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RESEARCH ARTICLE

DETERMINANTS ELEMENTS OF ANEMIA IN PREGNANT WOMEN CONSULTING IN HEALTH CARE STRUCTURE OF CASABLANCA AND SAFI

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Abstract

Objective: A multicentric cross sectional study conducted in 2021, and carried out in provincial hospital Mensour Bernoussi, provincial hospital Sidi Othman in the region of Casablanca settat and provincial hospital Mohammed V health center Saada and health center Jamaat Shaim in the region of marrakech safi . the first objective is to determine the key elements impacting the anemia ,the second , consist to see the role of the diversity food and the third one , the impact of iron supplementation on anemic and non anemic women.

Methodology: All pregnant women (503) attending to the 5 heath structure in the region Casablanca-Settat and Marrakech-Safi and have CBC result . a anonymous questionnary was conducted including CBC result , socio demographic data , (antenatal care) ANC follow up , iron supplementation , common signs and symptoms of anemia , complication during pregnancy and a total recall and modified MDDW and frequency at food consumption of 1 month . the data was analyzed using the Jamovi database .

Result: The mean and standard deviation age of participant was for the non anemic pregnant women 28.9+/- 6.21 years versus for the anemic pregnant women 26.6 +/- 6.26 years .The age range of the population was 33 years from 15 years to 48 years old . most anemic pregnant had a hypochromic 74.3% microcytic type of anemia, 92.9% where housewife and lower monthly income compare to the none anemic pregnant women , also the mean gestity and parity of the pregnant women was 2.55+/-1.44 and 2.14+/-1.37 respectively, a 85.9% patient was followed during pregnancy, a higher level of 75.5% of patient was on iron supplementation and there was significative result concerning anemia signs (especially pallor , hair loss and headache). Furthermore, using the longitudinal bivaried and multivaried regression revealed that the anemic pregnant women were respectively less exposed the older they are (reference (15-23 years) 28-32 years (p=0.045; OR=19.380; IC95%[1.01-3.706]) and 33-48 years (p=0.005; OR=27.307; IC95% [1.34-5.527])), the followed up during the pregnancy reduces significative the risk of anemia (reference (yes); no; p=0.005; OR=0.2409; IC95%[0.08839-0.657]), also the consumption of coffee/coffee with milk increased the risk. (Reference (yes); no; p=0.020; OR=17.821; IC95%=[1.10-2.879])

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Introduction:-

The anemia is defined as a decrease of the hematocrit, the hemoglobin or the red blood cell circulating in the body. It can be divided as normocytic, microytic and macrocytic types. The mild iron deficiency is commonly seen in women of childbearing age , and caused by menses and poor dietary intake of food (1). Most of the time, the anemia passes under radar scoop, hence the interest of screening. That's why the CBC is used a reference to track the anemia level according to the world health organization (WHO). It can diagnostic anemic and non-anemic pregnant women. The need of iron and other vitamins like folic acid and vitamin B12 differ greatly between the terms of pregnancy. Nonetheless, the food diversity plays an essential role not only as nutritional supply but also as a determinant factor of dietary iron depletion or supplement. We conducted a study to investigate the determinant factor impacting the pregnant women.

The mean objectives were to determine:

1. The key elements impacting the anemia
2. The role of the food diversity and its influence in anemia
3. The impact of iron supplementation on anemic and non anemic women.

Materiel and Methods:-

A/ Design and study setting

A multicentric cross sectional study was conduct in Morocco in 2021.

Two main regions were concerned. The first region is the region of Settat-Casablanca including the Provincial Hospital Mensour Bernoussi and the Provincial Hospital Sidi Othman. The second region is the region of Marrakesh-Safi, covering the Provincial Hospital Mohammed V, the Health Center Saada and the Health Center Jamaat Shaim.

B/ Study population

The study population was all the pregnant women attending to the 5 heath structures in the region of Casablanca-Settat and the region of Marrakech-Safi.

C/ Operational definition

The anemia threshold was defined using the world health organization (2) (WHO). Using the WHO criteria, pregnant women whose hemoglobin level was 11 g/dl and above at their first antenatal care clinics were selected as non-anemic pregnant women (NAPW) and those with a hemoglobin level less than

11 g/dl were selected as anemic pregnant women (APW). These anemic cases were dispatched in 3 classes: the mild (11-10.9 g/dl) the moderate (9.9-7.0 g/dl) the sever cases < 7.0 g/dl.

The mean corpuscular hemoglobin concentration (CMCH) was categorized as hypochromic if lower than 32 g/dL, nomrochromic if higher than 32g/dL. The mean corpuscular volume (MVG) was divided as microcytic if lower than 80, normocytic if between 80 and 100 fl, macrocytic higher than 100 fl (3).

We separate the gestational age as the first trimester of pregnancy from the first week to 13 weeks, the second trimester from 14 week to 26 week and the third trimester from the 27 week to 40 week (4). Infants delivered before the end of week 36 were considered premature, between 37 and 40 weeks were considered normal, between 40 and 41 weeks were considered a late-term pregnancy. More than 42 weeks, pregnancy were categorized as post term pregnancy(5).

The common complications taken in this study were intrauterine growth restriction (IUGR), preterm delivery, preeclampsia, prelabor rupture of membranes (PROM). While others were called: others complications.

The minimum dietary diversity for women (MDDW) was calculated from 1 month dietary recall data using a survey. The food was divided into 9 specific group: (1) cereal: grains, roots, tubers
(2) pulses (beans, peas, lentils), (3) nuts and seeds, (4) dairy,

(5) meat, poultry and fish, (6) eggs, (7) dark green leafy vegetables, (8) other oils and fats (9) other brewage and food. Each food consumed in any of the food groups was given a score of 1, if not score 0, the higher score was 9. The MDDW is categorized as low if < 5 and high if ≥ 5 (6). A food frequency questionnaire was used and subdivided as food eaten daily, weekly and monthly.

