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Research Article

Blood Biological Profile Evaluation of Women in Childbirth and their Newborns in South Abobo General Hospital (Abidjan, Côte D'ivoire)

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Abstract

The objective of this study is to evaluate and compare the hematological and biochemical profiles of pregnant women at birth with those of their newborns. To do this, during 17 days, 33 pregnant women from giving birth in maternity of South Abobo General Hospital, were recruited, on criteria for inclusion and non-inclusion. Blood samples of women at childbirth, and in the umbilical cord were performed. Blood samples are obtained with two types of tubes. Some contain EDTA was used for the determination hematological parameters and the others, without anticoagulant, for biochemical parameters.

The results showed a high anemia prevalence (42%) in mothers and (55%) in newborns. this anemia has been in the forms of hypochromic normocytic anemia (HNA), hypochromic microcytic anemia (HmA) and normochromic anemia (NNA), hypochromic macrocytic anemia (HMA) and normochromic microcytic anemia (NmA), observed in all study population. For biochemical parameters, hypercholesterolemia has been observed at childbirth. Moreover, mean values of some biochemical parameters were higher in newborns than in their mothers.

In conclusion, the study reported high proportions of anemia most high among newborns. The types of anemia only in the newborns and significant changes in blood lipids and other biochemical parameters both in the group of subjects.

Keywords: *Hematology; Biochemistry; Childbirth; Umbilical Cord; Newborn; Abobo (Abidjan)*

Introduction

Malnutrition has a major impact on health, especially during periods of development and pregnancy. They can affect optimal growth and make susceptible to certain diseases later in life [1]. Some authors claim that during pregnancy, the demand for energy, food for the mother and the fetus is increased. When a woman has a normal nutritional status, the additional energy demand is lower because the body adapts to increased energy needs [2]. However, when pregnant women suffer from malnutrition, her child is more likely to also suffer during the first 1000 days (approximately 33 months) of life [3]. For example, about 162 million children under five, 56% in Asia and 36% in Africa, are stunted [4]. In addition, the global estimate of the underweight prevalence at birth for 2005-2010, showed that 15% of newborns weighed less than 2.5 kg during this period. Moreover, estimates in 2010 showed that about 32.4 million children were born small for gestational age (27% of total births in low-income countries) [4]. These stunting and low birth weight can have long-term consequences for individuals and society. These consequences include reduced cognitive and physical development, reduced production capacity, poor health, and increased risks of developing degenerative and metabolic diseases such as diabetes [5]. Furthermore, in May 2012, WHO agreed to the goal of reducing by 40% the number of children aged under 5 years with stunted by 2025 [6]. This interest in stunting and its consequences has led to a revision of national strategies and programs, with a focus on prevention and integrated programs. Given this momentum and knowing that fetal development is influenced by maternal health and the quality of fetal-placental exchange (excess or deficiency of the mother) [7], studies on deepening knowledge about placental exchange is needed. They will raise awareness about the importance of proper nutrition during pregnancy.

In this vein, some authors have conducted work to highlight the impact that nutrition could have on pregnant women and their newborns [8-10]. Their results have reported that a diet adapted to the needs of the body can prevent adverse effects after birth (morbidity and mortality) of newborns. In addition, our previous study conducted in pregnant women in Abobo (Côte d'Ivoire) during the three trimesters of pregnancy, was revealed an alteration of the biological parameters of pregnant women during pregnancy [11]. Therefore, work highlighting the behavior of the biological parameters of women at birth and those of their newborns is important. Moreover, to our knowledge, there is no work highlighting the link between biological blood parameters of women at birth and that of their newborns in Côte d'Ivoire. Therefore, the general objective of this work is to appreciate the behavior of blood parameters of women at birth and their newborns. Specifically, it involves determining and comparing the hematological and biochemical parameters of pregnant women in labor and their newborns.

Materials and Methods

Setting and study population

This is a cross-sectional study, which took place from 03 to 20 April 2017 at the South Abobo General Hospital (Abidjan, Côte d'Ivoire). It involved 33 pregnant women who had come to give birth in the Obstetrics and Gynecology Department. After consulting individual health records, pregnant women who termed pregnantly (≥ 38 weeks), whose age ranges from 18 to 35 years old, with a mean age of 25.6 ± 0.9 years and who do not suffer from rheumatism, Hypertension, diabetes, HIV and hepatitis B were included in this study. In addition, all selected women were informed of the purpose of the study and their informed consent was prior obtained to the start of study. An interview was conducted with the selected women to obtain their anthropometric characteristics. Indeed, more than 60% of these women have been multiseptated and multiparous. The gestational status of these women was between 1 and 5 (2.42 ± 0.2). Their parity was between 1 and 5 (2.30 ± 0.2) and was closely spaced between 10 and 120 months (10). Moreover, 54% of these women had a normal body mass index. The mean value of the index was 26.8 ± 0.9 Kg/m^2. In addition, more than 80% of women in this study live in concubinage, have taken an anti-anemia and have more than 3 meals a day during pregnancy. Finally, 52% of these women did not attend school (Table 1).

