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Nutritional status of Moroccan pregnant women and the birth weight of their newborn: a case-control study in the province of El Jadida

Houda Elfane[1], Sanaa El-Jamal[1], Mohamed Mziwira[1,2], Imane Barakat[1], Mohammed Elayachi[1] and Rekia Belahsen[1,*]

[1] Laboratory of Biotechnology, Biochemistry and Nutrition, Training and Research Unit on Nutrition and Food Sciences, Department of Biology, Faculty of Sciences, Chouaib Doukkali University, El Jadida 24 000, Morocco
[2] Upper Normal School, Hassan II University, Casablanca, Morocco

* **Correspondence:** Email: rbelahsen@yahoo.com, b.rekia@gmail.com.

Abstract: Background: Maternal malnutrition is a global concern whose consequences for newborns are intrauterine growth retardation, fetal hypotrophy and exposure to risks of pathologies in adulthood. **Objective:** The aim of this study was to assess and compare the diet quality and nutritional status of pregnant women at the time of childbirth while assessing their newborn's weight at birth. **Materials and methods:** The study involved 400 parturient, divided into two groups of 200 each, the controls who have just given birth to newborns of normal weight and the cases who have just given birth to babies of low birth weight (LBW). Information on food intakes and dietary habits were collected using questionnaires and anthropometric parameters were measured. **Results:** The mean body mass index (BMI) of the cases was 25.93 ± 2.64 kg/m² vs. 28.25 ± 2.75 kg/m² in the controls. The dietary diversity and variety scores were higher in the controls than in the cases. Indeed means were 6.87 ± 1.30 vs. 8.88 ± 1.35 food groups for the diversity scores and 11.77 ± 1.57 vs. 15.90 ± 2.09 food items for the variety scores in the cases and the controls respectively. The average daily intakes of folates, calcium, iron and zinc were lower than the Recommended Daily Allowances (RDA) for both groups. The daily calcium intake represents only 1/5th of the RDI for the cases and 1/3 for the controls. Average dietary iron intake was insufficient at only 49% of the daily requirement for cases vs. 66.88% for controls while folates accounts for 64.33% of the RDA for the cases. **Conclusion**: Data from this study shows that the diets of women who have given birth to low birth weight infants are poorly diversified, poorly varied, and poor in certain nutrients essential for a successful pregnancy and childbirth.

1. Introduction

During pregnancy, women need sufficient energy and nutritional intakes to compensate for the physiological changes associated with gestation. Diet is an important factor for the successful course of gestation and the growth of the fetus. Malnutrition during gestation can lead to intrauterine growth retardation (IUGR) and/or fetal hypotrophy, and expose children with low birth weight (LBW) to greater risk of diseases in adulthood [1].

According to the World Health Organization (WHO), LBW is defined as any newborn weight strictly less than 2500 grams regardless of the term of pregnancy [2]. According to the literature, maternal under nutrition is the main driver of LBW, reflected in poor nutritional status at conception [3]. An infant's birth weight is indicative of its intrauterine environment and nutrition, but may also be indicative of the mother's health and nutrition status during pregnancy [4].

The transition from the Millennium Development Goals (MDGs) to the Sustainable Development Goals (SDGs) has placed women's health and well-being at the center of the Moroccan agenda. These goals include, among others, the improvement of maternal health byreducing the maternal mortality rate by 75% [5]. It is therefore essential that women have a high quality diet, before conception and during pregnancy, in order to reduce the prevalence of maternal and neonatal morbidity and mortality. A fortiori, a diet contributing to the prevention of LBW, must meet criteria of diversity and balance in terms of quantity, quality, and nutritional content. Dietary diversity remains an essential component for a qualitative measurement of food consumption. It does not evoke a new concept, but its practice remains recent, at least in developing countries [6]. Dietary diversity can be assessed by simple scoresdefined by the number of foods or of food groups, consumed over a period. It is onemethod of approaching the nutritional adequacy of the diet [7].

The objective of this study was therefore to assess and compare the quality diversity of dietary intake between two groups of Moroccan pregnant women at the time of childbirth while evaluating their newborn weight at birth. A semi-quantitative recall method of food consumption based on the food frequency during a usual week before pregnancy was used in order to record the usual consumption and build the food variety and diversity scores. A 24 hour recall was also used to assess the qualitative and quantitative aspects of the diet.