Bivarite logistic regression data included
First of all: socio demographic data: the patient age, family number, residency, study educational level.
Secondly, the Obstetric data: gestity, parity, number of children alive, interval between the last and the current pregnancy.
Thirdly, the follow up of pregnant women: trimestrial clinical and sonography consultation during pregnancy.
Furthermore, patient on iron supplementation during pregnancy: were divided into iron supplementation without folic acid and, iron with folic acid.

Nonetheless, the minimum dietary diversity for women (MDDW) selected food groups and some specific significant one were: white bread, corn flakes, olive oil, tea and infusion, coffee and coffee with milk, meat and fish, dark green leafy vegetables, pulses, eggs consumption and MDDW score.

The food selected was based on food with the higher iron content (7).

The significant P=0.05 was used for the bivaried logistic regression.

The multivariate logistic regression retained using p=0.05 as the significant threshold was: patient age, family number, number of children alive, patient followed, tea and infusion and coffee and coffee with milk consumption.

For both the bivaried and multivarite logistic regression we used the odds ratio (OR) and the confidence interval (CI) at 95%.

Inclusion and exclusion criteria
Inclusion criteria:
- All pregnant women who had a CBC (complete blood count).
- All pregnant women who came to any of the five health care centers (in the post partum time or just for check up).

Exclusion criteria:
- All pregnant women who suffered from anemia before the beginning of the pregnancy.
- All pregnant women who had some chronic intestinal disease.
- Other cause of bleeding aside of obstetric causes

Ethic comity accreditation
This research was done under the accreditation of the ethic comity

The reference number are CERB/UM6SS/08/2021

Data Collection Tool and Procedure
A pre-establish Survey was used trough face to face questioning, It was adapted to our context from the recommendation of the MDDW(6) and previous studies (8),(9).

The survey was written in English first and translated to local language for a better understanding for both the examinators and the patients.

The questionnaire was divided as socio demographic and obstetrics factors, medical history, antenatal, monitoring and check up, martial treatment, clinical sign of anemia, toxic habit, complication during pregnancy, and the minimum diary diversity for women (MDDW) with frequency of each categories of food aforesaid.

Data quality control
A pre test was conducted to discuss about the survey, the questionnaire, and adjustment.

All the examinators were informed and trained about the questionnaire and the confidentiality.

Each patient gave her verbal informed consent after the study's objectives were clearly explained and before subbmiting the questionnaire they were informed that the participation is volontary

Confidentiality and annonymity of the participant were maintained through the study.

Data processing and analysis
Data were checked for completeness and coded, cleaned to Jamovi for analysis. Descriptive statistics such as tables, graphs, and proportions were used to present data.

Result:-

Socio demographic results
In this study, there was 80.9% of pregnant women taken from provincial hospitals

A preeminent number of the NAPW 82.44% and (76.63%) of the APW lived in the urban area

The study education level of study was respectively for the NAPW and APW predominant between the primary 114 (35.73%), 63 (34.23%) and the secondary 124 (38.87%) ,76 (41.30%) level of study. When comparing the NAPW and APW, there were a higher number of pregnant women who had or still attend a college degree respectively at 9.09% and 5.97% and a lesser number of illiterate pregnant women at 16.30% and 18.47% respectively

There was a significant result using khi2 test when comparing the hemoglobin range with the age of patient ($p<0.001$) (15-23 years (NAPW 34% and 22.3% APW), 24-27 years (22.9% and 28.8%) 28-32 years (25.1% and 19.6%) and 33-48 years (29.8% and 16.8%)), the location between the hospital and health care center where was ($p=0.003$).

As shown it can be confounding factor, with the number of people in the house ($p=0.029$) (3 people (20.7% NAPW and 26.6% APW), 4 people (34.2% and 27.3%), 5 people (23.2% and 12.5%)

Also the profession of the patient ($p=0.012$) (housewife (NAPW 94.7% and APW 92.9%) and formal job (5.3% and 3.8%)), and the insurance ($p=0.038$) (no insurance (56.7% NAPW and 70.7% APW), RAMED (19.1% and 14.1%) and CNSS (19.7% and 12.5%)) is a significant result (Table 1).

Obstetric data
Considering the obstetric data, the NAPW had shown the gestity was 2.55 +/- 1.44, the parity was 2.14 +/- 1.37 and the number of children alive was 2.04 +/- 1.32.

The APW had a gestity of 2.26 +/- 1.21, a parity of 1.93 +/- 1.15 and a number of children alive of 1.88 +/- 1.11.

There was a notable data using khi2 with the gestity ($p=0.008$) (first gestation (58.5% APW and 27.7% NAPW) second gestation (57.6% and 42.4%), third gestation (26.6% and 14.7%) and fourth and more (17.6% and 15.2%)) and parity ($p=0.010$) (nullparrous (3.8% NAPW and 6% APW) primiparrous (30.1% and 29.9%), second parity (34.2% and 44.0%), third parity (21.3% and 9.8%), forth and more (10.7% and 10.3%).

Patient medical history
There was no significant result about medical history of the patient.

Socio demographic result, Obstetric data and Patient medical history

HB cross sectionnal study						
Hospital or health care center	**anemic**		**none anemic**		**Total**	
Provincial hospital SIDI OTHMAN	32	17,40%	86	27,00%	118	23%
Provincial hospital BERNOUSSI	46	25,00%	90	28,20%	136	27%

