



Composition and Culture of Eating (CoCu) pregnancy: a new short questionnaire to evaluate diet composition and culture of eating during pregnancy

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Abstract

Objective: The project aimed to validate a short questionnaire (CoCu pregnancy – Composition and Culture of Eating during pregnancy) and to investigate associations with age and socio-economic status (SES).

Design: The questionnaire was developed according to the validated CoCu for children and adolescents containing a diet composition (fourteen items) and a culture of eating part (six items). A Nutritional Health Score (NHS) was calculated based on diet composition (–120 and +120, with higher scores indicating healthier diets). The validity was assessed by comparing answers in CoCu pregnancy with a FFQ. In a subsample (n 97), we assessed the percentage of having chosen the same (or adjacent) response categories in the 24th and 36th week of pregnancy (wp).

Setting: Data were collected within the LIFE Child study in Leipzig, Germany.

Participants: We evaluated 430 questionnaires of pregnant women (24th wp).

Results: The results indicated a healthy diet in the present sample (NHS at 24th wp = 49.74 (95 % CI 47.27, 52.22)). The analyses revealed significant positive correlations between CoCu and FFQ (rho ranging from 0.32 to 0.61). For each food item, >90 % of women had chosen the same (50–60 %) or adjacent response categories in the 24th and 36th wp. The analysis revealed associations of the NHS with age (β = 0.11, P = 0.027), SES (β = 0.21, P < 0.001), snacking (β = –0.24, P < 0.001) and media use (β = –0.18, P < 0.001).

Conclusions: The questionnaire represents a useful tool for surveying the diets during pregnancy for research and clinical practice.

Keywords

Short nutrition questionnaire
Diet composition
Eating culture
Pregnant women
CoCu pregnancy

During pregnancy, a healthy, balanced diet, characterised by regular consumption of, e.g. vegetables, fruits, whole grains and fatty fish, is required for the health of women and their children *in utero* and later life⁽¹⁾. A healthy diet contributes to fetal development and growth, prevents exceptional maternal weight gain during pregnancy and decreases the risk for gestational diabetes⁽²⁾, preterm delivery^(3,4) and increased birth weight⁽⁵⁾. In newborns, an unbalanced diet in pregnancy impairs insulin, glucose and lipid metabolism and consequently increases the risk for CVD and type 2 diabetes in later life^(6,7). A higher intake of processed food during pregnancy has been shown to be positively associated with obesity during childhood⁽⁸⁾. In contrast, inadequate

micronutrient intake during pregnancy increased the risk of low birth weight and pre-eclampsia^(9,10).

The diet composition of pregnant women is further related to how they eat ('eating culture', e.g. number of meals per day). Although the diet during pregnancy has been widely examined, information on the eating culture of pregnant women is scarce. It has been demonstrated that skipping meals during pregnancy was associated with lower circulating levels of EPA, DHA and β -carotene⁽¹¹⁾ and with reduced diet quality in low-income women⁽¹²⁾.

It has been shown in further studies that diet is related to sociodemographic parameters such as age, gender and socio-economic background in children, adolescents^(13,14),

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adults⁽¹⁵⁾ and during pregnancy^(16–19). More precisely, healthier eating behaviour during pregnancy is positively associated with a higher socio-economic status (SES)⁽¹⁸⁾, level of education^(17,18) and increasing age^(17,18) of the woman and negatively with unemployment⁽¹⁶⁾.

This project aimed to establish and validate a short questionnaire on diet composition and eating culture. The Composition and Culture of Eating 'CoCu' has already been validated for children and adolescents⁽²⁰⁾. Here, we assessed the validity of the version for pregnant women. For this purpose, we compared the answers provided in CoCu with answers provided in a FFQ completed at the same time point. Predictive validity was not explored because the main aim of the questionnaire is to assess diet and not to predict further development. We further investigated whether given responses in 24th and 36th week of pregnancy (wp) are comparable. These results will provide interesting indications of changes in eating habits during pregnancy.

This questionnaire is intended to assess both diet composition and culture of eating in the areas of research and everyday clinical practice. Further, we suggest that it is necessary to understand how social-demographic factors (e.g. age and SES) of women of childbearing age might influence their food intake.

The knowledge of influencing factors can be used in further prevention programmes as women are particularly changing their lives during this time of life.

