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THE ASSOCIATION OF EDUCATION AND INCOME WITH NUTRITION OF PREGNANT AND PARTURIENT WOMEN

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Abstract. The **aim** of this epidemiological prospective cohort study is the analysis of the association of education and income with behavior related to nutrition of pregnant and lactating women in Iaşi area. This study is part of a more complex one which has investigated the nutrition of pregnant woman and newborn in the context of many determinant factors of their health. **Material and methods.** This study was performed in a group of 263 pregnant women in which we have analyzed how education and income influence the behavior related to nutrition during pregnancy and postpartum. The nutrition was investigated by a food consumption frequencies questionnaire and 24 hour dietary recall data. The total energy intake was under the recommended values, due to, at least partially, the reduced bread intake. **Results.** The study found out that the high educational level and a good income were associated to a high intake of proteins (meat, dairy, eggs), animal lipids and fruits. The low educational level and a low income were associated to the high intake of bread, potatoes, vegetal lipids and alcoholic beverages. Regardless the education and income, we found out some unhealthy eating habits (like low fish consumption, high coffee and sweets consumption) that make necessary the improvement of education for health of all pregnant women, and generally of childbearing women, concerning the proper nutrition during pregnancy. **Conclusions.** High educational level and good income were associated with high intake of proteins (meat, dairy, eggs), animal lipids, fruits and sweets. Low educational level and low income were associated with high intake of bread, potatoes, vegetal lipids and alcoholic beverages. Some unhealthy eating habits (like low fish consumption, high coffee and sweet consumption) were not related to education and income.
Key words: nutrition, pregnancy, education, income

Rezumat. Scopul acestui studiu epidemiologic prospectiv de tip cohortă, efectuat în județul Iași, este analiza asocierii educației și venitului cu comportamentul legat de nutriție al femeilor gravide și al celor care alăptează. Acesta face parte dintr-un studiu mai complex care a evaluat starea de nutriția a femeii însărcinate și a nou-născutului în contextul factorilor multipli determinanți ai stării de sănătate. **Material şi metodă**. Studiul s-a efectuat pe un grup de 263 femei gravide, am analizat modul în care educația și venitul influențează comportamentul alimentar în timpul sarcinii și după naştere. Nutriția a fost investigată printr-un chestionar de frecvenţă a consumului de alimente și prin înregistrarea dietei din ultimele 24 de ore. Ingestia totală de energie a fost sub valorile recomandate, datorită, cel puțin parțial, consumului redus de pâine. **Rezultate.** Studiul a constatat că un nivel educațional ridicat și un venit bun s-au asociat cu un consum mare de proteine (carne, lactate, ouă), lipide animale, fructe și dulciuri. Un nivel coborât de educație și un venit redus s-au asociat cu consumul mare de pâine, cartofi, lipide vegetale și băuturi alcoolice. Indiferent de educație și venit, am constatat unele obiceiuri alimentare nesănătoase (precum consumul redus de peşte, consumul mare de cafea și dulciuri)

care fac necesară îmbunătățirea educației pentru sănătate a tuturor femeilor gravide, şi în general a femeilor de vârstă fertilă, în ceea ce priveşte nutriția corespunzătoare din timpul sarcinii. **Concluzii.** Un nivelul crescut de educație şi un venit corespunzător au fost asociate cu un consum crescut de proteine (carne, lactate, ouă), lipide animale, fructe şi dulciuri. Nivelul scăzut de educație şi venitul insuficient au fost asociate cu un consum crescut de pâine, cartofi, grăsimi vegetale şi alcool. Unele obiceiuri alimentare nesanogene (consum scăzut de peşte, consum crescut de cafea şi dulciuri) nu au fost asociate cu gradul de educație şi venitul.