2. Materials and methods

2.1. Ethical considerations

The investigation obtained the approval of the Moroccan Ministry of Health regional directorate. Participation in the survey was subject to a free and informed written consent of the participants and their newborns. After receiving a detailed explanation of the conduct and conditions of the survey, the female respondents were free to refuse or withdraw from the survey at any time.

2.2. Study population and setting

The study took place in the maternity ward of the provincial hospital of El Jadida province of Morocco, over a period from January 1, 2017 to December 31, 2018. This hospital represents a 2 nd level public health structure with a high influx of the rural population.

2.3. Sample

This cross-sectional case-control study included 400 pregnant women who are in labor and who attended the maternity ward for childbirth whatever the gestational age. Sampling is done by reasoned choice and the women were divided into two groups:

(1) A control group of 200 women defined as parturient who have just given birth and who gave birth to newborns of normal weight between 2600 and 4000 g [8].
(2) A group of cases numbering 200 women defined as parturient who have just given birth tolow-weight newborns below 2500 g [1].

All pregnant women childbearing age that gave birth to live newborns were included in this study. Twin and multiple pregnancies, stillbirths and fetal deaths in utero were excluded from the study.

2.4. Information collected

Information was collected by means of an established questionnaire, which collected information on socio-demographic and economic factors, namely: age, origin, level of education, profession, family type and the level of monthly income.

Dietary data are collected by the 24-hour dietary recall technique to list all foods ingested and the macronutrient and micronutrient intake of parturient was determined using the BILNUT software. This 24-hour dietary recall was performed one day before childbirth so that it is a usual day for pregnant women and to avoid warning signs of childbirth such as nausea and vomiting which may influence the results. Each pregnant woman is asked to describe precisely everything she has consumed (drunk and eaten) during the previous 24 hours, from rising the night before until the same time on the day of the survey. The respondent is also asked to quantify the foods described, with her own measures (household measures). The nutrient content of the standard portions is obtained from the Food Table computerized BILNUT. The values obtained were then compared with the nutritional intakes of reference [9]. A semi-quantitative food frequency questionnaire (FFQ) was also completed in the participants to this study to transcribe their food consumption habits. The dietary diversity score was assessed by counting the number of food groups that were the source of food items consumed by each woman in a typical week before pregnancy. The food frequency was used for more precision in the calculation of the dietary diversity scores. this food frequency is made up of two parts: one closed list of foods and a section where consumption frequencies can be indicated (for example, several times a day, 3 to 4 times a week, 1 to 2 times a week, 1 to 2 times a month ...) and a section with more detailed questions about the size the portion consumed and its composition, or the method of preparation of the dishes (frying, cooking or in the oven…).

2.4.1. Dietary diversity score (DDS)

Before calculating DDS, the food groups are defined considering the eating habits and practices of the study population. In the present study the following 12 food groups: cereals, vegetables, legumes, fruits, fish, sugar and derivatives, meat and derivatives, eggs, milk/dairy products, oleaginous products, condiments and sugary drinks are used to get as close as possible to the food composition table for use in Africa proposed by the Food and Agriculture Organization (FAO) [10].

The DDS is then calculated by simply counting the food groups to which belonged the foods items a woman consumed in a typical week before childbirth [11]. The number of food groups consumed reflects the degree of diversity in the food intake.

2.4.2. Food variety score (FVS)

The Food Variety score (FVS) is defined by the number of different foods consumed over a given period of time: a cumulative variety score represents the number of foods consumed in one or more days. The occurrences of consumption as well as the quantities ingested are not taken into account. The FVS estimates the number of foods/products consumed (with a consumption threshold of at least 0.1 g) by a household or a person during the last 24, 48 hours or 3 days [12,13]. In other words, the consumption of a mixture of foods belonging to different groups (cereals, fruits, dairy products, etc.) and of a mixture within each group: bread, rice, couscous, etc. for the cereals group, for example [14]. This is the number of different foods consumed by the person (identified from a list of 242 items in our study).

Both DDS and FVS scores correctly reflect the quality of the diet in terms of micronutrient coverage [15].

2.5. Anthropometric data

Anthropometric measurements were performed following procedures recommended by the WHO. Pregnant women were weighed before delivery on electronic scales with an accuracy of 100 grams. The height was measured to the nearest millimeter using a wall chart.