Anthroposociodemographic parameters	Childbirth		Newborn	
Sex	M ± SEM	Proportions (%)	M ± SEM	Proportions (%)
Female			17	51.52
Male			16	48.48
Weight (g)			2923 ± 87	
< 1000			-	-
1000 - 1500			-	-
1500 - 2500			8	24.24
2500 - 4000			24	72.73
> 4000			1	3.03
Size (cm)			48.1 ± 0.33	
BMI (g/cm²)			1.26 ± 0.03	
Head circumference (cm)			31.9 ± 0.22	
Placenta weight of (g)			617 ± 18.9	
Age (Years)	25.6 ± 0.9	-		
IMC (Kg/m²)	26.8 ± 0.9	-		
< 18.5	0	0		
18.5 - 26	18	54.55		
> 26	15	45.45		
Gestity	2.42 ± 0.2			
Primigravida	10	30.3		
Multigravida	23	69.7		
Parity	2.30 ± 0.2			
Primipare	11	33.33		
Multiparous	22	66.67		
Intergenesis interval (Month)	36.3 ± 5.8			
< 36	14	42.42		
≥ 36	19	57.58		
Study level				
No educated	17	51.52		
Elementary	2	6.06		
Secondary	11	33.33		
Upper	3	9.09		
Marital status				
Married	1	3.03		
Concubine	28	84.85		
Single	4	12.12		
Per day number meals				
< 3	5	15.15		
≥ 3	28	84.85		
Taking antianemic				
Yes	32	96.97		
No	1	3.03		

Table 1: *Study population characteristics.*

As for children, there was almost as much newborn male (48.48%) as female (51.52%), with a birth mass between 2000 and 4050g (2923 ± 87g). More than 72% of these newborns had a normal birth mass. In contrast, 24% of them were born with a small mass. Furthermore, the mean size of these newborns was between 44 and 51 cm (48.1 ± 0.33 cm), and that of the Head circumference varies from 29 to 34 cm (31.9 ± 0.22 cm). As for the weight of the placenta, it is between 400 and 900 g (617 ± 18.9g). The body mass index of these newborns was 1.26 ± 0.03 g/cm^2 (Table 1).

Blood samples and assay of biological parameters

Blood samples were taken from pregnant women who were at childbirth in the veins of the bent elbow and the umbilical cord after delivery. The blood was collected in sterile 5 ml volume tubes, containing anticoagulant EDTA (Purple Tube), preservative sodium fluoride+potassium oxalate (Gray Tube) and no anticoagulant (Dry tube). A few minutes after blood collection, the blood in the tubes containing the EDTA anticoagulant was used to determine the hematological parameters, with an automatic hematological analyzer (Rayto RT 7600S, China). Tubes without anticoagulant and those containing preservative glucose were centrifuged at 3000 rpm for 5 minutes. Blood glucose and serum creatinemia are determined on the same day. The serum e dry tube is kept in freezer at -20°C for subsequent assay of biochemical parameters using a semi-automatic spectrophotometer (Prietest Touch Robonik, India). Blood glucose, total protein, calcium, chlorine, sodium, total and direct bilirubin, total cholesterol, HDL cholesterol and triglycerides are determined by a colorimetric method with their respective reagents. LDL cholesterol is determined by a calculation method (LDL Cholesterol=Total Cholesterol-HDL Cholesterol-Triglyceride/5) [12]. The serum potassium concentration was estimated by a turbidimetric method. The serum creatinine concentration and transaminases were performed by a kinetic method. The used protocol and experimental procedures in this study were approved by the Ministry of Higher Education and Scientific Research of Côte d'Ivoire, the authorities of the University Nangui Abrogoua, the Department of Establishments and Health Professions (DEPS) and South Abobo General Hospital.