Cuvinte cheie: nutriție, sarcină, educație, venit

INTRODUCTION

Nutrition is probably the most important external factor which influences the mother health and the pregnancy evolution, creating at the same time pre-requisites for the newborn health. The extent to which maternal nutrition can improve maternal health and survival is not yet well understood. Excluding deaths due to induced abortions, the other main four causes of maternal mortality (preeclampsia, hemorrhage, obstructed labour, and infection) may be amenable to nutrition intervention (1). During pregnancy and the first year of life, the homeostatic mechanisms of the future child are very vulnerable; that is why the nutritional problems of the mother in these periods are of great interest. Besides health status, age, weight, physical and nervous activity, environmental conditions, eating habits, culinary techniques, etc., socio-economical factors generally influences the nutrition. As part of socio-economical situation, education and income, tightly close with it, are very important characteristics.

The aim of the paper was to analyze how education and income influence the behaviour related to nutrition of pregnant and lactating women in Iaşi area, this time with various and important changes in social and economical transformations.

This paper is part of a more complex study which has investigated the nutrition of pregnant woman and newborn in context of many determinant factors of their health.

MATERIAL AND METHODS

This epidemiological prospective cohort study was performed between 2000 and 2004 IN Iaşi county. A number of 263 pregnant apparently healthy women aged between 18 and 39 years (28.0 ± 4.3 years) were recommended by the general practitioners or obstetricians to our institute for routine analyses. Iaşi county is characterized by a middle economical level and a high birth rate (12.3 ‰ versus 9.8 ‰ in Romania in 2003) (2).

The subjects were investigated in the first half of pregnancy (10.3 ±3.5 weeks), in the second half of pregnancy (31.4 ± 3.8 weeks) and postpartum (8.2 ± 2.6 weeks). For every women questionnaire was filled in. It comprised, besides other information, the socio-economical situation including education and income per capita.

Three educational levels were considered: elementary (<= 8 years of

study), middle (9-13 years of study) and high (>13 years of study). The whole income of the family, were divided by family members and three categories resulted: low, middle and good (taking into account every year different thresholds depending on inflation). Every time the women visited the institute, they were asked about the frequencies of food consumption and 24 hour recall of food intake. Total energy and the main nutrients energy (total and animal proteins, total and animal lipids and carbohydrates) were estimated.

In order to assess the relationship between education or income and nutrition, we have compared the frequencies repartition with "chi square" test for qualitative variables and with ANOVA test for quantitative variables (Epi Info programme).

RESULTS AND DISCUSSION

Table 1 shows the educational level and the income of the pregnant women. One can notice that the proportion of good incomes surpassed the proportion of high educational level (accounting a part of middle educational level).

Table 1. Educational level and income of pregnant women

		Number	%
Educational level	Elementary	11	4,2
	Middle	118	44,9
	High	134	51,0
Income	Low	20	7,6
	Middle	77	29,3
	Good	166	63,1

Mean total energy intake was under the recommended values (table 2) in Romania, but the energy intake in late pregnancy was comparable with that from another study (3).

Table 2. Energy intake (kcal/day)

	Mean ± Standard deviation	Recommended value for women 20 - 45 aged (middle effort) (4)
Early pregnancy	2165.3 ± 808.9	2700
Late pregnancy	2520.2 ± 863.9	3200
Postpartum	2330.8 ± 892.4	3400

As table 3 shows, the quantity of total proteins, like as their proportion of energy intake, rose during pregnancy and postpartum. In the same way the animal proteins varied. Total lipids intake was higher late in pregnancy and slightly decreased after delivery. Their energy proportion fell in late pregnancy, but increased postpartum. Animal lipids rose during study the period and their proportion of total lipids decreased in the second stage of study. The carbohidrates had the highest values late in pregnancy. Taking into account the World Health Organisation limits for the mean consumption of the population, which are 10-15 % energy for total proteins, 15- 30 % energy for total lipids and 55-75 % energy for carbohydrates, we can conclude that in our subjects carbohydrates values were under the lower limit and total lipids were over the upper limit (4). Comparative to another study in pregnant women, we can say that the proportion of total lipids, total proteins and carbohydrates were alike in the two stages of pregnancy, but the respective quantities (in grams) were lower in early pregnancy in our study (5).

