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The Vitamin Status Of Alpha Tocopherol And Vitamin C In Subjects Diagnosed With Breast And Prostate Cancer

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ABSTRACT

Background. Alpha-tocopherol (α-T) is known to be the main bioactive form of vitamin E founded in plasma and tissues.

A prior plasma dosage of both vitamin E and vitamin C is required before and during chemotherapy and radiotherapy, in order not to potentiate (when taking VE) a potential imbalance of the pro-oxidant/anti-oxidant balance at the origin of the appearance of metastasis and recurrence of cancer. The aim of this study was to analyse the variations in plasma alpha tocopherol and vitamin C levels in subjects diagnosed with breast or prostate cancer before any treatment.

Methods. 30 samples were taken, 15 of which were subjects diagnosed with breast or prostate cancer and 15 healthy subjects as controls. Plasma assay was performed by high performance liquid chromatography.

Results. Vitamin E varies in inverse proportion to the amount of vitamin C. An increase in one leads to a decrease in the other.

Conclusion. The analyses showed that the plasma level of alpha tocopherol varies inversely with that of vitamin C. Hence the interest to take into account the vitamin status of these two micronutrients beforehand and to combine them during a supplementation. In order to avoid possible negative effects of this vitamin therapy.

Key words: vitamin status, alpha tocopherol, vitamin C, breast and prostate cancer.

1. Introduction

Alpha-tocopherol (α-T) is kown to be the main bioactive form of vitamin E founded in plasma and tissues .It's micronutrient has considered to have anticancer and antidiabetic effects.

(1 ; 2).

Supplementation with antioxidants such as vitamins E and C in the early months of breast cancer diagnosis is aimed at reducing the risk of metastasis and cancer recurrence (3).

However, numerous studies report opposite and contradictory effects (.4; 5; 6; 7). According to these studies, adjuvant vitamin E therapy seems to reduce the efficacy of radiotherapy, chemotherapy and induce carcinogenic effects with the consequence of increased recurrence of certain cancers such as breast or prostate, but also the appearance of cardiovascular disease or diabetes (6).

The negative results of these trials have been attributed not only to the form or dose of vitamin E used but also to the failure to take into account the synergies between different antioxidants (e.g. vitamin C and vitamin E). The synergy between vitamin C and vitamin E is well documented (8). The mechanism of this synergy is characterised by the reduction of tocopheryl radicals (α-TO -) by vitamin C (ascorbic acid) to regenerate α-tocopherol (8). The concentration of ascorbic acid is important because it is this co-antioxidant that will regenerate α-T. When the concentration of ascorbic acid is low, the pro-oxidant effect of α-T appears (9; 10). A prior plasma dosage of both vitamin E and vitamin C is necessary before and during chemotherapy and radiotherapy, in order not to potentiate (in case of EV intake) a potential imbalance of the pro-oxidant/antioxidant balance at the origin of the appearance of metastasis and recurrence of cancers. Hence the objective of this work which aims to analyse the variations in plasma levels of alpha tocopherol and vitamin C in subjects diagnosed with breast or prostate cancer before any treatment.

2. Material and methods

The study was conducted at the Institut National de Recherche en Sciences de la Santé du Congo (IRSSA). The protocol was approved by the ethics committee of Médical Congo, under study number 048/MRSIT/IRSSA/CERSSA.

2.1. Material

Plasma from male and female patients diagnosed with breast or prostate cancer and healthy subjects as controls was collected before any treatment.

A total of 30 subjects were sampled, including:

15 subjects diagnosed with breast and prostate cancer

15 healthy subjects as controls

2.2 Methods

High performance liquid chromatography was used for the determination of vitamins (Cet E).

Statistical analysis

The data were organised and analysed using the following software: Microsoft Excel version 2016 for the creation of the database, Epi-Info version 7.2. The data were expressed as mean ± standard deviation. The F-test statistics and the degree of freedom (df) associated with each comparison were expressed.