Provincial hospital MOHAMED V	75	40,80%	78	24,50%	153	30%
health care center SAADA	25	13,60%	49	15,40%	74	15%
health care center JMRAA SHAIM	6	3,30%	16	5,00%	22	4%
TOTAL	184	100,00%	319	100,00%	503	100%
Patient Age						
15-23	64	34,80%	71	22,30%	135	27%
24-27	53	28,80%	73	22,90%	126	25%
28-32	36	19,60%	80	25,10%	116	23%
33-48	31	16,80%	95	29,80%	126	25%
Matrimonial status						
Married	179	97,30%	316	99,10%	495	98%
Single	5	2,70%	3	0,90%	8	2%
Recidency						
Urban	141	76,60%	263	82,40%	404	80%
Rural	43	23,40%	56	17,60%	99	20%
Family number						
2	7	3,80%	13	4,10%	20	4%
3	49	26,60%	66	20,70%	115	23%
4	63	34,20%	87	27,30%	150	30%
5	23	12,50%	74	23,20%	97	19%
6+	42	22,80%	79	24,80%	121	24%
Patient work						
Housewife	171	92,90%	302	94,70%	473	94%
Formal	7	3,80%	17	5,30%	24	5%
Informal	1	0,50%	0	0,00%	1	0%
Student	5	2,70%	0	0,00%	5	1%
Husband work						
Unemployed	4	2,20%	9	2,80%	13	3%
Formal	144	78,30%	255	79,90%	399	79%
Informal	31	16,80%	53	16,60%	84	17%
No husband	5	2,70%	2	0,60%	7	1%
Patient education level						
Illiterate	34	18,50%	52	16,30%	86	17%
Primary	63	34,20%	114	35,70%	177	35%
Secondary	76	41,30%	124	38,90%	200	40%
College	11	6,00%	29	9,10%	40	8%
Gestity						
1	51	27,70%	72	22,60%	123	24%
2	78	42,40%	106	33,20%	184	37%
3	27	14,70%	85	26,60%	112	22%
4+	28	15,20%	56	17,60%	84	17%
Parity						
0	11	6,00%	12	3,80%	23	5%
1	55	29,90%	96	30,10%	151	30%

2	81	44,00%	109	34,20%	190	38%
3	18	9,80%	68	21,30%	86	17%
4+	19	10,30%	34	10,70%	53	11%
Miscarriage						
0	157	85,30%	257	80,60%	414	82%
1	22	12,00%	45	14,10%	67	13%
2+	5	2,70%	17	5,30%	22	4%
Number of children alive						
0	10	5,40%	15	4,70%	25	5%
1	62	33,70%	101	31,70%	163	32%
2	77	41,80%	116	36,40%	193	38%
3	18	9,80%	56	17,60%	74	15%
4+	17	9,20%	31	9,70%	48	10%
Interval between the previous and the current pregnancy						
Higher than 2 years	94	51,10%	196	61,40%	290	58%
Lesser than 2 years	41	22,30%	54	16,90%	95	19%
Never	49	26,60%	69	21,60%	118	23%
Duration of the menstrual cycle						
Anormal	0	0,00%	3	0,90%	3	1%
Normal	184	100,00%	316	99,10%	500	99%
Gyneco-obstetric						
Cesarean						
0	139	75,50%	236	74,00%	375	75%
1	21	11,40%	34	10,70%	55	11%
2+	24	13,00%	49	15,40%	73	15%
Abortion						
0	169	91,80%	280	87,80%	449	89%
1	12	6,50%	31	9,70%	43	9%
2+	3	1,60%	8	2,50%	11	2%
Bledding history						
0	177	96,20%	301	94,40%	478	95%
1	7	3,80%	16	5,00%	23	5%
2+	0	0,00%	2	0,60%	2	0%
Other gynocologic history						
Yes	9	4,90%	14	4,40%	23	5%
Surgical history						
Yes	6	3,30%	12	3,80%	18	4%
Medical history						
Commun medical histroy						
Yes	15	8,20%	22	6,90%	37	7%
Other medical history						
Yes	6	3,30%	13	4,10%	19	4%

Follow up during pregnancy

Only 85.86% of the APW were followed during their pregnancy versus 94.35% of the NAPW. Also 49.84% of the NAPW show up 3 times during their pregnancy at least one time by semester versus 68.8% of the APW. The majority of the NAPW 43.26% were followed up using ultrasound 3 times at least one by semester vs 30.97% for the anemic one.

Furthermore, for both the clinical and ultrasound check up the pregnant women came most of the time during their second and third trimester (table 4).

Tableau 1:- Follow up during pregnancy and Iron supplementation taken.

HB cross sectionnal study						
Patient followed during pregnancy	**Anemic**		**none anemic**		**total**	
Yes	158	85,90%	301	94,40%	459	91%
Trimestrial clinical consultation for pregnancy follow-ups						
0	8	4,30%	9	2,80%	17	3%
1	55	29,90%	78	24,50%	133	26%
2	46	25,00%	73	22,90%	119	24%
3	75	40,80%	159	49,80%	234	47%
Trimestrial sonography consultation for pregnancy follow-ups						
0	14	7,60%	26	8,20%	40	8%
1	75	40,80%	99	31,00%	174	35%
2	38	20,70%	56	17,60%	94	19%
3	57	31,00%	138	43,30%	195	39%
Patient on iron supplementation						
YES	139	75,50%	232	72,70%	371	74%
Number of martial treatment taken						
1	141	37,60%	234	73,40%	375	75%
2	33	17,90%	50	15,70%	83	17%
3	1	0,50%	11	3,40%	12	2%
4	0	0,00%	1	0,30%	1	0%
Never	9	4,90%	23	7,20%	32	6%
Number of pills for martial treatment taken						
1	159	86,40%	282	88,40%	441	88%
2	14	7,60%	12	3,80%	26	5%
NA	2	1,10%	3	0,90%	5	1%
Never	9	4,90%	22	6,90%	31	6%
Ferrous sulfate + folic acid						
Yes	112	60,90%	227	71,20%	339	67%
Ferrous sulfate						
Yes	37	20,10%	38	11,90%	75	15%
Polymatose iron hydroxide						
Yes	24	13,00%	46	14,40%	70	14%
Iron oxide + folic acid						
Yes	2	1,10%	5	1,60%	7	1%
Iron protein-insuccinylate						
Yes	2	1,10%	18	5,60%	20	4%

Iron gluconate + folic acid						
Yes	0	0,00%	1	0,30%	1	0%
Iron chelator (dexchloyheniramine)						
Yes	0	0,00%	1	0,30%	1	0%
Folic acid						
Yes	2	1,10%	6	1,90%	8	2%
Folic acid + B12						
Yes	0	0,00%	1	0,30%	1	0%
Iron with out acid folic suplemnatation						
Yes	61	33,20%	89	27,90%	150	30%
Iron with acid folic suplemnatation						
Yes	74	40,20%	95	29,80%	169	34%

Concerning the martial treatment taken, most of the NAPW and APW were on medical supplementation (72.72% versus 75.74%).