Table 3. Daily quantities and energy intakes by the main nutrients

		Early pregnancy (mean +/- SD)	Late pregnancy (mean +/- SD)	Postpartum (mean +/- SD)
Total proteins	g	76.7 +/- 32.0	89.6 +/- 31.3	90.5 +/- 36.7
	% of energy	14.6 +/- 3.5	14.4 +/- 3.4	16.1 +/- 3.7
Animal proteins	g	41.5 +/- 25.8	49.5 +/- 23.9	55.1 +/- 28.8
	% of total proteins	51.6 +/- 20.1	53.8 +/- 17.7	59.7 +/- 18.7
Total lipids	g	86.2 +/- 39.7	99.7 +/- 47.6	97.9 +/- 45.3
	% of energy	36.7 +/- 9.7	35.9 +/- 8.9	39.0 +/- 9.9
Animal lipids	g	44.0 +/- 27.8	49.2 +/- 29.2	53.3 +/- 31.8
	% of total lipids	51.8 +/- 23.3	50.3 +/- 21.7	54.7 +/- 23.1
Carbohydrates	g	255.7+/-113.6	299.0+/-110.3	256.0 +/-118.5
	% of energy	48.6 +/- 10.4	49.2 +/- 9.9	44.9 +/- 10.8

Table 4 shows the consumption frequencies of the main categories of foods. As regard the meat and meat products, most of subjects had declared a frequency of 4 or more times/week. One can notice an increase of meat consumption during pregnancy and postpartum. The intake of dairy products, fruits, sweets and animal lipids have increased during pregnancy and slightly decreased postpartum. The intake of eggs and dry vegetables gradually decreased during the study period. Although we did not calculate the daily food intake, we can conclude an insufficient consumption of eggs and dairy products of some women. Intakes of fish, potatoes, cereal products and vegetal lipids have remained approximately constant.

Table 4. Frequency of main food intake

Food	Frequency	Early pregnancy		Late pregnancy		Postpartum	
		n	%	n	%	n	%
Meat and meat products	No	4	1.6	1	0.5	0	0
	Rarely	19	7.7	14	6.8	11	5.5
	2-3 times/week	74	29.8	52	25.1	39	19.4
	>=4 times/week	151	60.9	67	67.6	151	75.1
Dairy products	Rarely	31	12.4	9	4.4	11	5.5
	2-3 times/week	68	27.3	40	19.3	44	21,9
	>=4 times/week	150	60.2	158	76.3	146	72.6
Eggs	No	13	5.2	1	0.5	3	1.5
	Rarely	41	16.5	28	13.5	23	11.4
	2-3 times/week	140	56.2	104	50.2	99	49.3
	>=4 times/week	55	22.1	74	35.7	76	37.8
Fish	No	21	8.4	20	9.7	30	14.9
	Rarely	211	84.7	166	80.2	156	77.6
	2-3 times/week	17	6.8	21	10.2	15	7.5
Potatoes	Rarely	25	10.0	18	8.7	23	11.4
	2-3 times/week	104	41.8	94	45.4	96	47.8
	>=4 times/week	120	48.2	95	45.9	82	40.8
Dry vegetables	No	35	14.1	33	15.9	110	54.7
	Rarely	196	78.7	153	73.9	74	36.8
	2-3 times/week	16	6.4	19	9.2	17	8.5
	>=4 times/week	2	0.8	2	1.0	0	0.0
Fruits	Rarely	13	5.2	4	1.9	12	6.0
	2-3 times/week	18	7.2	5	2.4	16	8.0
	>=4 times/week	218	87.6	198	95.7	173	86.1
Sweets	No	10	4.0	7	3.4	19	9.5
	Rarely	114	45.8	54	26.1	70	34.8
	2-3 times/week	55	22.1	58	28.0	46	22.9
	>=4 times/week	70	28.1	88	42.5	66	32.8
Cereal derivatives	No	3	1.2	7	3.4	15	7.5
	Rarely	88	35.3	70	33.8	63	31.5
	2-3 times/week	81	32.5	70	33.8	61	30.3
	>=4 times/week	77	30.9	60	29.0	62	30.8
Vegetal lipids	Rarely	151	60.6	117	56.6	135	67.2
	2-3 times/week	63	25.3	50	24.2	29	14.4
	>=4 times/week	35	14.1	40	19.3	37	18.4
Animal lipids	No	52	20.9	39	18.8	42	20.9
	Rarely	97	39.0	55	26.6	67	33.3
	2-3 times/week	75	30.1	68	32.9	44	21.9
	>=4 times/week	25	10.0	45	21.7	48	23.9
Coffee	No	143	57.4	102	49.3	104	51.7
	Rarely	25	10.0	31	15.0	22	10.9
	2-3 times/week	15	6.0	22	10.6	16	8.0
	>=4 times/week	66	25.6	52	25.1	59	29.4
Alcoholic beverages (wine, beer)	No	116	46.6	109	52.7	99	49.3
	Rarely	11	44.6	83	40.1	66	32.8
	2-3 times/week	14	5.6	10	4.8	28	13.9
	>=4 times/week	8	3.2	5	2.4	8	4.0

