g/day), good (score 20–30 g/day), very good (score $\geqslant$30 g/day). The scores for fat intake were also grouped in three categories: too low (score $\leqslant$47 g/day), good (score 47–82 g/day), too high (score $\geqslant$82 g/day).[2] Categories were determined based on recommendations from the Public Health Institute.

[2]The instrument and procedures used allow neither calculating total energy intake, hence preventing us from adjusting fat intake for total energy intake, nor separating total fat into saturated versus unsaturated fat.

Intake of different food items was measured on a 9-point frequency scale (less than once a week–more than once a day). Items were chosen based on their importance in a daily dietary pattern and because some of these items are subject to specific recommendations during pregnancy. The selected food items are meats (beef, pork, poultry) and fish, fruit and vegetables (raw vegetables, cooked vegetables) and dairy products (milk, cheese, yoghurt and dairy desserts).

To assess food avoidance for safety reasons, respondents were asked whether they eat a certain food product, using a binominal yes/no scale. Products with a heightened safety risk during pregnancy were included, such as raw meat, processed meat products, raw vegetables, raw fish, ready-to-eat meals, raw milk cheese, organ meat, raw shellfish and raw eggs. Safe food handling was assessed on a 4-point scale (never–always), on items such as sufficiently reheating the food, washing hands before food preparation and consumption, preparing meat well done and washing fruit and vegetables before consumption. Both 'avoidance of foods' categories, and 'food handling practices' were selected based on literature review and on the specific advice from Belgian authorities.

Intake of different food items compared to one year earlier was determined as having decreased (less), maintaining the same level (equal) or having increased (more). The same items as for intake assessment were included.

The consumption of alcoholic beverages was assessed on a 6-point scale (never–several times a day). Smoking behaviour was asked for through three items: smoking behaviour now (regularly–occasionally–never), past smoking behaviour (regularly–occasionally–never) and hours passive exposure to environmental smoke per day. To measure physical activity, respondents were asked to indicate how many days a week they perform at least 30 min moderate physical activity.

Respondents were finally asked to score the amount of attention paid to different sources of food and diet information on a scale from 1 to 5 (no attention at all–a lot of attention). They also rated the perceived influence of the different information sources on their dietary behaviour on a 5-point scale (no influence at all–a lot of influence). Gaining insight into the use and impact of information sources is highly relevant, particularly with respect to formulating recommendations for future public health and nutrition information campaigns.

Analysis procedures

Statistical analyses were performed using SPSS 12.0. Comparisons of group means for normally distributed variables were performed using independent samples *t*-tests and ANOVA *F*-tests with Tukey post hoc comparison. To test for association between categorical variables and to compare proportions chi-square tests were used. Statistical analyses were performed using a 5% significance level ($p < 0.05$).

Results

Perceived role of food for health

The perceived role of food for health is not significantly different for pregnant versus non-pregnant women ($p = 0.955$). Both groups had a mean score of 3.77 on the composite scale from 1 to 5. Furthermore, two questions were asked to investigate the current perception about the safety and the healthiness of food in comparison with five years earlier. No significant difference in the perception about food safety (less safe–safer) and healthiness (less healthy–healthier) was found between pregnant and non-pregnant women. The mean scores of pregnant women are respectively 4.79 and 4.68 on the 7-point scale. Non-pregnant women scored respectively 4.91 and 4.64 on the 7-point scale. These analyses show that both sub-samples (pregnant versus non-pregnant women) do not differ with respect to the perceived role of food for health or overall food safety or healthiness perception. As a result, any subsequent differences between pregnant and non-pregnant women are to be attributed to factors other than general food perceptions.

Fibre and fat intake

Pregnant women have a significantly higher intake of dietary fibre (mean = 30 g/day), compared to non-pregnant women (mean = 25 g/day) ($p = 0.001$) (Table 2). Pregnant women also have a significantly higher fat intake than non-pregnant women (means are respectively 95 and 85 g/day) ($p = 0.023$). The mean score for fat intake is too high as compared with dietary recommendations for both groups (Public Health Institute, 2005). Whereas 16.2% of pregnant women score too low on fibre intake, slightly over one-third have too high a fat intake. Larger shares of non-pregnant women score too low on fibre intake (33.1%) and too low on fat intake (29.2%).