The type of martial treatment taken in this study during pregnancy was:

The APW consume more often Ferrous Sulfate + Folic Acid and Ferrous Sulfate than the none anemic one (table 5). Ferrous Sulfate (p=0.018), Fessous Sulfate + Acid Folic (p=0.013) and Iron Protein insuccinylate (p=0.012) using khi2 test was positive

In other word, the number of the NAPW that was put under Iron without folic acid supplementation was 27.89% and iron with folic acid supplementation was 29.78% (table 5) versus the number of the APW who ingest Iron without folic acid supplementation was 33.15% and iron with folic acid supplementation was 40.21% (table 5). Also the iron with acid folic supplementation showed the same positive result using khi 2 test (p=0.017).

Blood results , Sign of anemia and Complication during pregnancy

Most of the NAPW had a normochromic 73.9% and a nomocytic type of anemia at 77.1%. Instead the APW had hypochromic 74.3% and a microcytic type of anemia at 78.6%.

There was a significant result when comparing the NAPW and APW with the latest CBC realized during pregnancy p<0.001 using khi2 test (1 trimester (41.7% non anemic and 64.7% anemic patient), 3 trimester (50.2% and 30.4%)).

The MGV p<0.001 (APW (microcytic 53.8%) NAPW (normocytic 88.7%) And CMCH p<0.001 (nomochromic NAPW 54.3% and APW 88.7%).

Comparing the APW and NAPW with the common sign of anemia, the significant result was pale skin p<0.001, hair loss p=0.012 and headache p=0.031.

There was no remarkable complications during pregnancy using khi2 test.

	HB cross sectionnal study					
Severity of anemia (HB)	**anemic**		**none anemic**		**Total**	
Moderate	79	42,90%	0	0,00%	79	16%
mild	105	57,10%	0	0,00%	105	21%
Normal	0	0,00%	319	100,00%	319	63%
The lastest CBC realised during the pregnancy						
1 trimester	119	64,70%	133	41,70%	252	50%
2 trimester	9	4,90%	26	8,20%	35	7%

3 trimester	56	30,40%	160	50,20%	216	43%
Type anemia (CMCH)						
Hypochromic	84	45,70%	29	9,10%	113	22%
Normochromic	100	54,30%	283	88,70%	383	76%
TOTAL	184	100,00%	312	97,80%	496	99%
Type anemia (MVG)						
Macrocytic	1	0,50%	2	0,60%	3	1%
Microcytic	99	53,80%	27	8,50%	126	25%
Normocytic	84	45,70%	283	88,70%	367	73%
TOTAL	184	100,00%	312	97,80%	496	99%
ABO type blood						
ARH+	38	20,70%	85	26,60%	123	24%
ARH-	11	6,00%	15	4,70%	26	5%
BRH+	16	8,70%	31	9,70%	47	9%
BRH-	4	2,20%	5	1,60%	9	2%
ABRH+	14	7,60%	13	4,10%	27	5%
ABRH-	1	0,50%	2	0,60%	3	1%
ORH+	93	50,50%	155	48,60%	248	49%
ORH-	7	3,80%	13	4,10%	20	4%
TOTAL	184	100,00%	319	100,00%	503	100%
Pale skin						
Yes	100	54,30%	101	31,70%	201	40%
Hair loss						
Yes	88	47,80%	116	36,40%	204	41%
Asthenia						
Yes	91	49,50%	180	56,40%	271	54%
Nail streak						
Yes	25	13,60%	40	12,50%	65	13%
Vertigo						
Yes	93	50,50%	140	43,90%	233	46%
Headache						0%
Yes	77	41,80%	103	32,30%	180	36%
Geophagy						
Yes	14	7,60%	14	4,40%	28	6%
Commun sign of anemia						
Yes	153	83,20%	251	78,70%	404	80%
Commun complication during pregnancy						
Yes	5	2,70%	13	4,10%	18	4%
Uncommun complication during pregnancy						
Yes	16	8,70%	19	6,00%	35	7%
All the complication during pregnancy						
Yes	20	10,90%	32	10,00%	52	10%

H/ Dietary diversity

a/ Minimum dietary diversity for women (MDDW) and Selected food consume during last month of pregnancy

As shown in table 9, most of NAPW and APW had the MDDW score of 9 (59.24% versus 59.23%). All of the pregnant women in this study had high food diversity. The MDDW score for all participants was equal to 5 or above. The mean and standard deviation of the MDDW was 8.41 +/- 0.853.

Table:- Dietary diversity for women (MDDW) and Selected food consumed during last month.

HB cross sectionnal study							
MDDW	**N**	**Anemic**		**none anemic**		**total**	
5	6	1	16,70%	5	45,50%	6	1%
6	12	4	40,00%	8	40,00%	12	2%
7	50	26	78,80%	24	32,40%	50	10%
8	137	44	84,60%	93	40,40%	137	27%
9	298	109	92,40%	189	38,80%	298	59%
White bred							
Yes		149	34,70%	280	65,30%	429	85%
Corn flakes							
Yes		33	47,10%	37	52,90%	70	14%
Olive oil							
Yes		155	34,80%	290	65,20%	445	88%
Tea and infusion							
Yes		144	33,60%	284	66,40%	428	85%
Coffee/Coffee with milk							
Yes		116	41,70%	162	58,30%	278	55%

As expressed in table 10, there was an important number of NAPW versus APW that consumed some notable type of food that shown noteworthy result, using Khi2 test, which included: white bread 65.3% vs 34.7% (p=0.038), corn flakes 52.9% vs 47.1% (p=0.048), olive oil 65.3% vs 34.8% (p=0.024), tea and infusion 66.4% vs 33.6%(p=0.001) and coffee/coffee with milk 58.3% vs 41.7% (p=0.008).