Body mass index (BMI) was obtained by dividing an individual's weight in kilograms by the square of their height in meters. A BMI value strictly less than 18.5 kilograms (kg)/square meter (m²) represents under weight, normal weight is 18.5 to <25 kg/m², overweight 25 to <30 kg/m² and obese for a BMI greater or equal than 30 kg/m² [16].

2.6. Statistical analyzes

Statistical analysis of data was performed using Statistical Package for the Social Sciences (SPSS) software version 23.0 for Windows. Analysis of variance (ANOVA) was used for the comparison of several means tested against each other using Tukey's test. Thus, the analyzed results are expressed as unadjusted means ± Standard Deviation or as adjusted means ± Standard error. Student's test was used for independent samples.

3. Results

Table 1 presents the socio-demographic and anthropometric characteristics of the study population. The age of the sample of women studied is on average 25.95 ± 3.79. The distribution by age group shows a similarity in the distribution of cases and controls with a predominance of the age group ≥20; 30≥ representing respective rates of 61% for cases and; 67% for the controls of. Depending on the area of residence, the majority of participants in the control group (84%) and the case group (77.5%) come from rural areas. In addition, almost half of the controls (48%) and the majority of cases (61%) are illiterate. The data also show that the highest levels of education affect only 6% of female controls against 1.5% of cases. The analysis also revealed a high proportion of 60.5% of the parturient controls and 50% of the cases living in extended families and almost all of the controls (92.5%) and cases (86%) are professionally inactive. Otherwise, the anthropometric parameters show that, the control women surveyed had on average a height of approximately 1.63 ± 0.05 m, a weight of 75.25 ± 8.40 kg and a build estimated by the body mass index rather satisfactory (mean BMI = 28.25 ± 2.75kg/m²) with high prevalence of overweight (48.5%) and obesity (44%). The estimation of these parameters in the cases shows that on average the height was 1.60 ± 0.04 m, the weight was 67.26 ± 8.06 kg and the mean BMI of the cases was 25.93 ± 2.64 kg/m². According to the BMI of this latter group of parturient, 35.5% were described as "normal", 57% overweight and only 7% of cases were obese.

Table 2 shows that overall the pregnant women studied had on average nutritional intakes that exceeded the recommended daily values [17] for energy, protein, vitamin C, vitamin E, magnesium and phosphorus in both cases and controls. These average contributions of cases and controls are respectively 2756 Kcal vs. 2915 Kcal for energy; 90.30 mg/d vs. 101.40 mg/d for proteins; 96 mg/d vs. 112 mg/d for vitamin C; 18.84 mg/d vs. 21.22 mg/d for vitamin E; 490 mg/d vs. 521.3 mg/d for magnesium and 1545.16 mg/d vs. 1721.02 mg/d for phosphorus intake. However, insufficient intakes are recorded in calcium and iron which are lower than the recommended daily intakes which do not exceed 28% for calcium and 58% for iron in the total population. Likewise, insufficient coverage of daily intake of zinc, vitamin B1 and folates and below recommendations was recorded in both cases and controls. These intakes were 9.11 mg/d vs. 10.65 mg/d for zinc; 1.02 mg/day vs. 1.45 mg/day for vitamin B1 and 386 μg/day vs. 428 μg/day for folates for cases and controls respectively.

Table 1. Socio-demographic and anthropometric characteristics of parturient (Cases vs. controls).

		Cases				Controls			
Socio-demographic characteristics		n = 200	%	Average	Standard deviation	n = 200	%	Average	Standard deviation
				26.09	5.58			25.81	5.57
Age	<20	34	17			22	11		
	≥ 20; 30≥	122	61			134	67		
	>30	44	22			44	22		
Origin	Urban	45	22.5			32	16		
	Rural	155	77.5			168	84		
Study level	Illiterate	122	61			97	48.5		
	Primary	47	23.5			55	27.5		
	Middle School	28	14			36	18		
	High school	3	1.5			12	6		
Profession	Without	172	86			185	92.5		
	Worker	25	12.5			15	7.5		
	Employee	3	1.5			0	0		
Family type	Nuclear	102	51			121	60.5		
	Enlarged	98	49			79	39.5		
Monthly income level	Low	145	72.5			111	55.5		
	Middle	49	24.5			73	19.5		
	High	6	3			16	8		

	Cases				Controls		
Anthropometric characteristics							
BMI			25.93	2.64		28.25	2.75
<18.5 Kg/m² (Underweight)	1	0.5			-	-	
≥18.5; <25 Kg/m² (Normal weight)	71	35.5			15	7.5	
≥25; <30 Kg/m² (Overweight)	114	57			97	48.5	
≥ to 30 Kg/m² (Obesity)	14	7			88	44	
Weight			67.26	8.06		75.25	8.40
Height			1.60	0.04		1.63	0.05

Table 2. Daily energy and nutritional intake of cases, controls and the total population compared to the recommended daily allowances (RDA).