Materials and methods

Study participants and design

Data were collected between 2016 and 2020 in the framework of the LIFE Child study. The LIFE Child study is a longitudinal study investigating normal child development and the development of civilisation diseases from pregnancy to adulthood (NCT02550236)^(21,22).

Within the study, pregnant women also pass a detailed study programme. They are invited to participate at two time points during pregnancy, once in the 24th wp and once in the 36th wp. Any queries were answered on the spot by study assistants.

CoCu was completed by 430 women in the 24th wp. Most analyses presented in this paper are based on this sample. Of these women, ninety-seven have completed the questionnaire at both time points during pregnancy. The analyses on agreement between responses were based on this subsample.

Study participants provided information on their education, their occupational position and their family net income for the assessment of SES. Based on this information, a SES score was derived^(23,24) which ranged between 3 and 21, with a higher score indicating higher SES. Scores between 3 and 8.4 indicate a low SES, scores between 8.5 and 15.4 a middle SES and scores between 15.5 and 21 a high SES. In a representative sample, 60 % of participants

would be expected to have a middle SES, 20 % a lower SES and another 20 % a higher SES⁽²³⁾.

Measures

Composition and Culture of Eating pregnancy: composition and culture of eating

CoCu is a screening instrument developed to assess the composition of diets and the culture of eating in children and adults. For children, there exists two different versions of the questionnaire (self- and parent-reported version) which have already been described previously⁽²⁰⁾. The CoCu pregnancy is nearly identical to the version for children but includes a further question about raw product consumption. It consists of two parts, a diet composition part and a culture of eating part. The composition of diet part contains fourteen questions on *what* women eat. In more detail, women indicate how many portions of different food products they eat per day (for fruits/vegetables, unsweetened milk products, sweetened milk products, sweetened beverages, whole-grain bread, white bread) or per week (for meat, fish, ready-made meals, fried potatoes, potatoes, rice/noodles, cakes, sweet or savoury snacks). Answers are given on a six-point scale ranging from 1 ('never') to 6 ('>7 portions'). Reference portions are described in the text (e.g. 'a fistful') or illustrated using photographs.

The selection of food items was largely based on a FFQ that has been applied in the LIFE Child study for several years⁽²⁵⁾. We summarised the inquired foods (e.g. apple, berry fruits, salad, carrots) from FFQ as categories (e.g. fruit/vegetables). The categories were included into the CoCu. The questions in the short questionnaire only cover the food category, not a specific food itself. Some of the food groups presented in the FFQ were not included in CoCu, as they were judged to be consumed too infrequently (e.g. oil, nuts), to reveal little about the healthiness of the subject's diet (e.g. tea, water) or to be inappropriate for pregnant women (e.g. alcohol).

Importantly, the answers for the composition of diet part of CoCu pregnancy can be analysed in two phases. First, the consumption of each food product can be described in terms of portions/week. Second, the level of consumption of each food product can be categorised as either healthy ('green' or '10 points'), moderately healthy ('yellow' or '0 points') or unhealthy ('red' or '-10 points'). The categorisation into 'green', 'yellow' and 'red' was adapted from CoCu for children and adolescents⁽²⁰⁾, with specific parameters set for each food product (see online supplementary material, Supplemental 1). For example, for fruits/vegetables, answers of '4–5' portions/week or more were categorised as 'green', answers of '2–3 portions/week' were categorised as 'yellow' and answers of 'never' or 'max.1/week' were categorised as 'red'. Three of the original food items (sweetened milk products, cakes, and sweet or savoury snacks) were aggregated into one item called 'treats'.



As for the CoCu in children and adolescents⁽²⁰⁾, a 'Nutritional Health Score' (NHS) is derived by summing the categorisations/points of all food items. This score may range from -120 (in cases where all responses were categorised as unhealthy (-10 points)) to +120 (in cases where all responses were categorised as healthy (+10 points)), with higher scores indicating healthier diets.

The second part of CoCu pregnancy (eating culture) comprises six questions on the value of meals. The women are asked how many and which meals they eat each day (first breakfast, second breakfast, lunch, afternoon snack, dinner), whether they use media while eating, or whether they eat unhealthy snacks between meals.

As raw products should be avoided during pregnancy⁽²⁶⁾, the CoCu pregnancy questionnaire also comprises questions on the consumption of raw milk products and raw meat. The questions could be answered by either Yes or No. Furthermore, we asked if the women follow a certain diet (vegetarian, vegan, gluten-free, lactose-free or other). The entire questionnaire, in German (original) or English (translation), is available on request.