The lower number of APW that consumed coffee and tea infusion can be explained by the patient that was put on iron supplementation and had received advices about food consumption during pregnancy.

Frequency food eaten by group and frequency

	Total	**Anemic pregnant women**				**None anemic pregnant women**				**P value**
		Daily	**Weekly**	**Monthly**	**Never**	**Daily**	**Weekly**	**Monthly**	**Never**	
		%	%	%	%	%	%	%	%	
Cereal	503	**97%**	3%	0%	0%	**99%**	1%	0%	0%	0.233
Dark green leafy vegetable	503	20%	**64%**	9%	7%	19%	**69%**	6%	6%	0.389
Meat, poultry and fish	503	**58%**	40%	2%	1%	**33%**	23%	1%	0%	0.126
Pulse	503	9%	**75%**	8%	8%	7%	**76%**	11%	6%	0.554
Dairy	503	**51%**	31%	4%	14%	**47%**	33%	4%	16%	0.869
Eggs	503	23%	**52%**	10%	15%	23%	**55%**	5%	18%	0.145
Oils and fats	503	**93%**	6%	0%	1%	**97%**	3%	0%	0%	0.090
Nuts and seed	503	**50%**	43%	3%	4%	**52%**	39%	5%	4%	0.765
Beverages	503	**74%**	11%	3%	11%	**83%**	9%	1%	7%	0.082
White bred	503	19%	**72%**	7%	2%	12%	**84%**	3%	1%	**0.011**

Tea and infusion	503	22%	**66%**	10%	2%	11%	**78%**	10%	1%	**0.008**
Coffee	503	**37%**	22%	32%	9%	**49%**	22%	22%	6%	**0.026**

Using khi2 test, noteworthy statistics were found especially when contesting it with frequency eaten of white bred (p=0.011) (APW (daily 19%, weekly 72%, monthly 10% and never 2%) NAPW (daily 12%, weekly 84%, monthly 3% and never 1%), tea and infusion (p=0.008) (APW (daily 22%, weekly 66%, monthly 10% and never 2%) NAPW (daily 11%, weekly 78%, monthly 10% and never 1%) and coffee/coffee with milk (p=0.026) (APW(daily 37%, weekly 22%, monthly 32% and never 9%) NAPW (daily 49%, weekly 22%, monthly 22% and never 6%) shown, was considerable (table 12).

Regression result

The bivaried logistic regression shown significant result as the APW as reference basis .Which was: the patiente age (reference (15-23 years) 28-32 years (p=0.009; OR=2.00; IC95%[1.193-3.36]) and 33-48 years (p<0.001; OR=2.76; IC95% [1.630-4.68])), the family number (reference (≥5); 2 to 5; p=0.005; OR=0.580; IC95% [0.397-0.848]), the gestity (reference (1); 3; p=0.005; OR=2.230; IC95% [1.271-3.91]), the parity (reference (0); 3; p=0.012; OR=3.46; IC95% [1.314-9.13]), patient followed (reference (yes); no; p=0.002; OR=0.363; IC95%[0.193-0.683]), the trimestrial sonograpgy consultation during pregnancy patient (reference (3); p=0.006; OR=0.545; IC95%=[0.355-0.838]), iron with folic acid supplementation taken (reference (yes); no; p=0.017; OR=1.59; IC95%=[1.085-2.32]), the white bread consumption (reference (yes); no; p=0.040; OR=0.593; IC95%=[0.360-0.975]), the corn flakes consumption (reference (yes); no; p=0.050; OR=1.67; IC95%=[1.001-2.77]), the olive oil consumption (reference (yes); no; p=0.028; OR=0.534; IC95%=[0.308-0.927]), the tea and infusion consumption (reference (yes); no; p=0.001; OR=0.444; IC95%=[0.270-0.729]), the coffee/coffee with milk consumption (reference (yes); no; p=0.008; OR=1.65; IC95%=[1.14-2.40]), the MDDW score (reference (9); 7; p=0.040; OR=0.532; IC95%=[0.291-0.973]).

Instead, the multivaried logistic regression reveled positive data as the APW as reference basis. Which included: the patient age (reference (15-23 years) 28-32 years (p=0.045; OR=19.380; IC95% [1.01-3.706]) and 33-48 years (p=0.005; OR=27.307; IC95% [1.34-5.527])), the family number (reference (≥5); 2 to 5; p=0.045; OR=0.5702; IC95% [0.327-0.992]), the number of children alive (reference (0); 3+; p=0.020; OR=0.0524; IC95% [0.00436-0.630]), the patient followed (reference (yes); no; p=0.005; OR=0.2409; IC95% [0.08839-0.657]), the tea and infusion consumption (reference (yes); no; p=0.003; OR=0.380; IC95%=[0.200-0.722]), the coffee/coffee with milk consumption (reference (yes); no; p=0.020; OR=17.821; IC95%=[1.10-2.879]).

Table 13:- Logistic binominal bivaried and multivariate regression.

					Liniar binominal univariate				**Liniar binominal multivariate**			
	Anemic		**Non-**		**P**	**Odds ratio**	**95% confidence**		**P**	**Odds ratio**	**95% confidence**	
Predict	**N**	**%**	**N**	**%**			**Lower**	**Upper**			**Lower**	**Upper**
Total	**18**	**100**	**31**	**100**								
Patient age												
15-23	64	34,8	71	22,3		1				1		
24-27	53	28,8	73	22,9	0.386	1.24	0.761	2.02	0.63	11.543	0.6349	2.099
28-32	36	19,6	80	25,1	**0.009**	2.00	1.193	3.36	**0.04**	19.380	1.01	3.706
33-48	31	16,8	95	29,8	**<.00**	2.76	1.630	4.68	**0.00**	27.307	1.34	5.527
Family number												
≤ 2	7	3,8%	13	4,1%	0.630	0.789	0.301	2.068	0.31	19.818	0.5183	7.577
2 to 5	65	35,3	15	48,0	**0.005**	0.580	0.397	0.848	**0.04**	0.5702	0.3279	0.992
≥5	11	60,9	15	48,0		1				1		
Residency												
Urbain	14	76,6	26	82,4		1				1		
Rural	43	23,4	56	17,6	0.115	0.698	0.447	1.09	0.63	11.562	0.6301	2.121
Study level												
Illiterate	34	18,5	52	16,3		1				1		