Dietary behaviour

The current dietary behaviour of pregnant and non-pregnant women was compared as shown in Table 3. There

Table 2
Fibre and fat intake (% of respondents) as compared with dietary recommendations

	Fibre intake			Fat intake		
	Too low	Good	Very good	Too low	Good	Too high
Pregnant women ($n = 148$)	16.2	42.6	41.2	19.6	45.9	34.5
Non-pregnant women ($n = 130$)	33.1	37.7	29.2	29.2	47.7	23.1

Table 3
Claimed food consumption frequency of pregnant versus non-pregnant women, mean on a 9-point scale (less than once a week–more than once a day)

Food group	Pregnant women ($n = 148$)		Non-pregnant women ($n = 130$)		t-value	p-value
	M	SD	M	SD		
Beef	2.80	1.14	2.44	1.08	2.627	0.009
Pork	2.68	1.19	2.59	1.28	0.575	n.s.
Poultry	2.66	1.18	2.72	1.13	−0.477	n.s.
Fish	1.87	1.11	2.03	1.40	−0.944	n.s.
Raw vegetables	3.65	2.23	4.17	2.14	−1.929	0.055
Cooked vegetables	5.93	1.91	5.61	2.02	1.345	n.s.
Fruit	7.40	2.17	6.73	2.42	2.175	0.031
Milk	6.59	2.68	5.72	3.07	2.492	0.013
Cheese	4.57	2.33	5.00	2.32	−1.525	n.s.
Yoghurt	4.97	2.47	4.87	2.48	0.332	n.s.
Dairy desserts	3.15	2.21	2.34	1.90	3.181	0.002

are no significant differences in the consumption frequency of pork, poultry, fish, cooked vegetables, cheese, and yoghurt. Pregnant women tend to eat raw vegetables less frequently, though consume significantly more frequently beef, fruit, milk and dairy desserts as compared to non-pregnant women.

Additionally, a highly significant association between pregnancy and intake of vitamin supplements was detected (chi-square = 63.59; $p < 0.001$). Vitamin supplements were used by only 14.6% of the non-pregnant women versus 61.5% of the pregnant women.

Food avoidance for safety reasons

Significantly more pregnant women indicated not to eat products with a heightened safety risk, mainly from potential microbiological contamination, such as raw meat, raw vegetables, raw fish, ready-to-eat meals, raw milk cheese and raw shellfish. Results are shown in Table 4.

Good nutritional practices during pregnancy also involve safe food handling. For reheating the food until it is steaming hot and for washing hands before preparation of the food, no significant association was found with pregnancy. Always or often washing hands before preparation of the food is done by 85.0% of the pregnant and 81.5% of the non-pregnant women. For three items, chi-square analyses showed significant differences between pregnant and non-pregnant women. Two-thirds (66%) of the pregnant women claimed to prepare their meat always well done versus only 26.4% of non-pregnant women (chi-square = 53.977; $p < 0.001$). More pregnant women (80.4%) claimed to always wash fruit and vegetables before consumption versus only 65.1% of the non-pregnant women (chi-square = 12.279; $p = 0.006$). Pregnant women (37.7%) claimed more often to always wash their hands before eating versus only 21.9% of the non-pregnant women (chi-square = 12.279; $p = 0.006$).

Table 4
Number of respondents claiming avoidance of different food categories (%)

Food group	Pregnant women ($n = 148$)	Non-pregnant women ($n = 130$)	Chi-square	p-value
Raw meat	85.1	46.9	45.90	<0.001
Processed meat products	37.7	16.2	15.96	<0.001
Raw vegetables	16.4	3.1	13.47	<0.001
Raw fish	93.2	84.5	5.46	0.019
Ready to eat meals	60.5	46.2	5.75	0.017
Raw milk cheese	57.4	24.8	30.07	<0.001
Organ meat	94.6	85.4	6.70	0.010
Raw shellfish	81.1	61.5	13.10	<0.001
Raw eggs	39.9	29.2	3.45	0.063

Table 5
Number of respondents claiming changes (more–less) in consumption frequency compared to one year earlier (%)

Food group	Pregnant women ($n = 148$)	Non-pregnant women ($n = 130$)	Chi-square	p-value
More poultry	12.0	22.7	6.19	0.045
More fruit	40.5	16.2	18.28	<0.001
More milk	34.0	19.8	8.24	0.016
Less raw vegetables	29.5	5.5	28.06	<0.001
Less dairy desserts	5.5	21.4	12.77	0.002

Claimed changes in dietary behaviour

For both groups, the self-administered changes in consumption in comparison with one year earlier (more, equal or less) were analysed. There is no significant association between pregnancy and reported change in the consumption of beef, pork, fish, cooked vegetables, yoghurt and cheese as compared to one year earlier. Significant associations were found for the consumption of poultry, fruit, raw vegetables, milk and dairy desserts, as shown in Table 5. The comparison of these results with the results of Table 3 will be further addressed in the discussion.