FFQ

The FFQ applied in the LIFE Child study provides a detailed overview of a woman's diet during pregnancy⁽²⁵⁾. Participants indicate not only the frequency of consumption of different food products (choosing from nine possible frequency levels ranging from 'never' to 'more frequently than 4 times per day') but also the portion size they usually consume (three to five different answer categories). The eighteen food groups (forty-two subgroups) are reflected in eighty-two different questions. In the LIFE Child study, the FFQ is completed in the 24th and 36th wp⁽²¹⁾.

Statistical analysis

The concurrent validity of CoCu pregnancy was investigated by comparing responses in CoCu pregnancy with responses in the FFQ using Spearman correlations. All items were expressed as portions/week or weight/week (where it was not possible to identify a portions/week value). Each item of CoCu pregnancy was associated with the appropriate item(s) of the FFQ. If an item of CoCu pregnancy was represented by more than one item in the FFQ, the relative items of the FFQ were aggregated. Spearman rank correlations were calculated.

Retest reliability is usually checked by comparing answers from two study visits. This procedure is fraught with some problems during pregnancy, since eating habits may change (stronger than outside pregnancy) and may also be affected by other factors such as nausea and abdominal fullness. Here, we calculated two types of percentage agreement for answers given in the 24th (T1) and 36th wp (T2). In the first evaluation, agreement was defined as having chosen exactly the same response category at both time points. In the second analysis, having chosen adjacent response categories (e.g. 'max. 1 portion/week' in the 24th wp, and

either 'never', 'max. 1/week' or '2-3 portions/week' in the 36th wp) was also considered as agreement.

Associations between the healthiness of women's diet (as reflected by the NHS), the consumption of raw products and eating culture (reflected by the different items of the culture of eating part), on the one hand, and age and SES, on the other, were assessed using multiple linear or logistic regression analyses. Possible relationships between the healthiness of diet (as dependent variable) and eating culture (as independent variable) were investigated using multiple linear regression analysis. Age and SES were included as control variables. In linear regression analyses, effect sizes were described in terms of standardised regression coefficients (β). In the logistic regression analyses, they were described in terms of OR.

Results

The present sample

The two samples included in the analyses (430 women participating in the 24th wp, ninety-seven women participating in the 24th and 36th wp) are described in Table 1. The mean age of women completing the questionnaire in the 24th wp was 31.3, ranging from 21 to 39. The SES was rather high, with only 1% having a low SES but 52% having a high SES. The education was high as well, with approximately half of the participating women having a University degree. The majority of women (>80%) came from an urban area. Information on the course of pregnancy and previous pregnancies was available for 379 participants. Of these women, 111 reported at least one complication during the current pregnancy (e.g. bleeding, placental insufficiency, cervical weakness, anaemia, gestational diabetes), 107 reported one previous pregnancy and eighty-one reported two previous pregnancies. Fifty-six women reported at least one previous miscarriage, and nineteen reported at least one previous abortion.

A comparison of women participating in the 24th and 36th wp (n 97) and those lost to follow-up (n 333) revealed no significant differences regarding age, the distribution of SES and education, the frequency of one or two previous pregnancies or the frequencies of miscarriages or abortions in one of the previous pregnancies (all $P > 0.05$). However, compared with women participating in the 24th and 36th wp, those lost to follow-up consumed significantly more treats (9.82 *v.* 8.31 portions per week, $P = 0.015$) and ready-made meals (0.64 *v.* 0.44 portions per week, $P = 0.019$). Regarding the other food items and the NHS, the two samples did not differ significantly (all $P > 0.05$).

Diet composition, raw products, specific diets and eating culture in the present sample

Table 2 shows the consumption of different food products in terms of mean portions per week. The food products

Table 1 Description of the study samples analysed in the present analyses

	Participants in 24th wp (n 430)	%	Participants in 24th and 36th wp (n 97)	%
Age				
Mean	31.3		31.25	
Range	21–39		23–39	
SES				
Low	3	1	0	0
Middle	202	47	47	48
High	225	52	50	52
Education after school				
No educational degree:	14	3	3	2
Apprenticeship:	184	43	38	39
University degree:	205	48	52	54
Missing:	28	6	5	5
Previous pregnancies				
None:	209	48	50	51
One pregnancy:	107	25	24	25
Two pregnancies:	81	19	21	22
Missing:	33	8	2	2
Previous miscarriage				
None:	341	79	85	88
One:			10	10
Two:		12	0	0
Missing:	33	8	2	2
Previous abortions				
None:	378	88	90	93
One:	18	4	4	4
Two:	1	0	1	1
Missing:	33	8	2	2
Troubles during the present pregnancy*				
None:	286	64	73	75
At least one:	111	28	22	23
Missing:	33	8	2	2
Residency				
Urban:	340	79	81	84
Suburban/rural:	65	15	16	16
Missing:	25	6	0	0