Statistical analysis of data

The statistical analysis of the results and the graphical representations (histograms of the proportions) were carried out with the software GraphPad Prism version 5.01 (San Diego, California, USA). The results were presented as an average followed by the standard error on the mean (M ± ESM). The Student's t-test was used to compare the mean between the different groups of subjects. The test G, a plausibility test was used to compare proportions of key biological parameters estimated in groups of subjects in this study. These proportions were presented in three levels: low, normal and high compared to the reference values. The comparison of the proportions of different biological parameters is carried out between pregnant women at childbirth and their newborns. This statistical processing was performed by the Windows version R.2.0.1 statistical program [13]. The significance was set at $p < 0.05$ for the expression of the results.

Results

Hematologic profile

Table 2 presents the distribution of hematological parameters of pregnant women at birth and their neonates. The analysis of these results was shown that the mean values of erythrocyte parameters of newborns were higher than those of pregnant women at birth. However, all mean values of hematological parameters of pregnant women at birth were consistent with the reference values, unlike those of newborns. In fact, for the erythrocytes, the mean values of red blood cells (4.07 ± 0.15 $10^6/mm^3$), hemoglobin (13.62 ± 0.43 g/dL), hematocrit (39.94 ± 1.38%) and VGM (98.81 ± 2.03 fL) were inferior to normal. In contrast, MCH (33.8 ± 0.79 pg) and MCHC (34.38 ± 0.6 g/dL) were respectively higher and consistent with the reference values. With the exception of neutrophil and eosinophil levels of newborns that were below normal, all leukocyte and thrombocyte parameters in study population were consistent with the reference values. At the erythrocyte level, a highly significant ($p < 0.001$) increase in hemoglobin, hematocrit, MCV, MCH, and MCHC of newborns compared with pregnant women at birth was observed. The lymphocyte and monocyte levels of children were significantly higher ($p < 0.0001$) and ($p = 0.0136$) than those at childbirth.

Biochemical parameters	Childbirth	Newborn	Reference Values	p
Blood glucose (g/L)	0.91 ± 0.05	0.75 ± 0.05	0.6 - 1.1	0.027
Total protein (g/L)	63.02 ± 2.16	63.64 ± 2.16	66 - 83 / 45 - 75	0,84
Triglycerides (mg/L)	1.78 ± 0.12	0.56 ± 0.05	0.4 - 1.4 / 0.3 - 1.1	< 0.0001
Total cholesterol (g/L)	2.34 ± 0.12	0.72 ± 0.04	1.5 to 2.32 / 1.6 - 2.2	< 0.0001
HDL cholesterol (g/L)	1.36 ± 0.14*	1.04 ± 0.03	0.4 - 0.75 / 0.12 - 0.5	0.036
LDL cholesterol (g/L)	1.11 ± 0.13	0.46 ± 0.05	1.08 - 1.88/1.1 - 1.6	< 0.0001
Atherogenicity index	2.02 ± 0.137	0.721 ± 0.052	< 5	< 0,0001
ASAT (UI/L)	14.97 ± 1.45	33.27 ± 2.45	7 - 37 / 20 - 80	< 0.0001
ALAT (UI/L)	17.64 ± 1.17	20.73 ± 2.28	6 - 40 / 5 - 35	0.23
Creatinemia (mg/L)	10.13 ± 0.45	11.6 ± 0.69	6 - 17/7 - 10	0.073
Total bilirubin (mg / l)	4.12 ± 0.44	4.5 ± 0.77	3 - 10 / 8 - 25	0.67
Conjugated bilirubin (mg/L)	0.75 ± 0.2	4.39 ± 0.4	<4 / 1 - 3	< 0.0001
Calcium (mg/L)	102.4 ± 5.49	107.6 ± 3.74	81 - 104 / 100 - 115	0.44
Sodium (meq/L)	124.6 ± 5.9	127.8 ± 4.79	135 - 155 / 130 - 145	0.76
Potassium (meq/L)	3.12 ± 0.24	5.55 ± 0.35	3.5 - 5 / 3.6 to 5.6	< 0.0001
Chlorine (meq/L)	114.4 ± 2.98	105.2 ± 2.35	90 - 105 / 100 - 110	0.018

Table 3: *Repartition of biochemical parameters between childbirth and newborn.*
HDL: High Density Lipoprotein; LDL: Low Density Lipoprotein; ASAT: Aspartate Aminotransferase;
ALT: Alanine Aminotransferase; p: Significance level to a lower value than 0.05.

Serum biochemical profile

Variations in the serum biochemical parameters of pregnant women at birth and they're newborn were shown in table 3. The results indicated that mean creatinine, transaminase (ASAT, ALT), total protein, bilirubin (total and conjugated), calcium, sodium, and potassium values were higher in neonates than in pregnant women at birth. Mean values of triglycerides, total cholesterol, HDL and chlorine were higher than reference values during childbirth, while mean values of total protein, sodium and potassium for pregnant women were lower than the reference values.