n: number of subjects

Fish consumption, an important food for pregnant women (due to omega-3 fatty acids content), was very low almost in all women. Regarding the coffee and alcoholic beverages, approximately 50 % of women declared that they drank not at all during the study. The other 50 % of women had a steadfast consumption during pregnancy which has slightly increased after delivery.

The lactating mothers drank coffee in a lower proportion than nonlactating mothers (p=0.018). But, the repartition of mothers by frequencies of alcohol beverages intake was homogenous in lactating and nonlactating ones (p=0.698).

The quantity of consumed bread was higher in the second half of pregnancy compared to the other two stages, and it was under the recommended quantity in every stage (table 5).

Table 5. Daily quantities of bread intake (g)

	Mean ± SD	Recommended values (4)
Early pregnancy	228.5 +/- 11.6	275
Late pregnancy	240.6 +/- 116.6	325
Postpartum	227.7 +/- 118.8	325

The following of the association between educational level, income and nutrition was done by stage, taking into account that nutritional needs are physiologically different determinated at the beginning of pregnancy, at the end of pregnancy or in lactating period.

Only the statistically significant associations are presented. Thus, the women with a good income had a better proportion of protein intake at the beginning of pregnancy compared to those with a reduced or middle income (F statistic=4.94; p=0.008)

The quantities of total and animal proteins, total and animal lipids and carbohydrates were higher in mothers with a higher education in different stages of the study. Animal lipids intake was in direct association also with the income of the mother (table 6).

Table 6. Association of the main nutrients quantities with education and income

Nutrient type	Associated factor	Stage	F statistic	p
Total proteins	High education	Late pregnancy	5.3	0.0066
Total proteins	High education	Postpartum	3.5	0.0309
Animal proteins	High education	Postpartum	4.5	0.0121
Total lipids	High education	Late pregnancy	4.4	0.0135
Animal lipids	High education	Postpartum	4.1	0.0171
Animal lipids	Good income	Postpartum	3.0	0.0487
Carbohydrates	High education	Late pregnancy	3.1	0.0453

The quantity of the consumed bread had higher values during pregnancy in women with an elementary education (F statistic=6.53; p=0.0021 in early pregnancy and F statistic=0.0023; p=0.0023 in late pregnancy).

Bread consumption out of meals in women with elementary education in late pregnancy and in women with a low income during the study period was more frequent than in women with a middle or high education or in women with middle or good income respectively (table 7).

As table 8 shows the frequencies of meat intake was higher in women with a high educational level and with good income in all stages of the study.

Table 7. Association of out of meals bread intake with education and income

Associated factor	Stage	$\chi 2$ (DF)	p
Elementary education	Late pregnancy	6.98 (2)	0.0304
Low income	Early pregnancy	6.96 (2)	0.0308
Low income	Late pregnancy	11.80 (2)	0.0027
Low income	Postpartum	7.49 (2)	0.0235

DF: degrees of freedom

Table 8. Association of the meat and meat product intakes with education and income

Associated factor	Stage	$\chi 2$ (DF)	p
High education	Early pregnancy	12.54 (2)	0.0018
High education	Late pregnancy	8.10 (2)	0.0173
High education	Postpartum	18.32 (1)	0.0000
Good income	Early pregnancy	6.32 (2)	0.0424
Good income	Late pregnancy	6.42 (2)	0.0394
Good income	Postpartum	13.84 (2)	0.0009

DF: degrees of freedom

Table 9 shows that dairy product intake has recorded higher frequencies in women with high education at the end of pregnancy and postpartum and in those with good income during the study period.