*Troubles might be a general disease, long-term medication, abusos, mental stress, bleeding, placenta previa, multiple births, hydramnion, oligohydramnios, uncertainties regarding date of birth, placental insufficiency, cervical weakness, premature labour, anaemia, urinary tract infection, indirect Coombs test positive, abnormal serum findings, protein excretion 1%, hypertension, hypotension, oedema, gestational diabetes, adjustment anomaly or other troubles.

consumed most frequently were fruits and vegetables (mean portions per week = 21.05). The food products consumed least frequently were fried potatoes, ready-made meals and fish (all fewer than once per week, see Table 2). For all food products, the mean portions per week were categorised as either healthy (green) or moderately healthy (yellow). Only for sweetened beverages and treats, the mean responses of 8.28 and 9.48 portions per week indicated a tendency to moderately healthy consumptions (indicated by a daily consumption of more than one portion per day).

Nearly 16% of the participating pregnant women reported eating some raw products, where raw meat was consumed more frequently than raw milk products (see Table 2).

Nearly 13% of pregnant women reported that they eat according to a certain diet. Vegetarian and lactose-free diets were more frequent than vegan and gluten-free diets (see Table 2).

The average responses to the items of the eating culture part of the questionnaire are also displayed in Table 2. Pregnant women reported having on average between 3 and 4 meals per day. Nearly 50% used media while eating, and more than 50% reported to snack between meals.

Concurrent validity

The concurrent validity of CoCu pregnancy was tested by comparing answers given in CoCu pregnancy with answers given in a more detailed FFQ. The results of these analyses are presented in Table 3. For each food product, the correlations between answers given in both questionnaires were positive and significant (all $P < 0.001$), although some showed weak correlations (white bread and sweetened milk products ($r_{ho} = 0.32$)). The strongest correlation was observed for the consumption of fish ($r_{ho} = 0.61$).

Agreement between responses given in the 24th and 36th week of pregnancy

Percentage agreement of responses was assessed in a subsample of pregnant women ($n = 97$) who had completed the CoCu questionnaire at two time points, namely in the 24th and 36th wp. As can be seen in Table 4, between 35% (sweet/savoury snacks) and 71% (fish, potatoes) of women had chosen the same response category at both time points. Furthermore, the results demonstrated that 90% (beverage sweetened) to 99% (rice/noodles, fried potatoes, fish) of pregnant women selected the same or adjacent categories at both study visits.

Table 2 Diet composition, raw products, specific diets and eating culture in the present sample (24th wp) (*n* 430)

Diet composition	Mean portions/week	95 % CI	Categorisation
Fruits/vegetables	21.05	20.06, 22.04	Healthy
Milk unsweetened	11.76	10.95, 12.57	Healthy
Milk sweetened	4.02	3.57, 4.48	
Beverage sweetened	8.28	7.25, 9.31	Moderately healthy
Whole-grain bread	11.27	10.46, 12.09	Healthy/moderately healthy
White bread	5.38	4.75, 6.01	Healthy
Meat	3.06	2.86, 3.24	Healthy
Fish	0.84	0.75, 0.93	Healthy
Ready-made meals	0.60	0.51, 0.68	Healthy/moderately healthy
Fried potatoes	0.50	0.44, 0.56	Healthy/moderately healthy
Rice/noodles	2.80	2.66, 2.93	Healthy
Potatoes	1.93	1.80, 2.06	Healthy
Cakes	2.18	2.02, 2.34	
Snack	3.27	3.07, 3.48	
Treats*	9.48	8.90, 10.05	Moderately healthy
Nutritional Health Score	49.74	47.27, 52.22	
Raw products	%	95 % CI	
Some raw products	15.81	12.37, 19.26% yes	
Raw milk products	6.28	3.99, 8.57% yes	
Raw meat	12.79	9.63, 15.95% yes	
Specific diets	%	95 % CI	
Any specific diet	12.79	9.63, 15.95% yes	
Vegetarian	5.12	3.03, 7.20% yes	
Vegan	1.16	0.15, 2.18% yes	
Gluten-free	0.93	0.02, 1.84% yes	
Lactose-free	3.49	1.75, 5.22% yes	
Eating culture	Mean response or %	95 % CI	
Meals/day	3.70	3.63, 3.77	
Media while eating	46.74	42.03, 51.46% yes	
Unhealthy snacks between meals	53.26	48.54, 57.97% yes	

*Treats summarise sweetened milk products, cakes and snacks.