Other healthy lifestyle behaviours

There is a significant association between alcohol consumption and pregnancy (chi-square = 81.461; $p < 0.001$). More than one quarter (27.9%) of the pregnant women answered never to consume alcoholic beverages

during pregnancy, while only 3.1% of the non-pregnant women never consume alcohol. In spite of the recommendations against alcohol use, still 12.3% of pregnant women answered to consume alcoholic beverages at least once a week. However, none of the pregnant women indicated to use alcohol on a daily basis. The equivalent share for non-pregnant women is 5.4%.

A significant effect of pregnancy on current smoking behaviour is found (chi-square = 8.81; $p = 0.012$). Slightly over one-fifth (21.5%) of the non-pregnant and 9.5% of the pregnant group smoked at the time of the survey. When asked if they have ever been smoking in the past, this was still 41.1% of the non-pregnant and 35.8% of the pregnant group. For past smoking behaviour, no significant association with pregnancy was found (chi-square = 1.24; $p = 0.538$), which indicates that a substantial amount of women quitted smoking because of pregnancy. A significant association was also found for passive exposure to tobacco smoke (chi-square = 11.83; $p = 0.003$). Almost half of the pregnant women (44.6%) claimed not to be exposed to environmental tobacco smoke versus 25.4% of the non-pregnant women. Of the pregnant women who are exposed to environmental tobacco smoke, 46.4% is exposed to it more than 30 min a day. The equivalent share for non-pregnant women is 52.2%.

There is a significant difference in physical activity between pregnant and non-pregnant women ($p = 0.004$). Pregnant women reported a mean of 1.5 days per week with 30 min moderate physical activity versus 2.1 days a week for non-pregnant women. As much as 29.9% of the pregnant women reported that they never exercise for 30 min a day versus 16.4% of the non-pregnant women. Only 8.8% of the pregnant women reported to exercise at least 5 days a week versus 14.9% of the non-pregnant women.

Use of nutrition information sources

All participants were asked to score on a scale from 1 to 5 the degree of influence of and attention paid to different sources of information concerning food, diet and health. Pregnant women pay significantly more attention to the nutrition recommendations from personal medical sources ($p = 0.005$) and from a gynaecologist ($p < 0.001$), while non-pregnant women pay significantly more attention to the opinion of family and friends ($p = 0.034$). Both pregnant and non-pregnant women pay the least attention to information about nutrition from mass media, the internet or the government. Claimed influence of personal medical sources ($p = 0.006$) and gynaecologists ($p < 0.001$) is significantly higher among pregnant women. The influence of education at school is significantly higher among non-pregnant women ($p = 0.002$).

Presence of children and pregnancy

Specific attention is paid to the impact of presence of children, since presence of children is indicative for having experienced pregnancy earlier in life. First, general linear model univariate analysis of variance revealed no significant interaction effects of being pregnant (or not) and having children (or not) in terms of dietary behaviour, food avoidance, or other healthy lifestyle behaviours (all $p > 0.10$ for second-order interaction terms). As a result, it can be concluded that the observed effects of being pregnant are independent of the presence of children.

Second, differences between the first time mothers and others in the pregnant group, and between those without and with children in the non-pregnant group were analysed. Pregnant women with children were found to consume significantly less raw milk cheese, and to score significantly higher on preparing meat well-done as compared to pregnant women without children. Within the non-pregnant group, women with children reported a significantly higher consumption frequency of beef, pork and cooked vegetables, and a lower fruit consumption frequency as compared to non-pregnant women without children. The analyses do not allow concluding whether the observed differences are caused by the presence of children in the family, or by the individual preferences and choices of the mothers. Furthermore, neither within the pregnant nor within the non-pregnant group, differences in food avoidance or other lifestyle behaviours depending on the presence of children were observed.

Discussion

The objective of this study was to investigate dietary behaviour of pregnant versus non-pregnant women. Although pregnant women describe the influence of pregnancy on their consumption habits and food choices as moderate, results show some clear differences in dietary behaviour between pregnant and non-pregnant women. Since both sub-samples are comparable with respect to individual factors such as relevant socio-demographics and food perception issues, differences in dietary behaviour can presumably be attributed to situational factors, the most likely being pregnancy in this case.