Energy and nutrient	RDA[§]	Average Cases	Standard deviation	% RDA of cases	SD	Average controls	SD	% RDA of cookies	SD	Average of Total Female Population	SD	% RDA of total female population	SD
Energy (Kcal)	2500	2756	914.2	110.2	36.5	2915	927	116.6	37	2835	929.6	113.4	37.18
Protein (mg)	60	90.30	49.4	150.5	82.3	101.40	52.6	169	87.6	95.85	51	159.75	85
Vitamin B1 (mg)	1.4	1.02	0.6	72.85	42.8	1.45	0.9	103.57	64.2	1.23	0.75	87.85	53.5
Vitamin C (mg)	80–85*	96	84.8	112.94	100	112	102.5	131.76	120.5	104	93.65	122.35	110.1
Vitamin E (mg)	15	18.84	14.8	125.6	98.6	21.22	17.8	141.46	118.6	20.03	16.3	133.53	60.3
Calcium (mg)	2500	538	288.4	21.52	11.5	841	449	33.64	17.9	689.5	368.7	27.58	14.74
Iron (mg)	27	13.32	7.7	49.33	21.5	18.06	8.5	66.88	31.4	15.69	8.1	58.11	30
Magnesium (mg)	400–350*	490	246.6	140	70.4	521.3	275.7	148.94	78.7	505.6	261	144.45	74.5
Phosphorus (mg)	1250–700*	1545.16	731.8	220.73	104.5	1721.02	861.2	245.86	123	1633.09	796.5	233.29	113.7
Zinc (mg)	13–11*	9.11	6.5	82.81	59	10.65	7	96.81	63.6	9.88	6.7	89.81	60.9
Folates (µg)	600	386	175.9	64.33	29.31	428	186.6	71.33	31.1	407	181.2	67.83	30.2

*Indicates levels used by pregnant women ≤18 years old and >18 years old. SD: standard deviation. [§]https://ods.od.nih.gov/HealthInformation/Dietary_Reference_Intakes.aspx

Table 3. Mean dietary diversity and food variety scores according to socio-demographic characteristics and BMI of the cases and the controls.

Characteristics		N case	Mean DDS case	Standard deviation	P	Mean FVS 11.77	Standard deviation	P	N controls	Mean DDS 8.88	Standard deviation	P	Mean FVS 15.90	Standard deviation	P
			6.87	1.30			1.57				1.35			2.09	
Age	<20	34	7.14	0.95	0.154	11.64	1.59	0.800	22	8.90	1.10	0.992	15.72	2.25	0.111
	≥20; 30≥	122	6.72	1.33		11.82	1.57		134	8.88	1.34		16.11	2.10	
	>30	44	7.04	1.41		11.70	1.56		44	8.86	1.50		15.36	1.94	
Origin	Urban	45	6.75	1.31	0.864	11.15	1.22	0.062	32	8.93	1.47	0.200	15.90	1.92	0.994
	Rural	155	6.90	1.30		11.94	1.61		168	8.86	1.33		15.90	2.31	
Education level	Illiterate	122	6.95	1.33	0.993	11.74	1.58	0.411	97	9	1.25	0.024	16.10	2.17	0.309
	Primary	47	6.95	1.33		11.82	1.49		55	8.85	1.33		15.58	1.97	
	Middle School	28	7.07	0.94		11.92	1.69		36	8.36	1.58		15.66	2.15	
	High school	3	7	1		10.33	0.57		12	9.58	1.08		16.50	1.73	
Profession	Without	172	6.87	1.34	0.948	11.83	1.61	0.354	185	8.82	1.34	0.032	15.89	2.13	0.757
	Worker	25	6.80	1		11.44	1.15		15	9.60	1.35		16.06	1.66	
	Employee	3	7	1.73		11	2		-						
Family type	Nuclear	102	6.92	1.36	0.853	11.67	1.48	0.207	121	8.80	1.38	0.650	15.66	1.94	0.159
	Extended	98	6.81	1.24		11.86	1.65		79	9	1.30		16.26	27	
Monthly income level	Low	145	6.86	1.27	0.538	11.70	1.61	0.035	111	8.91	1.22	0.894	16	2.10	0.759
	Middle	49	6.95	1.41		12.12	1.42		73	8.82	1.45		15.80	2.01	
	High	6	6.33	1.21		10.50	0.83		16	8.87	1.78		15.68	2.46	
BMI	<18.5 (Underweight)	1	8	-	0.048	12	-	0.868	-	-	-	0.154	-	-	0.301
	≥18.5; <25 (Normal weight)	71	7.15	1.14		11.80	1.48		15	9.33	1.34		16	2.26	
	≥25; <30 (overweight)	114	6.75	1.37		11.78	1.64		97	8.71	1.39		16.12	2.24	
	≥ to 30 Obese	14	6.28	1.20		11.42	1.50		88	8.98	1.29		15.64	1.88	