Table 3 Concurrent validity: Spearman rank correlations between the answers given in Composition and Culture of Eating (CoCu) pregnancy and those given in the FFQ

Food item	<i>rho</i>	95 % CI	<i>n</i> †
Fruits/vegetables	0.57	0.51, 0.64*	427
Milk unsweetened	0.43	0.35, 0.51*	418
Milk sweetened	0.32	0.23, 0.41*	391
Beverage sweetened	0.48	0.40, 0.56*	408
Whole-grain bread	0.38	0.23, 0.40*	423
White bread	0.32	0.17, 0.41*	419
Meat	0.53	0.45, 0.61*	400
Fish	0.61	0.54, 0.68*	419
Fried potatoes	0.53	0.46, 0.61*	430
Rice/noodles	0.47	0.39, 0.55*	426
Potatoes	0.51	0.43, 0.58*	429
Cakes	0.58	0.52, 0.65*	417
Sweet/savoury snacks	0.49	0.41, 0.57*	419

**P* < 0.001.

†Due to missing values in the items of the FFQ, different numbers of participants were included in the single analyses.

Table 4 Percentage of agreement between responses given in 24th (T1) and 36th (T2) wp

	Agreement (only same categories are considered as agreement) %	Agreement (adjacent categories are considered as agreement) %
Fruits/vegetables	59	95
Milk unsweetened	64	98
Milk sweetened	69	98
Beverage sweetened	44	90
Whole-grain bread	62	95
White bread	65	96
Meat	49	92
Fish	71	99
Fried potatoes	59	99
Rice/noodles	56	99
Potatoes	71	97
Cakes	52	93
Sweet/savoury snacks	35	92

Associations between diet composition/raw products/eating culture and age/socio-economic status

Diet composition

The analysis revealed significant positive associations between the NHS and age ($\beta = 0.11$ (95 % CI 0.01, 0.20), $P = 0.027$) as well as SES ($\beta = 0.21$ (95 % CI 0.11, 0.30), $P < 0.001$). For pregnant women aged 22 years, the NHS

estimated by the statistical model was 29. For pregnant women aged 40 years, in contrast, the model estimated a NHS of 56. The estimated average NHS for pregnant women of middle (score of 12) and high SES (score of 18) were 43 and 54, respectively.

Table 5 Associations (indicated by standardised regression coefficients or OR) between diet composition, raw products, eating culture and age and SES

Dependent variable	Independent variable								
	Age		SES		Age		SES		
	β	95 % CI	β	95 % CI	OR	95 % CI	OR	95 % CI	
Diet composition									
Nutritional Health Score†	0.11	0.01, 0.20*	0.21	0.11, 0.30***					
Raw products									
Some raw products‡					1.03	0.96, 1.09	0.89	0.82, 0.97*	
Raw milk products‡					1.08	0.98, 1.19	0.91	0.80, 1.04	
Raw meat‡					0.98	0.91, 1.06	0.94	0.86, 1.04	
Culture of eating									
Meals/d†	0.12	0.03, 0.22*	0.11	0.01, 0.20*					
Media while eating‡					0.90	0.86, 0.95***	0.84	0.78, 0.90***	
Unhealthy snacks between meals‡					0.97	0.92, 1.02	0.93	0.86, 0.99*	

All associations are adjusted for the other independent variable.

* $P < 0.05$,

** $P < 0.01$,

*** $P < 0.001$.

†Linear regression.

‡Logistic regression, reference = no raw products/no media while eating/no unhealthy snacks between meals.

Raw products

Pregnant women with a lower SES were more likely to eat raw products than women with a higher SES (OR = 0.89, $P = 0.011$). In the middle social stratum, the percentage of women eating some raw products was estimated 21%, compared with 12% in the high social stratum.