Biochemical parameters	Childbirth	Newborn	Reference Values	p
Blood glucose (g/L)	0.91 ± 0.05	0.75 ± 0.05	0.6 - 1.1	0.027
Total protein (g/L)	63.02 ± 2.16	63.64 ± 2.16	66 - 83 / 45 - 75	0,84
Triglycerides (mg/L)	1.78 ± 0.12	0.56 ± 0.05	0.4 - 1.4 / 0.3 - 1.1	< 0.0001
Total cholesterol (g/L)	2.34 ± 0.12	0.72 ± 0.04	1.5 to 2.32 / 1.6 - 2.2	< 0.0001

HDL cholesterol (g/L)	1.36 ± 0.14*	1.04 ± 0.03	0.4 - 0.75 / 0.12 - 0.5	0.036
LDL cholesterol (g/L)	1.11 ± 0.13	0.46 ± 0.05	1.08 - 1.88/1.1 - 1.6	< 0.0001
Atherogenicity index	2.02 ± 0.137	0.721 ± 0.052	< 5	< 0,0001
ASAT (UI/L)	14.97 ± 1.45	33.27 ± 2.45	7 - 37 / 20 - 80	< 0.0001
ALAT (UI/L)	17.64 ± 1.17	20.73 ± 2.28	6 - 40 / 5 - 35	0.23
Creatinemia (mg/L)	10.13 ± 0.45	11.6 ± 0.69	6 - 17/7 - 10	0.073
Total bilirubin (mg / l)	4.12 ± 0.44	4.5 ± 0.77	3 - 10 / 8 - 25	0.67
Conjugated bilirubin (mg/L)	0.75 ± 0.2	4.39 ± 0.4	<4 / 1 - 3	< 0.0001
Calcium (mg/L)	102.4 ± 5.49	107.6 ± 3.74	81 - 104 / 100 - 115	0.44
Sodium (meq/L)	124.6 ± 5.9	127.8 ± 4.79	135 - 155 / 130 - 145	0.76
Potassium (meq/L)	3.12 ± 0.24	5.55 ± 0.35	3.5 - 5 / 3.6 to 5.6	< 0.0001
Chlorine (meq/L)	114.4 ± 2.98	105.2 ± 2.35	90 - 105 / 100 - 110	0.018

Table 3: *Repartition of biochemical parameters between childbirth and newborn.*

HDL: High Density Lipoprotein; LDL: Low Density Lipoprotein; ASAT: Aspartate Aminotransferase;

ALT: Alanine Aminotransferase; p: Significance level to a lower value than 0.05.

For the neonates, the mean values of creatinine, HDL cholesterol and conjugated bilirubin were higher than normal values. In contrast, mean values of total cholesterol, LDL cholesterol, total bilirubin, and sodium were lower than reference values in neonates. In addition, the comparison of the results was revealed on the one hand, hyperlipidemia (triglycerides, total cholesterol and LDL) very highly significant ($p < 0.001$) in pregnant women at birth compared to their newborns. And on the other hand, it was revealed a very highly significant increase in mean ASAT, combined bilirubin and potassium values of newborns compared to pregnant women at birth. Moreover, a highly significant hyperchloraemia ($p = 0.0181$) in pregnant women at birth compared to their newborns was noted. Significant statistical differences ($p < 0.05$) were observed between pregnant women at birth and their newborns in mean blood glucose, serum creatinine and HDL cholesterol levels. The atherogenicity index was consistent with the reference values in this study. However, this index was significantly higher ($p < 0.0001$) in pregnant women at birth compared to their newborns.

Prevalence of anemias

Figure 1 shows the proportions of anemia and types of anemias of study population. The analysis of the results was revealed that the prevalence of anemia among pregnant women at birth (42%) was lower than that of their newborns (55%). However, any significant difference ($p > 0.05$) was observed between study population. In addition, three types of anemia were revealed in pregnant women at birth as well as in newborns. These are: hypochromic normocytic anemia (HNA), hypochromic microcytic anemia (HmA) and normochromic anemia (NNA). In addition, two other types of anemia, including normochromic microcytic anemia (NmA) and hypochromic macrocytic anemia (HMA) are observed in neonates. In addition, a preponderance of NNA was observed among pregnant women at birth (24%), followed by HmA (12%) and HNA (6%). AHN was the type of the highest anemia (18%) among children, followed by AHM and ANM (12%) and MHA (9%) and ANN (3%). The comparison of these different types of anemia was revealed a highly significant ($p = 0.013$) prevalence of ANN in mothers compared to neonates. In contrast, HMA ($p = 0.041$) and ANm ($p = 0.018$) were significantly higher in neonates than mothers.