Student test used for independent samples and the One-Way Anova Test. DDS: Dietary diversity score; FVS: Food variety score; BMI: Body mass index. $P < 0.05$.

The socio-demographic characteristics and BMI of the cases and controls according to the means of the dietary variety and diversity scores are presented in Table 3. The data in the table clearly show that the mean of the dietary diversity and variety scores of the controls exceeded that of the cases. In fact, the means of the diversity scores were 6.87 ± 1.30 for the cases and 8.88 ± 1.35 food groups for the controls. Likewise, the food variety scores were 11.77 ± 1.57 food items for the cases, lower than those found in the controls (15.90 ± 2.09). On the other hand, the level of education and the level of income of control women were clearly associated with the dietary diversity score. However, in the case group, a significant association was found between family type and food variety score.
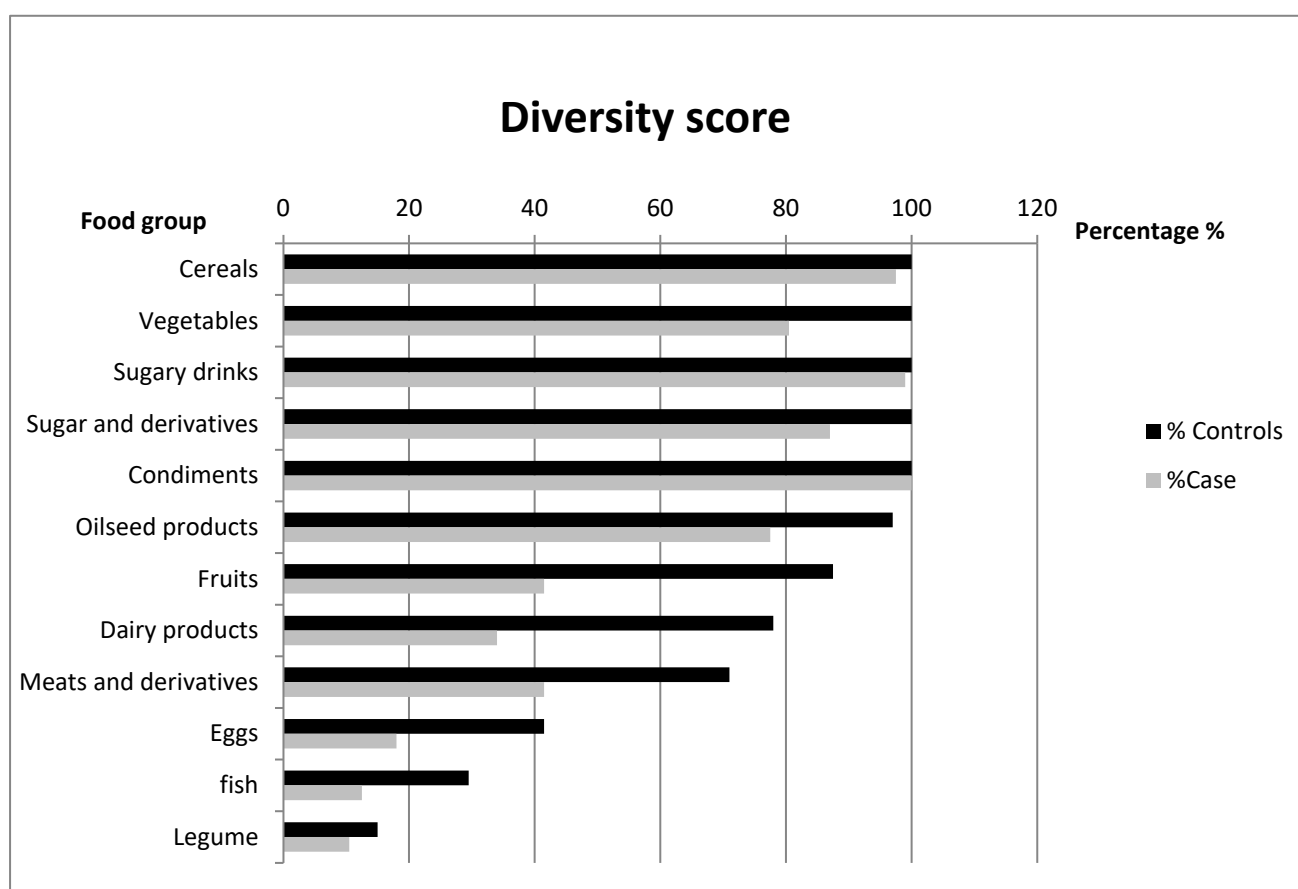
Figure 1. Dietary diversity score of cases and controls.