Eating culture

The analyses on associations between the different eating culture items and age and SES are shown in Table 5. They revealed small but significant positive association between the number of meals per day and the age ($\beta = 0.12$, $P = 0.011$) and the SES ($\beta = 0.11$, $P = 0.025$) of the participating women. Furthermore, older women and women with a higher SES were less likely to use media while eating than younger women and women with a lower SES (OR = 0.90 and 0.84, respectively, both $P < 0.001$). Finally, pregnant women with a lower SES were more likely to eat unhealthy snacks between meals than pregnant women with a higher SES (OR = 0.93, $P = 0.027$).

Relations between Nutritional Health Score and eating culture

The NHS of women using media while eating was significantly lower than the NHS of women using no media ($\beta = -0.18$ (95% CI -0.27, -0.09), $P < 0.001$). Furthermore, women usually snacking between meals had a significantly lower NHS than women not snacking between meals ($\beta = -0.24$ (95% CI -0.33, -0.15), $P < 0.001$). The number of meals was not significantly associated with the NHS ($\beta = 0.08$ (95% CI -0.01, 0.17), $P = 0.078$).

Discussion

We developed a short questionnaire for evaluating the diet composition and eating culture in pregnant women.

Healthiness of diet reported in the present sample

Our results showed that food items were consumed according to the recommendations ('healthy') or only slightly different from recommendations ('moderately healthy') which indicate healthy eating in our sample. Pregnant women paid particular attention to an adequate intake of healthy foods (e.g. fruits, vegetables, unsweetened milk products) and avoided unhealthy foods (e.g. ready-made meals). The transition to motherhood is associated with changes in eating behaviour⁽²⁷⁻²⁹⁾ and increased consumption of fruits and milk products during pregnancy⁽²⁸⁾. The avoidance of specific food items (e.g. (raw) meat, raw fish) might be due to women's concerns about child health, aversion to different food items and nausea during pregnancy⁽²⁸⁾. However, nearly 16% of women reported that they eat raw products during pregnancy, contrary to recommendations⁽¹⁾. Nearly 7% of pregnant women followed a vegetarian or vegan diet. Unfortunately, we cannot say whether these (or even more) women had followed a vegetarian or vegan diet before pregnancy.

In our analysis, sweetened beverages and treats were, on average, consumed more frequently than once a day (8.28 portions/week and 9.48 portions/week, respectively) during pregnancy. Although it has been shown earlier that sweetened drinks are consumed frequently in other population groups and are further associated with overweight and obesity – due to underestimation of energetic intake – we suggest that during pregnancy, increased intake of sweetened drinks and treats might also be due to pronounced preferences for sweet taste during pregnancy⁽³⁰⁾.

Validity: comparison with FFQ

The answers given in CoCu pregnancy showed significant positive associations with answers given in the FFQ. The correlations for sweetened milk and white bread were



significant, but weak, which confirms our observations of CoCu in children and adolescents⁽²⁰⁾.

For both sweetened milk products and white bread, the weak correlations might be explained by the difficulty to correctly estimate the daily use, e.g. due to irregularities between different days (in the case these products are not consumed every day) or due to difficulties in distinguishing different types of food (e.g. yoghurts containing sugar or not; bread containing grains or not). For sweetened milk products, methodological differences between the questionnaires might also be responsible for the weak correlations. For example, fruit yoghurt is categorised as unsweetened milk product in the FFQ, but as sweetened milk product in the CoCu.

Overall, we were able to confirm the validity of all food items in CoCu pregnancy.

Agreement

We assessed percentage agreement of CoCu pregnancy in a subsample of ninety-seven women who had completed the questionnaire at two time points during pregnancy (24th and 36th wp). Our results demonstrate that responses for food consumption during pregnancy varied between study visits but that the large majority of pregnant women had chosen at least adjacent answer categories. The results indicate that eating habits in mid- and late-pregnancy are different and changes in diet during pregnancy are common. Our results indicate that eating habits for sweet and savoury snacks remain consistent in only 35 % of subsample which is in line with a previous study demonstrating changing sweet appetite during pregnancy⁽³¹⁾.

The high degree of agreement among the answers on fish consumption between 24th and 36th wp (71 %) might be explained by overall small consumption of fish (one portion per week or less). Consequently, variations between answers remain small.

Associations between diet composition/raw products/eating culture and age/socio-economic status

We further investigated whether diet composition, the consumption of raw products and eating culture are associated with age or SES in pregnant women.