3. Results

Table 1. Results of blood tests for α-T and vitamin C in breast cancer patients with positive prostate and healthy subjects

N = 15	Pathologies	Alpha-tocopherol (mg/l) Normal values 6 - 18	Vitamin C Normal values 26 - 85 (µmol/l)
1	Breast cancer	7,75	19, 9
2	Breast cancer	10, 34	< 2, 0
3	Breast cancer	9, 91	5,2
4	Breast cancer	6, 89	30, 9
5	Breast cancer	7, 1	22, 5
6	Breast cancer	6, 5	25, 6
7	Breast cancer	6, 73	27, 2
8	Breast cancer	8, 3	29, 3
9	Breast cancer	9,1	1,7
10	Prostate cancer	6, 89	29, 3
11	Prostate cancer	0, 43	20
12	Prostate cancer	11,2	< 1, 8
13	Prostate cancer	7, 2	28, 1
14	prostate Cancer	6, 7	26, 4
15	Prostate cancer	10,1	< 3,0
N=15	**Healthy plasma (control)**	**Alpha-tocopherol (mg/l) Normal values** 6 - 18 mg/l	**Vitamin C Normal values** 26 - 85 (µmol/l)26 - 85 µmol/l
	C1	8,2	31
	C2	8,6	26
	C3	8,6	20
	C4	11,8	29
	C5	14,9	28
	C6	10,1	29
	C7	10	30
	C8	9,3	30
	C9	9,1	32
	C10	8,0	35
	C11	6.2	42
	C12	9.7	35
	C13	8.9	26
	C14	11	29
	C15	9,0	31

C. control

Table 2. Mean vitamin E and C levels in breast and prostate cancer cases

	Breast cancer		Prostate cancer		Average difference	df	Statistique T	Critical value	p-value
	Medium	Standard deviation	Medium	Standard deviation					
Vit E	8,07	1,43	7,09	3,76	0,98	13	0,72	2,16	0,483
Vit C	18,24	11,98	18,08	12,61	0,16	13	0,02	2,16	0,980

Df. degree of freedom

Observation 1. No significant differences were found in the amounts of vitamin E and C in either breast or prostate cancer. Both micronutrients were present in patient plasma although there is a slight increase in vitamin E in breast cancer.