As presented in Figure 1, the dietary diversity estimated by the consumption of the different food groups was greater in the controls compared to the cases. The grain products, vegetables, sugary drinks, condiments and sweets food groups were consumed by all controls group. For the cases group, a high consumption of cereals and sugary drinks was recorded while the vegetables were consumed less (80.5%) than in the controls (100%). The analysis also showed a large difference in consumption for the rest of the food groups in the two groups of pregnant women with the proportions of consumption of the food groups of fruits (41.5%; 87.5%), dairy products (34%; 78%), meat and derivatives (41.5%; 71%), eggs (18%; 41.5%) and fish (12.5%; 29.5).
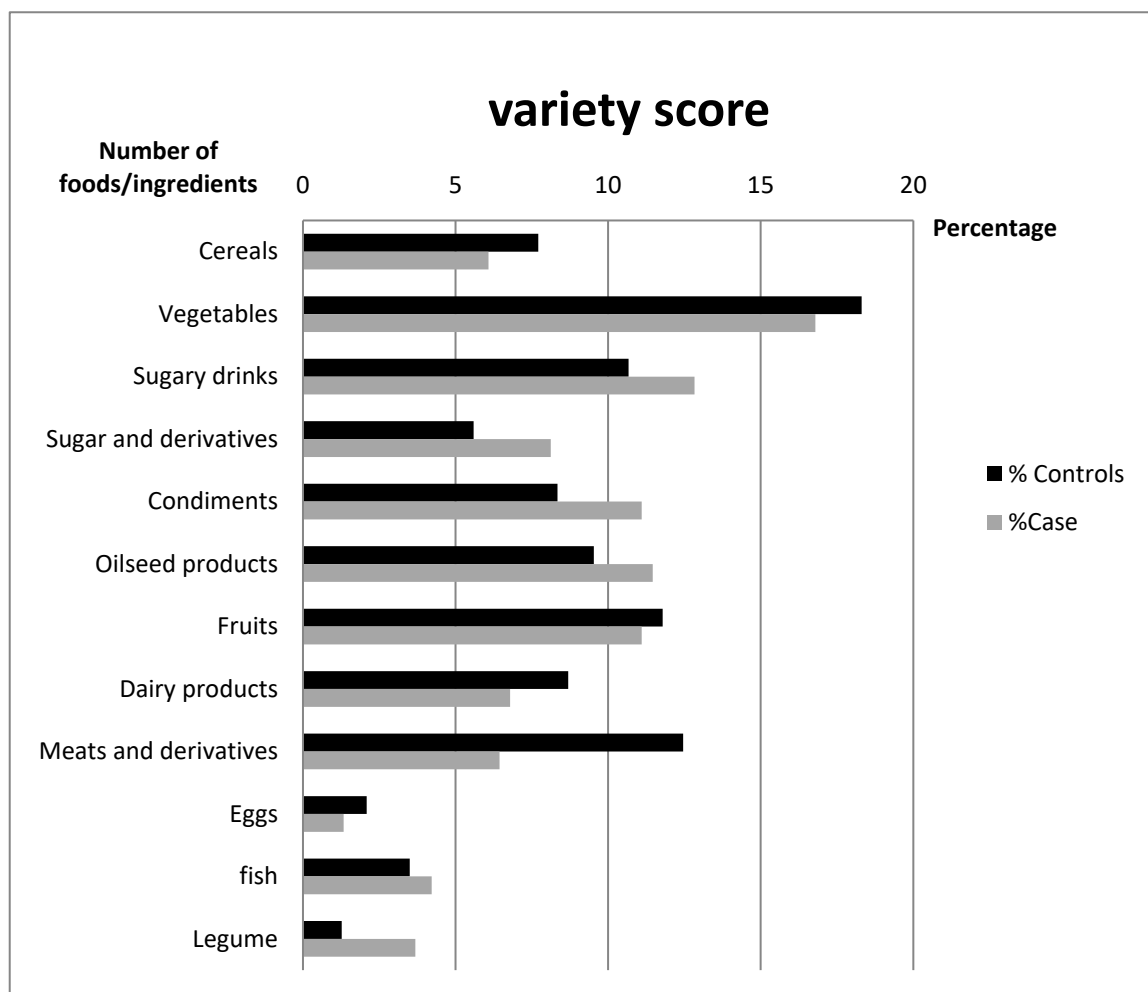
Figure 2. Food variety score of cases and controls.