Women with a high education and a good income consumed more fruits and animal lipids (table 10 and 11) while women with an elementary education and a low incomes consumed more potatoes, vegetal lipids and alcoholic beverages (tables 12, 13 and 14).

Table 9. Association of diary products intake with education and income

Associated factor	Stage	$\chi 2$ (DF)	p
High education	Late pregnancy	14.94 (1)	0.0001
High education	Postpartum	14.79 (1)	0.0001
Good income	Early pregnancy	13.03 (4)	0.0111
Good income	Late pregnancy	12.72 (2)	0.0017
Good income	Postpartum	10.89 (2)	0.0043

DF: degrees of freedom

Table 10. Association of fruits intake with education and income

Associated factor	Stage	$\chi 2$ (DF)	p
High education	Early pregnancy	11.45 (1)	0.0007
High education	Postpartum	11.60 (2)	0.0030
Good income	Early pregnancy	23.61 (2)	0.0000

DF: degrees of freedom

Table 11. Association of animal lipids intake with education and income

Associated factor	Stage	$\chi 2$ (DF)	p
High education	Early pregnancy	8.65 (2)	0.0132
High education	Late pregnancy	9.40 (3)	0.0244
High education	Postpartum	7.89 (3)	0.0482

DF: degrees of freedom

Table 12. Association of potatoes intake with education and income

Associated factor	Stage	$\chi 2$ (DF)	p
Low education	Early pregnancy	8.49 (2)	0.0143
Low education	Late pregnancy	15.35 (1)	0.0000
Reduced income	Early pregnancy	9.43 (2)	0.0089
Reduced income	Late pregnancy	10.32 (2)	0.0057
Reduced income	Postpartum	7.04 (2)	0.0292

DF: degrees of freedom

Table 13. Association of vegetal lipids intake with education and income

Associated factor	Stage	$\chi 2$ (DF)	p
Low education	Early pregnancy	59.49 (2)	0.0000
Low education	Late pregnancy	18.69 (2)	0.0000
Low education	Postpartum	8.43 (2)	0.0147
Reduced income	Late pregnancy	6.79 (2)	0.0336

DF: degrees of freedom

Table 14. Association alcoholic beverages intake with education and income

Associated factor	Stage	$\chi 2$ (DF)	p
Low education	Late pregnancy	4.49 (1)	0.0340
Low education	Postpartum	7.75 (1)	0.0053
Reduced income	Late pregnancy	10.39 (2)	0.0055
Reduced income	Postpartum	8.73 (2)	0.0127

DF: degrees of freedom

The eggs intake was higher in high educated mothers in early pregnancy (χ^2=6.31;p=0.0420). The sweets intake has registered higher frequencies in association with high education in the postpartum (χ^2=8.61; p=0.0349).
Same findings are also reported by other authors. Thus, Rogers and al. have shown that the women with difficulties in affording food had lower intakes of proteins and fruits than did the women with little or no difficulty (6).

CONCLUSIONS

The present study, which aimed to assess the nutrition of pregnant and parturient women in relationship with education and income, found out that:

1. High educational level and good income were associated with high intake of proteins (meat, dairy, eggs), animal lipids, fruits and sweets.
2. Low educational level and low income were associated with high intake of bread, potatoes, vegetal lipids and alcoholic beverages.
3. Some unhealthy eating habits (like low fish consumption, high coffee and sweet consumption) were not related to education and income; this make necessary the improvement of education for health of all pregnant women, and generally of childbearing women concerning the proper nutrition during pregnancy.
4. The information can be used for design programs and expertise to devise and manage individual wellbeing programs.

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