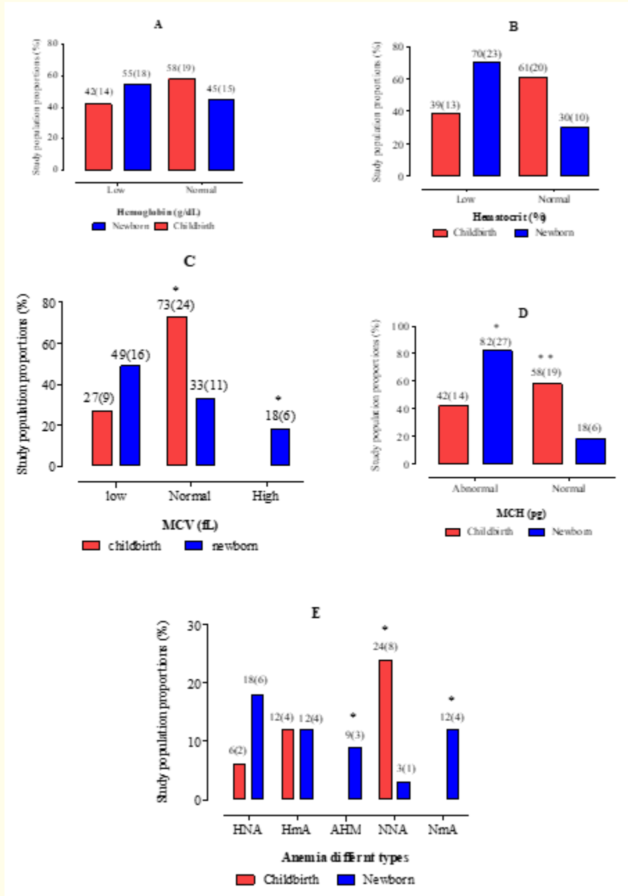

Figure 1: *Proportions of erythrocytes and anemia.*

*A: Hemoglobin; B: Hematocrit; C: Mean Corpuscular Volume; D: Mean Corpuscular Hemoglobin; E: Mean Corpuscular Hemoglobin Concentration; HNA: Hypochromic Normocytic Anemia; HMA: Hypochromic Macrocytic Anemia; NNA: Normochromic Normocytic Anemia; NmA: Normochromic Microcytic Anemia; *: p < 0,05: Statistically significant difference.*

Proportions of leukocyte and thrombocyte parameters

The proportions of some hematological parameters of pregnant women at birth and their newborns were presented in table 4. The normal proportion of eosinophilic polynuclear (100%) of mothers was significantly higher than that of their children. Like normal proportions, the high proportions of leukocytes (45% leukocytosis) and neutrophils (45% neutrophils) in mother were very highly significant ($p < 0.001$) in comparison with those of their newborns. However, the low proportions of neutrophils (neutropenia 55%) and thrombocytes (thrombocytopenia 24%) of neonates were significantly higher ($p < 0.05$) than those of mothers. Furthermore, any pregnant women at birth (0%) had low proportions of leukocytes, monocytes and eosinophils. However, their newborns had significantly higher ($p < 0.05$) proportions of these parameters.

Hematological parameters	Childbirth		Newborns		P
Leukocytes ($10^3/mm^3$)	N	%	N	%	
Low: <4 or 10	0	0	13	39	0.00002
Normal: 4-10/10-25	18	55	18	55	1
High: > 10 or 25	15	45	2	6	0.0008
Monocytes ($10^3/mm^3$)					
Low: <0.1 or 0.5	0	0	4	12	0.02
Nprmal: 0.1-1/0.5-1.2	29	88	19	58	0,147
High: > 1 or 1.2	4	12	10	30	0,103
Lymphocytes (10^3 mm^3)					
Low: < 1.5 or 2	7	21	2	6	0.086
Normal: 1.5 - 4/2-11	22	67	29	88	0.326
High: > 4 or 11	4	12	2	6	0,410
Neutrophils ($10^3/mm^3$)					
Low: < 1.7 or 6	1	3	18	55	0.00002
Normal: 1.7 - 7/6-25	17	52	15	45	0.724
High: > 7 or 25	15	45	0	0	0.000005
Eosinophils ($10^3/mm^3$)					
Low: < 0 or 0.2	0	0	22	67	$3.34\text{-}10^{-8}$
Normal: 0 - 0.5/0.2 - 0.5	33	100	10	30	0.0003
High: > 0.5	0	0	1	3	0.239
Thrombocytes ($10^3/mm^3$)					
Low: < 150	1	3	8	24	0.013
Normal: 150 - 400	30	91	25	76	0.5
High: > 400	2	6	0	0	0.096

Table 4: *Proportions of some hematological parameters to childbirth and in newborn.*
N: Observed number in each case; p: Significance level to a lower value than 0.05.