Figure 2 shows that the variety scores of controls and cases are distributed very unevenly within the sample. The results on the food variety of the controls group show an abundance of varied food items in the vegetables, meats and derivatives, fruits, cereals, sugary drinks and dairy products food groups with a moderate consumption of vegetables and eggs. For the cases group, the food variety scores of these food groups are less consumed compared to the controls except for the fish and legumes.

4. Discussion

The Moroccan diet which is Mediterranean type is based on a large consumption of foods of plant origin (cereals, fruits, vegetables, legumes, nuts, seeds and olives), with olive oil as the main source of added fat, moderate to high consumption of fish and seafood, moderate of eggs, poultry and dairy products (cheese and yogurt) and low of red meat.

The study data report a fairly high dietary diversity in control women compared to cases. Data analysis also made it possible to highlight significant links between the dietary diversity of these controls group women and their level of education and their profession. In fact, school-going women diversified their diet more than those who never attended school. Similar results from the literature

have also shown a better quality diet in educated women [18]. In addition, the food variety score of the controls seems to be influenced by household characteristics. Women living in nuclear families vary more in their diet compared to those living in extendedfamilies [19].

The results show that the most consumed foods among the controls group of pregnant women were cereals, vegetables, sugary drinks and sugar, condiments, oil products, fruits, meats and dairy products that are all frequently consumed. On the other hand, medium to low consumption is found for eggs, fish and legumes. The low consumption of fish observed for the two groups is probably linked to the insufficient purchasing power of households and the high prices charged. On the other hand, the more frequent consumption of sugar is linked to the subsidy of this product by the State.

Nevertheless, the cases group diet appears to be less varied and less diversified. Indeed, the comparison of the averages of the DDS and FVS in the "cases" group of parturient with those obtained in the controls shows that these scores are markedly lower in the cases compared to the controls. The dietary diversity score of the cases appears to be influenced by the body mass index of women [20]. Similarly, the data analysis also demonstrates a statistically significant link between this score and the body size of the cases in the present study. Indeed, the consumption of cereals and sugary drinks that contribute to energy intake was similar in the two groups of cases and controls while the other food groups remained relatively less consumed by the cases. This diet poor in fruits and vegetables, meat and dairy products, associated with an appetite for sweetness and fat could justify the high prevalence of overweight recorded in the cases (57%), while most nutrient requirements are not met. This result is in agreement with the literature confirming that a good quality diet is correlated with a normal full-weight status [21,22].

The results of the variety score reported in this study reveal that the diet of the cases is with less food variety compared to that of the controls. Nevertheless, this variety score of the cases women group diet consists mainly in excessive consumption of sugary drinks, sugar and condiments to the detriment of foods that are essential for a good diet for pregnant women testifying of an unhealthy diet in this group. The consumption pattern in this population of pregnant women surveyed can be explained by several factors. On the one hand, the high price of certain foods such as red meats and fruits making them less accessible, especially as 72.5% of the cases group is of low socio-economic level. Several literature findings have also demonstrated the effect of socioeconomic status on the quality of food [23–25]. These food categories not only diversify the diet but also contribute to improving nutritional status. In fact, meats are a source of highly bioavailable iron and proteins that stimulate the absorption of non-heme iron [26]. It is the same for fruits known to provide a large number ofvitamins and minerals essential for the good progress of pregnancy.