A number of methodological limitations are acknowledged. First, with respect to the sampling, it should be noted that respondents were not randomly selected, from a limited number of geographical areas, and that the resulting samples are biased towards higher education, which limits generalisation to the overall Belgian population. Second, it is possible that the recruitment procedure through gynaecologists and midwifes resulted in a higher attention of these clinicians for a healthy diet in their pregnant patients. This could have biased the results towards healthier dietary behaviour within the pregnant sample. Third, some limitations pertain to the measurement instruments and scales used. This holds specifically for the fibre and fat intake questionnaires, and for the measurement of dietary behaviour through self-reported food frequency intake.

These limitations notwithstanding, our results show that during pregnancy, consumption frequency of fruit increases, both in comparison with claimed personal intake one year earlier and in comparison with the current intake of non-pregnant women. These findings are in accordance with recent research in the US (Pick, Edwards, Moreau, & Ryan, 2005), where also an increase in fruit consumption among pregnant women was reported. In the American study, however, about 40% of the pregnant women did still not meet the minimum recommendations for fruit consumption as suggested by the Food Guide Pyramid. As a consequence, mean dietary fibre intake for the pregnant and the non-pregnant group was below recommended intake levels (Pick et al., 2005). Our study, however, shows that both groups score on average good to very good on fibre intake, with a slightly better performance of pregnant women on this criterion. However, this difference in conclusions may pertain to the methodology used. Whereas we used self-reported food frequency intake, which may be susceptible to optimistic bias and overestimation, Pick et al. (2005) used 4-day diet records and portion size models to assess intake. The better performance of pregnant women on fibre intake is explained by the higher fruit consumption. This change in dietary behaviour is probably explained by the recommendations for higher fruit consumption as a source of vitamins and minerals and to avoid constipation (Anderson et al., 1993; Eschleman, 1996; Ortega, 2001).

Iron requirements increase during pregnancy, but the absence of menstruation and increase in iron absorption usually suffice for well-nourished women to meet the needs (Anderson, 2001). Nevertheless, a second change in the dietary behaviour during pregnancy is a higher consumption of beef. For other meats, there is no difference between the two groups. Although increased fish consumption during pregnancy is advised because fish contains high levels of polyunsaturated fatty acids, no claimed change in fish consumption is observed. Although it is not clear from the current data why pregnant women do not increase their fish consumption, information about potential health risks from fish's content of heavy metals and PCB- and dioxin-like substances may play a role.

Another change in the dietary behaviour is the increase in consumption of milk and dairy desserts. Low milk consumption and low calcium intake are related with an increased risk of gestational hypertension (Ortega, 2001). Current evidence however indicates that pregnancy and lactation are characterised by physiological adaptive processes that are independent of maternal calcium intake and that provide the calcium necessary for foetal growth (Anderson, 2001).

The higher consumption of beef and in particular of milk and other dairy products during pregnancy, results in a high fat intake.[3] Almost 35% of the pregnant women have a fat intake that is too high according to the health advice of the Public Health Institute. The score for fat intake is also too high for 23% of the non-pregnant women. Since fat and energy intake from fat in developed countries is already too high, recommendations for higher milk consumption should focus more on skimmed milk products.

Pregnant women obviously are aware of food safety risks, since they reduce consumption of all products with high safety-related health risks. Also in food preparation pregnant women follow the recommendations for safe food handling more strictly. As a result, a decrease in the consumption of raw vegetables was observed. This is however not compensated by an increase in the consumption frequency of cooked vegetables. Several studies indicate that the overall consumption of vegetables is too low compared to dietary recommendations (Agudo et al., 1999; Baker & Wardle, 2003; Evans, Sawyer-Morse, & Betsinger, 2000; Verbeke & Pieniak, 2006). A daily intake of 300 g of vegetables is important during pregnancy because these are foods with high nutrient densities (especially folic acid) (Ortega, 2001). The overall intake of vegetables decreases during pregnancy, which may result in higher food safety but also in a less balanced diet.

Our results show a significant reduction in alcohol consumption during pregnancy. The effects of alcohol abuse are dose related. Heavy drinking during pregnancy increases the risk of mental retardation, learning disabilities and major birth defects, such as those included in FAS (Anderson, 2001). Also moderate alcohol intake, defined as no more than one drink per day for women, has been linked to impaired foetal growth and lower Apgar scores and may reduce fertility in women (Brundage, 2002; Kaiser & Allen, 2002). Nevertheless, 72.1% of pregnant women answered to consume alcoholic beverages occasionally, and still 12.3% of the pregnant women answered to consume alcoholic beverages at least once a week.