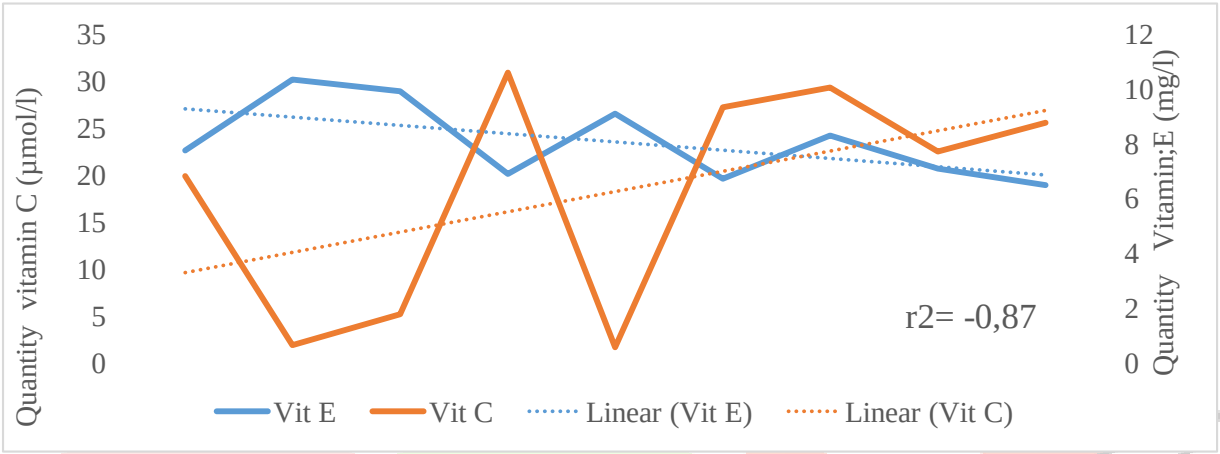

Figure 1. Assessment of vitamin E and C levels in breast cancer cases

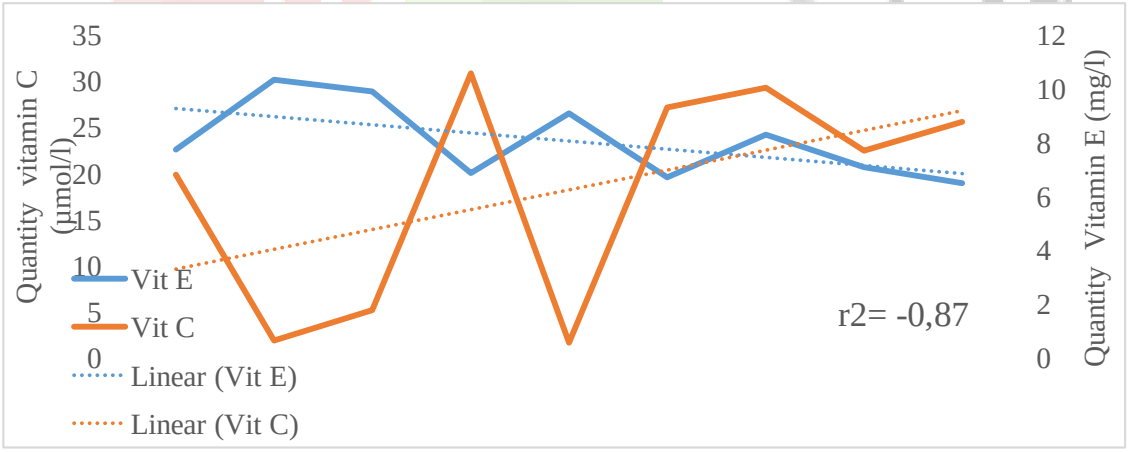

Figure 2. Evaluation of the amount of Vitamin E and C in prostate cancer cases

Observation 2. Overall, the amount of vitamin E varies inversely with the amount of vitamin C: an increase in one causes a decrease in the other. This relationship is barely noticeable in healthy individuals with a low correlation coefficient (r2) (0.36). In cases of prostate cancer, this correlation is all the more visible, but it is in cases of breast cancer that it is strong and flagrant (r2= - 0.87).

4. Discussion

Under normal physiological conditions, there is a synergy between α-T and ascorbic acid to prevent an imbalance in the pro-oxidant/antioxidant balance (11). In addition, vitamin C (VC) can indirectly regenerate vitamin E (VE), thus stabilising the concentration of α -T.

Plasma determinations (prior to any treatment) of α -T and its cofactor VC in breast and prostate cancer patients have revealed that :

- Overall, there is no deficiency of α -T in either type of cancer (Table 2),

except for one patient x, with prostate cancer, who showed a very low level of α -T. The values obtained, although normal, are high as they are close to the maximum threshold. The mean α -T observed for breast cancer is 8.07 (± 1.43) mg/l with extremes ranging from [6.5 - 11.2], with a confidence interval (CI) of [95%]. It is 7.09 (± 3.76) mg/l, CI [95%] for prostate cancer.

- However, there are variations in both tumour types: patients with

However, there are variations in both tumour types: patients with breast cancer have slightly higher α -T levels than those affected by prostate cancer (Table 1). This difference can probably be explained by the presence of a large amount of adipose tissue in the mammary gland which is a target tissue for EV storage. Data from the literature reveal that the adipocyte stock of EV is easily mobilised under conditions of hyper-metabolism and oxidative stress such as cancer (12).

- As far as VC is concerned, low levels were found in six patients, three of whom had

prostate cancer. The synergy between α -T and VC makes it possible to understand, among other things, that patient x with a very low level of α -T, also presented a strong decrease in plasma VC, probably related to the diet. Paradoxically, five patients with normal but extreme α -T values, ranging from [9.1-11.2], also had low VC levels.

One study reports that under pathological conditions elevated α-T can also lead to vitamin C deficiency (8). Indeed, the authors explain that α-T, by trapping peroxyl radicals during oxidative stress (which in this case is caused by cancer), is oxidised to the tocopheroxyl radical (α-TO-). This radical is immediately regenerated by vitamin C (ascorbate) into α-T. When all the ascorbate has been used to regenerate the radical form of α-T, the latter can no longer be regenerated and its concentration gradually decreases (8). Under such conditions, fluctuations in vitamin C (as observed in our study) may occur, which may unbalance the synergistic system between antioxidants and generate an imbalance in the pro-oxidant/antioxidant balance, which is a source of deleterious ROS for the body.

Conclusion

This study has shown that the plasma level of alpha tocopherol firstly, that vitamin deficiencies are not rare. Secondly, the plasma level of alpha tocopherol varies inversely with that of vitamin C. Hence the interest in taking into account the vitamin status of these two micronutrients beforehand and combining them during a supplementation. In order to avoid possible negative effects of this vitamin therapy.

Contributions from the authors:

Franck Arnaud Moukobolo Kinsangou and Henriette Poaty: conception, design of the methodologie and writing of the article. Koumou Onanga: analysis, interpretation of data and critical review of the article; Etienne Mokondjimobe: critical review of the article; Jean Félix Peko: critical review of the article; Ange Antoine Abena: final approval of the version to be published. All authors have read and approved the final version of the manuscript.

Conduct of experiments, data analysis: Franck Arnaud Moukobolo Kinsangou

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Conflict of interest

We do not declare any conflict of interest related to this article.

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