Proportions of some serum biochemical parameters

The proportions of serum biochemical parameters during childbirth and the newborns were presented in table 5. These results were indicated that 91% of pregnant women at birth had a normal creatinine level compared to 36% in newborns. In terms of blood glucose, respectively 61% and 64% of mothers and newborns had normal blood glucose. At the transaminase level, respectively 85% and 100% of pregnant women at birth had normal ASAT and ALT levels. Forty-eight point five percent of mothers had a normal total protein level, whereas 73% of newborns had a normal level of this parameter.

Biochemical parameters	Childbirth		Newborns		P
Blood glucose (g/L)	N	%	N	%	
Low: < 0.6	5	15	8	24	0.403
Normal: 0.6 - 1.1	20	61	21	64	0.876
High: > 1.1	8	24	4	12	0.244
Triglycerides (mg/L)					
Low: < 0.4 or 0.3	1	3	6	18	0.047
Normal: 0.4 - 1.4/0.3 - 1.1	7	21	25	76	0.001
High: > 1.4 or 1.1	25	76	2	6	$1.48.10^{-6}$
Total cholesterol (g/L)					
Low: < 1.5 or 1.6	3	9	0	0	0.041
Normal: 1.5 - 2.32/1.6-2.2	13	39	33	100	0.003
High: > 2.32 or 2.2	17	52	0	0	$1.21.10^{-6}$
HDL cholesterol (g/L)					
Normal: 0.4 - 0.75/0.12 - 0.5	1	3	0	0	0.239
High : > 0.75 or 0.5	32	97	33	100	0.901
LDL cholesterol (g/L)					
Low: < 1.08 or 1.1	16	49	32	97	0.02
Normal: 1.08 - 1.88/1.1 - 1.6	14	42	1	3	0.0003
High: > 1.88 or 1.6	3	9	0	0	0.041
Creatinemia (mg/L)					
Low: < 6 or 7	2	6	2	6	1
Normal: 6 - 17/7 - 10	30	91	12	36	0.005
High: > 17 or 10	1	3	19	58	$8,66.10^{-6}$
ASAT (UI/L)					
Low: < 7 or 20	3	9	4	12	0.705
Normal: 7 - 37/20 - 80	28	85	29	88	0.895
High: > 37 or 80	2	6	0	0	0.096
ALAT (UI/L)					
Normal: 6 - 40/5 - 35	33	100	28	85	0.522
High: > 40 or 35	0	0	5	15	0.009
Total protein (g/L)					
< 66 or 45 low	16	48.5	2	6	0.0004
Normal: 66 - 83/45 - 75	16	48.5	24	73	0,204
High: > 83 or 75	1	3	7	21	0.025
Total bilirubin (mg/L)					
Low: < 3 or 8	14	42	28	85	0.029
Normal: 3 - 10/8 - 25	19	58	5	15	0.003
Conjugated bilirubin (mg/L)					
Normal: < 4	32	97	12	36	0.002
High: > 4	1	3	21	64	$2.26.10^{-6}$

Table 5: *Proportions of biochemical parameters in study population.*
N: Number observed in each case; ASAT: Aspartate Aminotransferase Acid; ALT: Alanine Aminotransferase Acid; p: Significance level to a lower value than 0.05.

These results were also indicated that 58% of pregnant women at birth had a normal level of total bilirubinemia compared to 15% of newborns. As for the conjugated bilirubinemia, 97% of the mothers have presented a normal rate, whereas it was 36% of the newborns which had a normal rate of this parameter.

Proportions of some serum lipids

Table 5 was shown the proportions of some serum lipids of pregnant women at birth and their newborns. Analysis of the results were reported 18% hypotriglyceridemia and 97% LDL hypocholesterolemia in newborns. These proportions were significantly higher ($p < 0.05$) than those of mothers who were respectively 3% and 49%.