Our results indicate that a healthy diet, a higher number of meals per day and an infrequent use of media while eating are associated with increasing age in pregnant women. We suggest that less health awareness is more prevalent in younger women and increases during adulthood. A study investigating the adherence to the Mediterranean diet and their association with different maternal factors during pregnancy verified better adherence to the Mediterranean diet with increasing age of pregnant women⁽¹⁹⁾. Results from the NICE study indicated that increasing age was associated with a diet rich in fruits, vegetables, whole grains and fish while pregnancy⁽³²⁾. The increased health awareness is

also reflected in the fact that in our cohort, meal frequency was associated with age. While regular meals are recommended for children⁽³³⁾ and adults, skipping meals is associated with adverse health effects, e.g. overweight or obesity⁽³⁴⁾.

The higher media use while eating in younger as compared with older women might be explained by a generally greater ubiquity and naturalness of media, especially modern media such as mobile phones, among younger people and parents⁽³⁵⁾.

Furthermore, increasing age of pregnant women might indicate that they already have children and fulfil an enhanced role model function for them.

Our results demonstrated that healthy diet (NHS), less consumption of raw products and unhealthy snacks between meals, higher number of meals per day and less use of media while eating are associated with higher SES in pregnant women. This is in line with other studies in different countries showing socio-economic disparities for diet quality during pregnancy^(19,32,36,37). Additionally, another study demonstrated that pregnant women with lower SES was less compliant in avoiding raw food products⁽³⁸⁾. This is in line with our findings indicating lower consumption of raw products in pregnant women with high compared with middle SES.

People and parents from lower social strata generally show a higher media use than people from higher social strata, especially regarding entertainment media such as video games or television⁽³⁵⁾.

We suggest that higher SES and increasing age are associated with increased health awareness, avoidance of risks, increased knowledge about healthy eating and increased consideration of recommendations applicable during pregnancy⁽¹⁾. Within our cohort, socio-economic status seems to be even more important for diet and eating culture than age.

Our results showed that a healthy diet during pregnancy is affected by, e.g. SES and age. Therefore, we recommend practical support such as information on quick recipes, the provision of inexpensive or even free fruit and vegetable products and the promotion of subsidised, delivered lunches for pregnant women.

Associations between diet composition and eating culture

In our analysis, pregnant women with a high NHS used less media during meals. This confirms our results from analyses in children and adolescents⁽²⁰⁾ and was described in previous studies^(39,40). In our cohort, snacking was associated with lower NHS in pregnant women. Snacking has been further identified as potential risk factor for poor food quality in children⁽⁴¹⁾, adolescents⁽⁴²⁾ and adults⁽⁴³⁾. Our results indicate that pregnant women who are concerned about their diet composition also maintain an appropriate eating culture.



Implications

We created and validated the CoCu pregnancy as a useful and time-efficient tool assessing diet composition and eating culture in pregnant women. To the best of our knowledge, no other questionnaire combines questions on diet composition and eating culture in pregnant women.

The questionnaire might be used in epidemiological studies as well as in clinical practice. In consultation hours, information about deviations from recommendations during pregnancy could be identified more quickly and might help making further dietary advices more easily.

Limitations

We acknowledge that, like in other cohort studies, an increased number of participating women showed a high or medium SES. Therefore, it is possible that findings would differ in pregnant women from lower social strata. Furthermore, the number of questionnaires included into the analysis was rather small.

Another limitation is that the assessment of diet is subjective and we cannot exclude responses based on social desirability. With regard to the validity check, we were able to show a positive significant correlation for all food items, of those two food items showed only a low correlation. To validate the questionnaire, the comparison was made with only one other instrument (FFQ). This was due to other extensive study investigations. The output of, e.g. food diary or 24-h-recalls, would have exceeded the time frame for each participant.

Finally, the LIFE Child study does not assess diet consumption and eating culture before pregnancy. Therefore, we could not compare diet before and during pregnancy.

Conclusion

The created short nutrition questionnaire represents an economic and efficient tool for assessing the diet composition and eating culture in pregnant women and might be used in epidemiological studies as well as in clinical practice. The results demonstrated that both healthier diet composition and eating culture were associated with increased age and higher SES of pregnant women.

Furthermore, findings from the questionnaire can be used in the future to ensure better care for mother and child in the context of prevention.

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Supplementary material

For supplementary material accompanying this paper visit <https://doi.org/10.1017/S1368980021002445>

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