Primary	63	34,2	11	35,7	0.534	1.18	0.696	2.01	0.98	0.9927	0.5169	1.906
Seconda	76	41,3	12	38,9	0.807	1.07	0.635	1.79	0.87	10.566	0.5468	2.041
College	11	6,0%	29	9,1%	0.192	1.72	0.761	3.90	0.83	11.152	0.4109	3.027
Gestity												
1	51	27,7	72	22,6		1				1		
2	78	42,4	10	33,2	0.872	0.963	0.606	1.53	0.22	24.825	0.5694	10.822
3	27	14,7	85	26,6	**0.005**	2.230	1.271	3.91	0.07	47.412	0.8823	25.477
4+	28	15,2	56	17,6	0.238	1.417	0.795	2.53	0.32	24.861	0.4070	15.185

(Continued					**Liniar binominal univariate**				**Liniar binominal multivariate**			
	Anemic		**Non-**		**P**	**Odds ratio**	**95% confidence**		**P**	**Odds ratio**	**95% confidence**	
Predictor	**N**	**%**	**N**	**%**			**Lower**	**Upper**			**Lower**	**Upper**
Total (n)	**18**	**100**	**31**	**100**								
Parity												
0	11	6,0%	12	3,8%		1				1		
1	55	29,9	96	30,1	0.85	1.09	0.459	2.57	0.08	62.854	0.7959	49.633
2	81	44,0	10	34,2	0.99	1.00	0.429	2.35	0.34	28.248	0.3233	24.681
3	18	9,8%	68	21,3	0.26	1.66	0.680	4.04	0.09	90.464	0.6683	122.448
4+	19	10,3	34	10,7	0.32	1.64	0.608	4.42	0.15	70.880	0.4658	107.849
Number of children alive												
0	10	5,4%	15	4,7%		1				1		
1	62	33,7	10	31,7	0.85	1.09	0.459	2.57	0.21	0.3027	0.0450	2.036
2	77	41,8	11	36,4	0.99	1.00	0.429	2.35	0.14	0.2065	0.0249	1.708
3+	18	9,8%	56	17,6	0.13	2.07	0.794	5.42	**0.02**	0.0524	0.0043	0.630
Intervel between the last and the current pregnancy												
Inf	41	22,3	54	16,9		1				1		
Sup	94	51,1	19	61,4	0.05	0.632	0.393	1.02	0.15	0.6651	0.3795	1.166
Never	49	26,6	69	21,6	0.08	0.675	0.434	1.05	0.79	0.8411	0.2244	3.152
Patient followed:												
Yes	15	85,9	30	94,4		1				1		
No	26	14,1	18	5,6%	**0.00**	0.363	0.193	0.683	**0.00**	0.2409	0.0883	0.657
Trimestrial clinical consultation during pregnancy												
0	8	4,3%	9	2,8%	0.21	0.531	0.197	1.43	0.58	17.437	0.2382	12.759
1	55	29,9	78	24,5	0.07	0.669	0.430	1.04	0.54	13.417	0.5224	3.445
2	46	25,0	73	22,9	0.21	0.749	0.473	1.19	0.45	13.760	0.5949	3.182
3	75	40,8	15	49,8		1				1		

(Continued					**Liniar binominal univariate**				**Liniar binominal multivariate**			
	Anemic		**Non-**		**P**	**Odds ratio**	**95% confidence**		**P**	**Odds ratio**	**95% confidence**	
Predictor	**N**	**%**	**N**	**%**			**Lower**	**Upper**			**Lower**	**Upper**
Total (n)	**18**	**100**	**31**	**100**								
Trimestrialsonograpgy consultation during pregnancy												
0	14	7,6%	26	8,2%	0.47	0.767	0.374	1.575	0.88	11.014	0.2895	4.189
1	75	40,8	99	31,0	**0.00**	0.545	0.355	0.838	0.07	0.4451	0.1805	1.097
2	38	20,7	56	17,6	0.05	0.609	0.364	1.018	0.11	0.5087	0.2211	1.170
3	57	31,0	13	43,3		1				1		
Patient on iron supplemntation												
Yes	13	75,5	23	72,7		1				1		
No	45	24,5	87	27,3	0.48	1.16	0.764	1.76	0.05	17.729	0.9923	3.167
Iron without folic acid supplementaion taken												
Yes	61	33,2	89	27,9		1				1		
No	12	66,8	23	72,1	0.21	1.28	0.866	1.90	0.30	12.957	0.7942	2.114
Iron with folic acid supplementaion taken												
Yes	74	40,2	95	29,8		1				1		

No	11	59,8	22	70,2	**0.01**	1.59	1.085	2.32	0.27	13.612	0.7826	2.367
White bread consumption												
Yes	14	81,0	28	87,8		1				1		
No	35	19,0	39	12,2	**0.04**	0.593	0.360	0.975	0.32	0.7352	0.3979	1.358
Corn flakes consumption												
Yes	33	17,9	37	11,6		1				1		
No	15	82,1	28	88,4	**0.05**	1.67	1.001	2.77	0.07	17.557	0.9487	3.249
Olive oil consumption												
Yes	15	84,2	29	90,9		1				1		
No	29	15,8	29	9,1%	**0.02**	0.534	0.308	0.927	0.05	0.5106	0.2578	1.011