Any newborn (0%) had total hypocholesterolemia compared to 9% of mothers with a significant difference ($p = 0.041$). Just like the low proportions, analysis of normal proportions was revealed 76% triglycerides and 100% total cholesterol in newborns. These proportions were highly significant ($p < 0.01$), relative to the normal proportions of triglycerides (21%) and total cholesterol (39%) of pregnant women at birth. In addition, the normal LDL cholesterol levels of mothers (42%) were significantly higher than those of their newborns (3%). The proportions of hypertriglyceridemia (76%) and total hypercholesterolemia (52%) of pregnant women at birth were very highly significant ($p < 0.001$) compared to the proportions of neonates (6% and 0%) respectively. Any newborn (0%) had LDL hypercholesterolemia compared to 9% of mothers with a significant difference ($p = 0.041$).

Proportions of some serum minerals

The proportions of serum minerals in pregnant women at birth and their newborns were shown in figure 2. Analysis of the results were revealed high proportions of hypernatremia (45.5%) and hyperkalemia (36%) in newborns. These proportions were significantly higher ($p < 0.001$) than those of mothers who were 3%. In addition, normal proportions of sodium were significantly increased ($p = 0.003$) in mothers (52%). While, normal potassium levels were significantly increased ($p = 0.005$) in neonates (61%). Moreover, the analysis of the results was also indicated a high hypokalemia (79%), significantly elevated in pregnant women at birth. On the other hand, neonates had a high hypochloremia (42.4%) significantly increased.

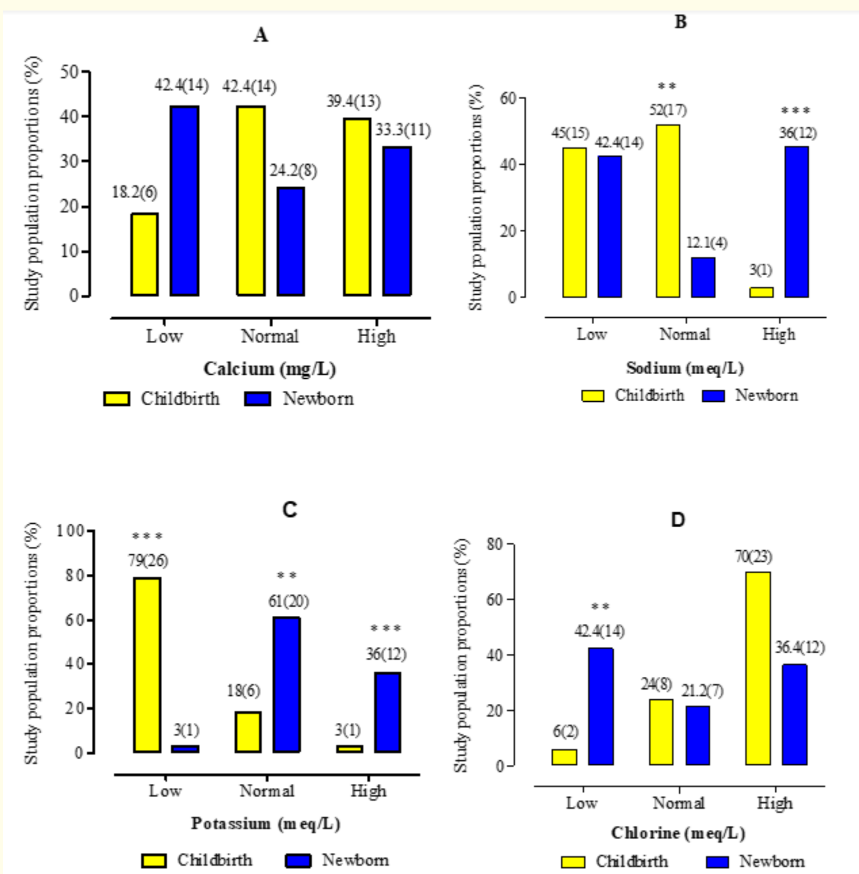

Figure 1: *Serum mineral proportions.*

*A: Sodium; B: Calcium; C: Potassium; D: Chlorine; **: p < 0.01 Highly statistically significant difference;*

****: p < 0.001 Very highly statistically significant difference.*

Discussion

In the present study, the mean values of erythrocyte parameters of newborns (hemoglobin, hematocrit, MCV, MCH and MCHC), except for red blood cells, are higher than those of pregnant women at mothers. Hematological parameters are generally higher in neonates than in pregnant women at birth according a study [14]. This could be explained by the presence of hematopoietic stem cells (HSCs) in the blood of umbilical cord [15,16]. These stem cells can produce other types of cells. Indeed, at the time of birth, the bone marrow is fully active, and all hematopoietic cell lines undergo cell differentiation and amplification [17]. In addition, fetal-maternal blood exchange, through the umbilical cord, could also contribute to the increase of infantile hematological parameters. A work reported that neonatal blood volume increases when umbilical cord clamping is not performed immediately after delivery [18]. Such results regarding erythrocyte parameters in neonates are also reported [19]. However, the results of this study have reported non-significant anemia prevalences of 42% in pregnant women at birth and 55% in neonates. The causes of anemia are nutritional, infectious or genetic. Indeed, the main cause of anemia during pregnancy is iron deficiency.

