Plasma Vitamin A, E, and β-Carotene Levels in Adult Post-Partum Algerian Women

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Abstract: Vitamins A and E are essential for foetal growth, reproduction, and lactation. In this article we report the results of a study, lead in three Eastern Algeria cities, that involved 786 post-partum women and 250 control levels of vitamins A, E, β-carotene, and some nutritional indexes were measured in both groups.

In control women, plasma retinol and β-carotene levels were significantly lower in Algeria than in France (retinol: 1.4 ± 0.42 vs. 1.78 ± 0.53 µmol/l, β-carotene: 0.35 ± 0.261 vs. 0.94 ± 0.611). These differences could be the sequence of different β-carotene and retinol intakes.

In Algeria, comparisons between post-partum women and controls showed that plasma vitamin A and β-carotene levels were significantly lower in post-partum than in control women. This fact, et, and the lower level of retinal in control women, raises the question of supplementation for pregnant women in Algeria, at least for those with the lowest standard of living whose protein and zinc levels are also very low after delivery.

Plasma vitamin E levels and vitamin E/total lipid ratios were not different in Algeria and in France. Vitamin E concentration was higher during pregnancy, but the vitamin E/total lipid ratio was significantly lower, which relative deficiency at the end of pregnancy. Comparisons of plasma vitamin E levels at delivery in primiparous and multiparous women reveal a better tocopherol status in multiparous women. This difference could an adaptive response to oxidative stress in multiparous women.

Key Word: Vitamin E, β-carotene, Algeria, post-partum

Introduction:

Vitamins A and E are essential micronutrients. Vitamin A is indispensable for reproduction. Foetal growth [1], lactation [2] skin keratinisation, and vision [3, 4] Rotinol helps to fight cancer and its deficiency causes exophthalmia, a public health problem in several African country vitamin E is needed for reproduction in rats and as α-tocopherol is the most powerful

[5] Vitamin E deficiency has been shown to cause regenerative hemolytic anemia in premature neonates [6, 7] Vitamin E status and defenses against peroxidation in rat pups depend on maternal tocopherol intake and status [8]. β-carotene is not considered as essential, but as an antioxidant, it also fights free radicals [9] and generates vitamin A. There are only few reports on these micronutrients in north Africa, and none has been published so far in Algeria. The retinol. α-tocopherol. and β-carotene status

is described in this study involving 733 post-partum women and 250 controls in Algeria.

**Material and Methods**

**Chemicals**: All-trans retinol, α-tocopherol, and β-carotene were from Sigma (Sigma Aldrich Chimie, L'Isle d'Abeau Chesne, France). Acetonitrile, methanol, dichoro-1,2 ethane were from Prolabo (Prolabo, Lyon, France).

**Apparatus**: Vitamins and β-carotene were measured with a Kontron HPLC system (Kontron Analytics, Montigny le Bretonneau, France), which consisted of 420 pump, a G425 gradient former, a 460 autosampler, a 430 UV/Vis detector, and a 450 data system.

Triglycerides and cholesterol measurements were performed on a RA100 autoanalyser by enzymatic method (Bayer-Technicon, Puteaux, France). Total lipids were calculated using Grundwald's formula. No plasma triglyceride concentration exceeded 4 g.

**Subjects and Methods**

Pregnant women for the post-partum group were randomly recruited in the Mila, Constantine, and Batna maternity hospitals. Healthy non-pregnant women (control group) were randomly recruited in the blood donor centers of the same three towns. Pregnant women and controls were all volunteers, and were included in the study after giving their informed consent. No woman took or received any micronutrient supplementation at least 3 months before blood sampling. None smoked and none took oral contraceptives.

Women from the two groups belonged mainly to farmer families, with some shopkeepers, and a minority of employees. In the post-partum group, all women were married whereas in the control group, there was an equal number of married and unmarried women.

Food consumed by all volunteers was basic Algerian rural diet. This consisted mainly of whole cereals (wheat, as basic food, along with vegetables (principally tomatoes, potatoes, eggplant, green and red peppers), olive oil, Olives, and local bread every day. Women also consumed watermelons, cantaloupes, dried figs, grapes, and dates regularly in the summer. They ate cakes, sheep or lamb meat once or twice a week. Drinks were water and mint-tea, alcohol being forbidden, it was never consumed.