(Continued					**Liniar binominal univariate**				**Liniar binominal multivariate**			
	Anemic		**Non-**		**P**	**Odds**	**95% confidence**		**P**	**Odds**	**95% confidence**	
Predictor	**N**	**%**	**N**	**%**		**ratio**	**Lower**	**Upper**		**ratio**	**Lower**	**Upper**
Total (n)	**18**	**100**	**31**	**100**								
Tea and infusion consumption												
Yes	14	78,3	28	89,0		1				1		
No	40	21,7	35	11,0	**0.00**	0.444	0.270	0.729	**0.00**	0.3800	0.2000	0.722
Coffee/coffee with milk consumption												
Yes	11	63,0	16	50,8		1				1		
No	68	37,0	15	49,2	**0.00**	1.65	1.14	2.40	**0.01**	17.821	1.10	2.879
Meat and fish consumption												
Yes	18	99,5	31	99,7		1				1		
No	1	0,5%	1	0,3%	0.69	0.575	0.0358	9.26	0.61	25.779	0.0643	103.214
Dark green leafy vegetables consumption												
Yes	17	92,9	30	94,0		1				1		
No	13	7,1%	19	6,0%	0.62	0.833	0.401	1.73	0.37	0.5993	0.1948	1.843
Pulses consumption												
Yes	16	91,8	29	93,7		1				1		
No	15	8,2%	20	6,3%	0.42	0.754	0.376	1.51	0.86	0.9208	0.3453	2.455
Eggs consumption												
Yes	15	84,8	26	82,1		1				1		
No	28	15,2	57	17,9	0.44	1.21	0.740	1.99	0.34	15.104	0.6408	3.560
MDDW score												
5	1	0,5%	5	1,6%	0.33	2.884	0.333	25.002	0.19	76.690	0.3567	164.857
6	4	2,2%	8	2,5%	0.81	1.153	0.339	3.919	0.57	0.5605	0.0750	4.188
7	26	14,1	24	7,5%	**0.04**	0.532	0.291	0.973	0.08	0.3655	0.1170	1.141
8	44	23,9	93	29,2	0.36	1.219	0.794	1.872	0.57	12.115	0.6180	2.375
9	10	59,2	18	59,2		1				1		

Note. Estimates represent the log odds of "non anemic vs anemic pregnant women= anemic pregnant women" vs. " non anemic vs anemic pregnant women= non-anemic pregnant women "
Note. The reference in each group was represented by the number "1".

Discussion:-

Socio demographic discussion

The pregnancy goes through a multitude of modification impacting all the organic system. The normal gestational age are between 266 days to 280 days ; approximately 9 months ; which represent half of pregnant women who will give birth (10).

At the end of our study the mean age and standard deviation was close enough to a studies conducted in Temara, Morocco (11) and Ghana (Greater Accra, Accra Metropolitan District and Western Region) (12), in contrast to other researches done in Morocco and Ethiopia and in Anatolian province, Turkey (13) (14), (15) (16).

It can be explained by the age range of our study which was higher than studies done In Oujda Angard, Morocco (17) and in Kembata Tembaro zone, southern Ethiopia (18). Even though, theses survey(17) (18) show that most of

the pregnant women were around 20 to 29 years old. Some inquiry done in Pakistan in 2014 (19) exhibit the fact that mean age of the NAPW were higher than the anemic one.

Therefore, among the foremost forecasting risk factors recognized in this studies, the pregnant women who were younger than 23 years old had 19 to 27 more times to develop anemia. This finding is consisted with others researches (11) (20) (21).

In our serie, large parts of the pregnant women were married, lived in urban area and were housewife. This result approaches that of additional survey (13) (11) (22) (23).

However, from our database, there was more inactive NAPW. This finding is in harmony with research done in Essaouira, Morocco (13) and in Somali region, Eastern Ethiopia (24). Even if some studies indicated that more APW were housewife (25) (21) (26).

Multiple logistic regression analysis didn't revealed any significant association with anemia, instead the family size is considered a protector factor against anemia the higher the number of individual in the house which consent with others researches (27) (28).

As far as for the husband work, there was no noteworthy result despite the fact that 78.3% of the NAPW and 79.9% of the APW had a formal work.

In the present study, most of the APW were illiterate or had a secondary level of study. Instead of the NAPW who had primary and college level of study. This results are consisted with a research done in Essaouira, Morocco (13). There was also a survey done in eastern zone of Tigray, Ethiopia in 2018 (29) which concluded that literate pregnant women were less exposed to anemia. The multivariate longitudinal regression didn't reveal any significant result.

Obstetric parameter Discussion:-

In our study, the majority of the pregnant women were a multigravida 2 and multipara 2 with a predominance of ANPW. This result approached this of other survey (13) (11) (30) (15) (20) (31) (22) which disclosed the fact that the number of gestation and parity constitute a risk factor of anemia, even if the result in this study could not caption the existence of association between anemia with the gestity and the parity using the multivariate longitudinal regression.

The majority of the APW and NAPW didn't had a miscarriage history (80.6% vs 85.6%) The same go to a inquiry done in Southeast Ethiopia in 2013 (85.7%).

The study showed that most of the pregnant women had 2 children alive, in covenant with others studies (17) (18). The study also revealed using multivariate regression data that pregnant women who didn't have any children alive had lower risk (0.0047x) of anemia comparing to pregnant women who had 3 children or more. It can be explained by blood loss during birth.

A lot of surveys and studies suggested an interval between 2 to 3 years between each pregnancy. A birth interval shorter than 24 months may impact the nutritional status, the children health and cause death according to the demographic and health surveys (DHS) program and USAID from the American People (32). That is why in this study 24 months was taken as reference.

The result demonstrated that 58% of the pregnant women had interval between each pregnancy higher than 2 years with a predominance of the NAPW, Same results came from some researches (27) (33) (31) (22).

In this survey the menstrual cycle was divided as normal (from 25 to 35 days) and abnormal. The result demonstrated that 99% of the pregnant woman had a normal menstrual cycle. Compared to others researches (31) (34), most of the pregnant women had a regular menstrual cycle.

Patient medical history
The overall pregnant women (more than 80%) didn't have any gyneco-obstetric, surgical or medical history.

Follow up during pregnancy:
To adapt to the study context, we only focused on the follow up of the patient, the number of clinical and sonographic consultation and the iron supplementation (with and without the folic acid).

The majority of the patient were followed during pregnancy (91.25%) with a predominance of NAPW who came to the clinical and sonography trimestrial check up, In convent with other studies (28) (8).