This occurs because physiological changes during pregnancy lead to increased demand for iron. And yet iron reserves before pregnancy are generally low [20], because the diet of women in developing countries is low in iron. In addition, parasitic infections endemic in these geographical areas, lifestyle and socio-economic conditions are also associated with high prevalence of anemia [21]. Similar proportions of anemia 44%, 41.6%, 39.8% and 39.5% were reported in India [22], in Turkey [23], in Cameroon [24] and in Benin [25] in pregnant women at birth. Moreover, anemia during pregnancy remains high in Africa (55.8%), Asia (41.6%), Latin America and the Caribbean (31.1%) and Oceania (30.4%). In Europe, however, anemia during pregnancy is estimated at 18.7% and 6.1% in North America [26]. The high prevalence of anemia in newborns may be explained by the fact that the amount of iron transferred to the fetus by the pregnant woman depends on the amount of maternal iron available. The fetus can only benefit from available iron concentrations in the mother [22]. Similar prevalences of neonatal anemia are reported in Côte d'Ivoire [27] and in Benin [25]. These authors showed proportions of anemia respectively of 56% and 61% in newborns. In addition, these results of anemia in pregnant women at birth and their newborns are corroborated some studies [28]. The latter reported a direct relationship between maternal and fetal hemoglobin levels. In addition, hypochromic macrocytic anemia (HMA) and normochromic microcytic anemia (NmA) observed only in neonates are higher than those of pregnant women at birth. Furthermore, the results of this study revealed the presence of hypochromic normocytic anemia (HNA) for hypochromic microcytic anemia (HMA) and normochromic normocytic anemia (NNA) as well mothers than their newborns. However, only NNA (24%) is higher among pregnant women at birth compared to newborns. This last type of anemia is usually high regardless of the trimester of pregnancy. These results are similar to those of some authors who reported a high prevalence of two types of anemias in women in the third trimester of pregnancy, in proportions of 20% for HmA and 53.3% for NNA [21].

Regarding the serum biochemical parameters, this study reveals, at the level of lipidemia, hypertriglyceridemia and hypercholesterolemia (total and HDL) are significant in pregnant women at birth compared to newborns. This increase of lipidemia suggests that of the pregnant women appetite and hyperphagia. Moreover, hormonal changes during the different trimesters would contribute to the increase of lipid reserves during pregnancy. These hormonal changes would reduce the elimination of triglycerides by lipoprotein lipase in the liver and adipose tissue, thereby reducing lipolytic activity [29]. Furthermore, taking into account the ability of lipids to cross the placenta [30] and the return to serum lipid levels of serum lipoproteins [31,32], this hyperlipidemia could be considered as an additional nutritional source contributing to the development of the fetus. Also, some investigations were reported an increase in lipidemia during pregnancy [29,33].

As for minerals, the study reports, a hyponatremia not significant both in pregnant women at birth and in newborns. Hyponatremia is a drop in the level of sodium in the blood. This phenomenon in pregnant women at birth could be due to a dilution of sodium in the body. During pregnancy, hyponatremia can cause major disorders in pregnant women and newborns [34], including edema and cell swelling

[35]. The latter observed that the sodium concentration in newborns is higher than that of mothers, without however presenting any significant differences. Neonates had significantly higher serum potassium than pregnant women at birth, which is lower than normal. The hypokalaemia recorded in pregnant women at birth could be caused by an increase in aldosterone, promoting a loss of potassium. This is manifested in pregnant women at birth with tiredness, muscle pains and weakness, abdominal contractions and cramps and abnormal heart rhythm. Hypokalemia induces uterine contractions according to some works [36].

Conclusion

At the end of this study concerning the variation of the hematological and biochemical parameters of pregnant women at birth and their newborns in Abobo (Abidjan_Côte d'Ivoire), several biological modifications are noted. At the hematological level, these changes are characterized by a higher prevalence of anemia in neonates than in mothers. The biochemical study reveals a significant increase in lipid parameters, including total and HDL cholesterol in pregnant women at birth compared to newborns. Neonates in this study have hypolipidemia. As for minerals, the study reveals hyponatremia and hypokalemia in pregnant women at birth.

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