# Assessing Vitamin E status in the Parental Nutrition (PN) Population in accordance to ESPGHAN guidance[1]: Comparing Serum Vitamin E levels to the Vitamin E:Cholesterol ratio

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## Introduction

ESPGHAN guidance recommends measuring both serum vitamin E and its lipid ratio to accurately monitor vitamin E status amongst paediatric patients on PN[1]. Alpha-tocopherol, the surrogate marker for vitamin E, is affected by lipid levels and as concentrations rise, vitamin E deficiency can be missed.[2,3] Vitamin E deficiency can result in neurological sequalae.[4] With cases reported in children with chronic cholestasis with normal vitamin E level but low vitamin E:cholesterol ratio.[4,5] To our knowledge this is the first study evaluating the impact of these recommendations.

## Method

In February 2020, at Royal Manchester Children's Hospital, 34 children (<17 years old) were administered home PN. In this cohort the cholesterol ratio was utilised to determine the vitamin E : lipid ratio. Retrospective serum vitamin E level, cholesterol level, vitamin E:cholesterol ratio and hepatic profile were collected from the electronic laboratory system for specimens received between October 2019 to February 2020. Data were collated and analysed within Microsoft Excel 2017. Two patients did not have vitamin E:cholesterol ratio performed and were excluded, resulting a final study population of 32 patients, *see table 1.*

***Table 1: Study Demographics***

| | Overall Population (n=32) | Abnormal Hepatic Profile (n=13) |
|---|---|---|
| Gender (male, female) | 16 (50%), 16 (50%) | 6 (46%), 7 (54%) |
| Age (month, years) | 6.6 (9mth-15yrs) | 7 (2-14yrs) |
| Weight (kg) | 19.5 (8.46 - 44.8) | 19.6 (9.1-32) |

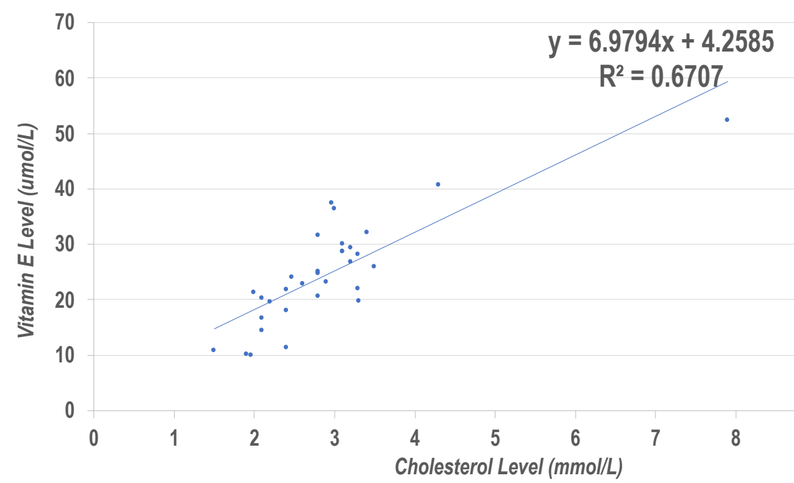
## Results

A positive relationship ($R^2$=0.6707) between cholesterol and vitamin E levels was demonstrated, as seen in *figure 1*. In the cohort, the mean vitamin E and cholesterol levels were within the normal range but vitamin E:cholesterol ratio elevated, *see table 2*. High proportion of children had normal serum vitamin E level (75%,n=24), whilst levels were low in 4 patients (12.5%) but high in the remaining (12.5%,n=4). The majority (94%;n=30) had a normal cholesterol levels with elevated level in the remaining (n=2). Many patients (66%, n=21) had an elevated vitamin E:cholesterol ratio and was normal in the remaining patients (n=11;34%). Notably, no patients had a low ratio.

***Table 2: The mean values for the overall cohort (n=31) and those with abnormal hepatic profile (n=13)***

| | Overall Population (n=32) | Abnormal Hepatic Profile (n=13) |
|---|---|---|
| Vitamin E level (11.6 - 34.8 mmol/L) | 24.4 (10.0 - 52.4) | 24.6 (10-52.4) |
| Cholesterol level (0 - 4 mmol/l) | 2.9 (1.9 - 7.9) | 3.0 (1.9-7.3) |
| Vitamin E : Cholesterol Ratio (3.85 - 7.56 ummol/mmol) | 8.5 (4.75 - 12.60) | 8.2 (4.75-12.6) |

***Figure 1: Within the entire cohort (n=32) the relationship between cholesterol and vitamin E levels***




Those patients with low vitamin E level (n=4) all had a normal vitamin E:cholesterol ratio. Thus, in accordance with the ESPGHAN guidance[1] these patients had a normal vitamin E status. In this subgroup, if the serum vitamin E level alone had been measured these patients would have undergone PN adjustments which were not clinically indicated.

Hepatic profile was performed in 94% (n=30) and derangement was noted in 41% (n=13). In this sub-cohort, the mean vitamin E, cholesterol levels and vitamin E:cholesterol ratio were similar to the entire cohort, *see table 2.* One patient demonstrated cholestasis (raised ALP and GGT) and associated abnormal synthetic liver function (raised PT time, normal albumin) with a normal vitamin E:cholesterol ratio (and cholesterol level) but high vitamin E level; thus, deficiency would not have been missed.

No patients had a low vitamin E:cholesterol ratio. These results are not keeping with other studies[2]. This could be attributable to the small study size. Also, as increased age is a risk factor for elevated lipid levels, this paediatric only population could be a limitation of this study.

## Conclusion

In accordance with the ESPGHAN guidance this study demonstrated the utility of measuring the vitamin E:cholesterol ratio to define the vitamin E status amongst the home PN population with potentially associated economical and logistical benefit.

## Reference

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