The patient during this study appeared to have a lower risk of anemia (0.244x) on bivariate as well as multivariate analysis which concord with other studies (28) (27).

Iron supplementation
in our study, most of the patient were on iron supplementation (with or without folic acid) (73.75%) with a majority of NAPW which concord with a study done in Jawaharlal Nehru Medical College, Belgravia, Karnataka, India (35). Contrasting with other surveys (27) (8) (31) which revealed a significant number of pregnant women who weren't on iron supplementation.

When summing up all the types of iron supplementation found in this study: the ferrous sulfate with acid folic was predominant with a total of 32.60% and respectively 28.8% vs 39.1% of the NAPW vs APW, then the ferrous sulfate alone with a total of 14.91% and 11.9% vs 20.1% of the pregnant women, polymatos iron hydroxide a total of 13.90% and 14.4% vs 13%. It can be explained by the fact that concerned anemic pregnant women did follow the iron supplementation treatment.

Our study also, revealed that 29.82% of the pregnant women were on iron supplementation without acid folic and 33.59% of them were on iron with folic acid (IFA) supplementation, which were higher than a study conducted in Dilla university in Adama Town Ethiopia (36) where 80.2% of the pregnant women was not on IFA supplementation .

Some study suggest that most of the obstetrician are more incline to switch into other iron supplementation treatement when patiente do not repond than using iv iron treatement (37), and even recommend using short iv iron supplemtation during pregnancy (38)

CBC parameter
The total population in this study was N=503, 36.6% of them were anemic. As compared with other study findings done in Oujda Angard, Morocco 16.1% (17), our inquiry datas are higher but lower than inquiry done in 2018 at Essaouira, Morocco that was 41.1% (13). Other developed countries as France shown 15.8% of anemic pregnant women (39)

In developing country like Kacha Birra District, Southern Ethiopia 2019 the result were 34%,(21) and as in east Anatolian province, Turkey 27.1% (16) of anemic pregnant women.

The mild anemia level was the most representative followed by the moderate one. There was no severe cases of anemia which concorde with other studies (11) (13) (20). Even though, most of the inquiry had the same repartition of mild level of anemia followed by the moderate one.

The majority of the NAPW had a normochromic normocytic type of anemia and APW had hypochromic microcytic type which is consistent with others studies (13) (17).

Sign of anemia
The retained sign of anemia for this study were pallor, hair loss, asthenia, nail streak, vertigo, headache, geophagia, will be called common sign of anemia.

In our study most of the pregnant women (80.31%) presented at least one sign of anemia including 83.2% of the APW. Comparing it to a study done in Kembata Tembaro zone, Southest Ethiopia (18) where 65% of the pregnant women had at least one sign of anemia.

The bivaried and multivared analyse didn't reveled any significant result.

Complication during pregnancy

Iron deficiency may appear in some studies as preeminent role of hypertension, preeclampsia and then eclampsie and also as a increase risk of preterm birth and low birth weight as other complications (40) (41).

The common complication taken in this study was intrauterine growth restriction (IUGR), preterm delivery, preeclampsia, prelabor rupture of membranes (PROM). and other called others complications. Non significant result was found and more than 90% of the pregnant women didn't suffer any complications during pregnancy. In contrast with a study done in Kholar district (42) where a higher rate of patient presented complications during pregnancy.

Dieatry diversity

In this research a food questionnaire concerning frequency consumption was done using the MDDW score

The observation conducted revealed that 59.24% of the pregnant women had a MDDW Score equal to 9, which is considered the highest score. The lower MDDW score was 5 and the mean and standard deviation was 8.41 +/- 0.853 meaning all the population had an adequate diversity food consumption. In contrast with other studies (43) (44) (45).

Select food in this study using Khi^2 revealed significant result between NAPW and APW. There was a higher rate consumption for white bread, corn flakes, olive oil. It can be explained by the fact that white bread and corn flakes contains an amount of iron supply, the olive oil by local custom (consumed frequently with bread (white or whole wheat bread)).

The consumption of coffee/ coffe with milk appeared to be a strong predictor of anemia on bivariate as well as multivariate analysis, Also the consumption of coffee/ coffee with milk increase the risk of anemia by 17 time during pregnancy.

Even if the result in this research shows a lower probability of developing anemia among pregnant women when consuming tea and infusion, It can be justified by the fact that most the pregnant women were followed during this study and benefit from the healthcare service including dietary advice, and then can be considered a confounding factor.

Last of all, the tea and coffee consumption are imputable to the anemia among pregnant women like some studies done in Kuwait (46), in Durame Town (25), in Eastern zone of Tigray (29) and in Kacha Birra District, (21) in Ethiopia. Even some survey in Costa Rica reveled the same data (47).

Even if the dietary diversity is important and had a significant impact in anemia during pregnancy there is also the vitamin deficiency that need medical supplementation (48)

Also even if in this study most of the women had a good dietary diversity some research suggest than there is a relevant correlation between anemia and obesity/ overweight (49)

Limit of the study

This study depends on the recollection (memory) of the patient not only on the food diversity but also on the medication they had taken and other data.

The MDDW score can't express the quantity of food consumed and can only explore the food biodiversity (qualitative and not quantitative).

In this study, not all the determinants of pregnancy were searched.

Conclusion:-

Is a world wide spread disease impacting the developed and developing country, it has a lot of determinant and result responsible of complications for both the pregnant women and fetus.

Our study found out that :

women whose age lower than 24 years old are 17 to 19 more time exposed to anemia high number of individual in the same house and the follow up during pregnancy are considered a protector factor against anemia

All the patient had a adapted food diversity score (100%) tea and infusion are considered a cofounding factor consumption of coffee/ coffee with milk increase the risk of anemia by 17 time during pregnancy

The ANC and the iron supplementation help to decrease the severity of anemia and improve the pregnancy well going.

The CBC level is a great and simple monitor's tool to help the detection of the anemia and its severity.

The prevention of anemia relies on the information and the education regarding nutritional advice.

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