The post-partum group included 733 women between 19 and 48 years of age (average: 30). Neonates were all normal and were born after full-term pregnancies with uncomplicated vaginal delivery. Blood sampling was done after delivery, following an overnight fasting, between 7 and 8 am.

The control group included 250 healthy women between 18 and 45 years of age (average: 25), none had borne children before. Blood sampling was done following an overnight fasting, between 7 and 9 am.

Blood was collected in 7 ml heparinized Vacutainer tubes. Lipid determination was performed in each University Hospital and plasma aliquots were sent to France to measure vitamin concentrations.

Vitamins were measured by HPLC, using a method that we have previously described [10].

Statistics: Data analysis was performed with the PCSM software (Dettasoft, Meylan, France), which was run on a PC compatible computer. Distribution normality was tested using a Kolmogoroff-Smirnoff test, As no variable was simultaneously Gaussian in both groups, differences between groups were tested with the Mann-Whitney U test [11]. Differences were considered significant when p <0.05.

**Results**

In the post-partum group, 228 women were between 18 and 26 years of age (28.5%), 313 between 26 and 34 (39.1%), 219 between 34 and 42 (27.4%), and 40 between 42 and 50 (5.0%). In the control group, 132 women were between 18 and 26 year of age (52.8%), 75 between 26 and 34 (30.0%), 30 between 34 and 34 (30.0%), 30 between 34 and 34 (12.0%), and 13 between 42 and 50 (5.2%). Cholesterol, triglyceride and total Lipid levels in plasma are summarized in Table 1. These three lipid fraction are significantly higher in post-partum women, and tri.

<table>
<thead>
<tr>
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<th>Control group (n = 250)</th>
<th>Post-partum group (n = 733)</th>
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<tbody>
<tr>
<td>Cholesterol (g/l)</td>
<td>1.25-1.82; 0.74-2.25</td>
<td>1.67-2.47; 0.80-3.43**</td>
</tr>
<tr>
<td>Triglycerides (g/l)</td>
<td>0.53-0.91; 0.92-1.72</td>
<td>1.53-2.43; 1.22-4.00**</td>
</tr>
<tr>
<td>Total lipids (g/l)</td>
<td>2.73-4.08; 2.70-6.17</td>
<td>5.98-8.54; 3.37-12.81**</td>
</tr>
</tbody>
</table>

Results are expressed as 5th percentile - median (bold)/95% confidence interval - and 95th percentile postpartum vs. control women differences: * p <0.05 ** p <0.01
triglyceride levels present the largest difference. Protein and zinc indexes arc reported in Table 11. Plasma proteins and zinc levels are also much lower in postpartum women. Plasma vitamins and α-carotene results are shown in Table III. Plasma α-tocopherol is significantly higher in postpartum women than in controls, but the α-tocopherol/total lipid ratio significantly lower. Retinol and β-carotene are both significantly lower in post-partum women both when expressed as concentration and as ratios to lipids.

Comparisons between primiparous and multiparous women revealed no significant difference except for vitamin E. Plasma α-tocopherol was significantly lower in primiparous women than in multiparous 

\[ (28.5 \pm 6.44 \text{ vs. } 31.9 \pm 5.86 \text{ µmol/I}, p < 0.05) \]

This significance was also sent for lipid corrected levels of vitamin E. Differences between vitamin E/total lipid ratio were also significant (3.4.70 vs. 3.7 ± 0.77, p = 0.0035).

### Discussion

Comparing post-partum women to controls shows that plasma lipid concentrations are significantly higher during pregnancy. Cholesterol concentration is 42% higher, triglyceride 283%, and total Lipids 211%. Such variation may be explained by changes in Lipid metabolism during pregnancy, by placenta synthesis, and by a higher lipid intake during pregnancy.