Maternal active smoking has been associated with a number of adverse developmental and reproductive endpoints. If the mother smokes less than one pack of cigarettes per day, the risk of low-birth-weight infant increases by 50%; with more than one pack per day, the risk increases by 130%. If the mother quits smoking by 16 weeks of pregnancy, the risk to the foetus is similar to that of a non-smoker (Brundage, 2002). Women are well aware of the negative consequences of smoking, as shown by our results. Only 9.5% of the pregnant women smoke, compared to 21.5% of the non-pregnant women. Passive exposure to tobacco smoke may also reduce infant growth and increase the risk for spontaneous abortion (Ananth, Kirby, & Kinzler, 2005; Lindbohm et al., 2002). Because of these relations, exposure to environmental tobacco smoke

[3]The comparison of single food product intake from the fat intake questionnaire confirmed that pregnant women report a significantly higher (*footnote continued*) intake of full fat milk ($p = 0.039$) and semi-skimmed milk ($p = 0.007$) versus a lower intake of skimmed milk ($p = 0.015$) as compared to non-pregnant women.

has been of increasing concern. Pregnant women significantly reduce their exposure to tobacco smoke. When being exposed to environmental tobacco smoke, this exposure exceeds 30 min for about half of the pregnant and non-pregnant women. Despite convincing evidence of reduced health risks from sufficient physical activity (Chasan-Taber et al., 2004), our results show low levels of physical activity, both in general and during pregnancy in particular. It is important though, that pregnant women become aware of the positive impacts of moderate physical activity during pregnancy.

Pregnancy can be viewed as an opportunity for developing good dietary choices and for building a knowledge base for future action (Anderson, 2001). This study shows that pregnant women may have made conscious efforts to improve their dietary behaviour in line with recommendations. For example, eating more fruit, increasing intakes of milk, caution for possible sources of microbiological contamination, avoiding alcohol consumption and reducing exposure to tobacco smoke. It is clear from our results that pregnant women attend to certain dietary restrictions for reasons of food safety in order to decrease potential risks for both mother and child. Lasting dietary changes, specifically in terms of nutrition and a more balanced and healthier overall diet during pregnancy, are less clear. This confirms the results of the study of Anderson (2001). It is highly speculative to attribute observed differences with the presence of children, either within the pregnant or non-pregnant group, to a previous pregnancy. Also interactions between pregnancy and presence of children were all insignificant.

Pregnant women, especially the ones expecting their first child, usually are highly motivated to correct poor eating habits (Eschleman, 1996). In the study of Anderson (2001), however, it was concluded that giving written advice can influence knowledge about healthier eating, but does not seem to alter attitudes, or actual behaviour. Our results show that recommendations concerning food safety and health risks are followed upon, but nutritional aspects are much less taken into account. It is possible that changes in dietary behaviour for negative reasons (motivation driven by risk perception and avoidance) have a lower probability of lasting, in this particular case beyond pregnancy, than eventual dietary change for positive reasons (motivation driven by health benefit beliefs). This may explain why Anderson (2001) found no long-term changes in dietary behaviour. Apparently, after pregnancy harmful effects are no longer of concern. Nutrition counselling during pregnancy is far reaching if it addresses both family members' normal needs and the additional needs imposed by pregnancy (Eschleman, 1996). Therefore, it is important to help future parents to increase their knowledge about nutritional aspects of food and to become aware of the influence their eating habits might have on their children.

Both pregnant and non-pregnant women indicate that they do not pay much attention to information about nutrition from mass media, the internet or the government. Unless these sources manage to attract more attention, they are not most suited to invoke changes in dietary behaviour. Our results show that pregnant women are sensitive for changes in their dietary pattern and that they are likely to be influenced mainly by personal medical sources, which corroborates findings by Anderson et al. (1993). This makes pregnant women a better reachable target group than non-pregnant women, who are mainly influenced by people in their social environment.

Conclusions

Results from our survey show that pregnant women are more conscious about their diet and that their food choices are stronger driven by safety concerns, as compared to non-pregnant women. Differences in food choice pertain to higher intake of fruits and beef, though mainly relate to the claimed avoidance of specific foods and safer food handling practices. Most pregnant women avoid food products with real or perceived food safety-related health risks, as well as harmful products like alcohol or tobacco. However, a substantial share of pregnant women does not follow upon recommendations with respect to alcohol use and exposure to environmental smoking. The perceived role of food for health is not different between pregnant and non-pregnant women, which indicates that the observed differences in dietary behaviour can be attributed to the state of being pregnant. The empirical findings provide insights into the importance of a specific lifecycle stage, like pregnancy in this case, on food choice and dietary behaviour. An issue to be addressed in future research is how much of these improvements in food choice and dietary behaviour persist after pregnancy.

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