In addition to the economic aspect, eating habits are also a factor influencing the consumption profile. This is the case of cereals as their consumption remains important for both groups of parturient due to Moroccan dietary customs consisting in consuming bread accompanying allthe traditional dishes or with tea [27].

To ensure the health of the mother and the fetus, pregnancy requires an increase in daily energy intake, which must cover the needs of fetal tissue synthesis and to compensate for the energy expenditure caused by the increase in the mother's weight [28]. A deficiency in energy intake can affect fetal growth below 1600 Kcal/day. However, our study found that the average daily energy intake of the parturient studied can provide information on a risk of weight excess given its intake higher than the recommended values (110% of the RDA of the cases vs. 116% of the RDA of the

controls). This intake is however in the upper range of the recommendations not to be exceeded indicating an adequate caloric intake, both in cases and in controls.

Similar results were previously reported by Belgnaoui and Belahsen on pregnant women in the same study province [29] whose energy intake was high and exceeded the energy needs estimated by FAO [30].

Micronutrient requirements are also higher during pregnancy. Micronutrient deficiencies are a key determinant of FPN. Newborns exposed to FPN are two to three times more vulnerable to neonatal and infant mortality [31]. In addition to the risks for their immediate survival, FPN predisposes the unborn child to deficits, reduced physical capacity, increased risk of lifelong illness and even chronic diseases linked to nutrition [32]. Other nutrients are also supplied in excess showing that the diet of the parturient population studied provides these nutrients insufficient quantity. These are proteins, vitamin C, vitamin B1, vitamin E, magnesium and phosphorus whose intake exceeds the recommendations in cases and controls except for vitamin B1 which only covered 72.85 % of RDI in the cases women.

In the opposite, the average daily intakes of other nutrients such as folates, calcium, iron and zinc were lower than the recommendations. Indeed, the daily intake of calcium represented only 1/5 th of the RDI for the cases and 1/3 for the controls. Iron only covers almost half (49%) of the daily requirement for the cases vs. 66.88% for controls while folates account for 64.33% of the RDA of cases. These nutrients are insufficiently provided by the diet despite the great dietary diversity of parturient as evidenced by the DDS. Indeed, even with an average consumption of 8 food groups (DDS) for the controls, these pregnant women did not reach the ideal value of calcium, iron and folates intakes. High dietary calcium deficiency could expose pregnant women at risks of decalcification or pregnancy complications such ashypertensive disorders [33]. These insufficient calcium intakes have been reported in other populations of pregnant women who, like the present study population, consume little dairyproducts [34]. Insufficient iron intake can expose the mother at a risk of developing iron deficiency anemia, responsible for asthenia, maternal and fetal tachycardia, dyspnea and pallor. In addition, the consumption of sweet tea, which belongs to the group of sugary drinks because of its content in sugar, remains very high in this population. The majority of parturient (86% of cases vs. 81% of controls) consumed indeed, an average of 3 glasses per day for the cases and 2 glasses per day of tea for the controls. This excessive consumption of sweet tea, in addition to providing excess energy, is also a source of inhibitors of iron absorption in these women constituting a major risk factor for developing anemia. This consumption level is somewhat similar to a previous study in the same region reporting thatpregnant women do not actually decrease their tea consumption during pregnancy [29].

5. Conclusion

The data from the present study show that the cases diets can be characterized as with low dietary diversity and variety compared to that of the pregnant control women. In general, the study reveals that the diet of the women in the study sample did not cover adequately their nutrient needs. The results of the present survey showed that the diet of women who gave birth to low birth weight newborns was poorly diversified and less varied and that it is especially poor in certain nutrients essential for the good progress of pregnancy and childbirth.

6. Strengths and limitations section

An important limitation of this study is related to the BMI of parturient. The participants' weight was weighed just before childbirth and the preconception BMI of these women could not be predicted. This study was also carried out on a specific sample from the Doukkala region. The results of this study provide for the first time a description of the quality of the diet of Moroccan pregnant women taking into account the seasonal variation in food consumption since the questionnaire concerned food consumption in a typical week.

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Conflict of interest

The authors declare that they have no links of interest.

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