In control women, plasma α-tocopherol concentrations higher than those reported in Saudi Arabia (15.2 ± 1.3 µmol/I, [12]), and the increase we report after delivery also higher. In our study vitamin E concentration is significantly higher fl women after delivery when compared control. In contrast, the vitamin E/total lipid ratio is significantly lower in women after delivery. Our vitamin E and lipid results corroborate those previously reported by Mino [13] in Switzerland. However, in our study, the vitamin E/total lipid ratio is lower after delivery while it was constant in Mino's study. This decrease could reflect a relative tocopherol deficiency during pregnancy in Algeria since howitt [14] considers that this ratio is a better index of vitamin E status. Altered vitamin E status may increase oxidative risk in pregnant Algerian women, and it may contribute to higher malondialdehyde levels as we previously described [15]. Interestingly, we found that vitamin E was significantly higher in multiparous women than in primiparous. and this difference is found for plasma tocopherol, for lipid adjusted values, and for vitamin E/total lipid ratio. This difference could be this result of a better tocopherol metabolism in multiparous women than in primiparous. It could reflect an adaptation, in multiparous women, 10 better defend tissues against Lipid per oxidation. Plasma Retinol concentration is lower in the postpartum group than in the control group (1.3 ± 0.77 vs. 1.44 ± 0.59, p = 0.0035). In control women, plasma levels of vitamin A and -carotene are significantly lower than those observed in France [16] table IV, in adult women. In postpartum women, retinol levels are not different from those reported in Thailand, at the first trimester [17], but slightly lower than those recorded in Turkey at 28-32 weeks of pregnancy (1.44 ± 0.14 vs. 30 µmol/l). In postpartum and control women could be related to an inadequate retinol intake, or a Lower protein and zinc status as described in table II.

### Table II: Protein and zinc indexes in control and post-partum women

<table>
<thead>
<tr>
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<th>Control group (n = 250)</th>
<th>Post-partum group (n = 733)</th>
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</thead>
<tbody>
<tr>
<td>Total plasma proteins (µg/I)</td>
<td>63.5 -71.0/1.18-79.0</td>
<td>52.0 -65.0/1.928-74.0**</td>
</tr>
<tr>
<td>Serum Albumin (g/I)</td>
<td>32.5 -41.0/1.07-48.0</td>
<td>25.0 -32.6/1.701-42.0**</td>
</tr>
<tr>
<td>Serum zinc (µmol/I)</td>
<td>10.2 -13.2/5.11-17.2</td>
<td>6.0 -8.6/3.26-13.6**</td>
</tr>
</tbody>
</table>

Results are expressed as 5th percentile - median (bold)/95% confidence interval - and 95th percentile Postpartum vs. control women differences: * p <0.05     **p <0.01

<table>
<thead>
<tr>
<th></th>
<th>Controls (n = 250)</th>
<th>Post-partum (n = 733)</th>
</tr>
</thead>
<tbody>
<tr>
<td>α-Tocopherol (µmol/l)</td>
<td>15.5 -20.0/8.4826.3</td>
<td>19.8 -30.6/1.01-42.8**</td>
</tr>
<tr>
<td>α-Tocopherol/total lipids (µmol/g)</td>
<td>3.4 -4.97/265-4.81</td>
<td>2.44 -3.49/130-5.25**</td>
</tr>
<tr>
<td>Retinol (µmol/I)</td>
<td>0.95 -1.35/104-2.09</td>
<td>0.67 -1.25/0.059-1.95**</td>
</tr>
<tr>
<td>Retinol/total lipids (µmol/g)</td>
<td>0.19 -0.336/0.032-0.58</td>
<td>0.072 -0.142/0.030-0.255**</td>
</tr>
<tr>
<td>β-carotene (µmol/I)</td>
<td>0.19 -0.28/0.055-0.153</td>
<td>0.07 -0.19/0.030-0.255**</td>
</tr>
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</table>

| β-carotene/total lipids (µmol/g) | 0.234 -0.0665/0.0200.2146 | 0.0069 -0.0215/0.0060.0738** |

results are expressed as 5th percentile - median (bold)/95% confidence interval - and 95th percentile post-partum vs. control women differences : * p <0.05     ***p <0.01
Indeed, total plasma protein, albumin, and zinc were much lower after delivery than in controls, and these indexes were also much lower than those previously observed in France [19]. Protein intake and zinc status decrease plasma retinol, indeed RBP synthesis depends both on protein and below which levels are considered as low, and values below partum.

Our results show that retinal status is not satisfactory in Algeria. This alteration seems to be related both to an inadequate dietary intake of vitamin A, and to an altered carotene status. Retinol supplementation should be carefully monitored in pregnant women, since retinol supplementation is teratogenic, - carotene is not. Pregnant women in Algeria could apply particularly to pregnant women with a low standard of living whose protein-calorie intake is not satisfactory.

References

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