

The role of baseline serum 25(OH)D concentration for a potential personalized vitamin D supplementation

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Motivation

- Many fields in nutrition where individuals respond differently to dietary interventions: heterogeneity in weight loss, in postprandial glycemia, etc...
- Personalized Nutrition aims to address such plurality in intervention responses delivering personalized nutritional recommendation
- But how to handle with individualized information, given the fact that many statistical approaches are conceived for evaluating average effects at the population level?

Suggested procedure

- Consider an outcome of interest, some covariates, a standard intervention ($k=1$) and an experimental intervention ($k=2$)
- Estimate the two linear multiple regressions within each intervention group. Focus on their difference
$$m_2(x, \hat{\beta}_2) - m_1(x, \hat{\beta}_1)$$
- Estimate parametrically the *net gain for preferring one intervention over the other* by new statistical methods (Ferrario et al. (2021) J Nutr Sci 10e23; Ritz et al. (2019) Eur J Clin Nutr 73(11):1529–35)

Vitamin D – illustrative example

- We reevaluated data from a randomized controlled trial (RCT), by Steenhoff et al. (2015) Plos One 10(2):e0117123
- We considered the serum 25(OH)D concentration as outcome of interest, baseline serum 25(OH)D concentration, age, sex, weight as covariates, 12 weeks supplementation with 4000 IU/day cholecalciferol as standard intervention, with 7000 IU/day as experimental intervention
- How to achieve an improvement in the serum 25(OH)D concentration by preferring one intervention over the other? Which is the role of baseline serum 25(OH)D concentrations for preferring the standard or the experimental intervention?

Results

- No statistically significant difference between the two supplementation doses in average by standard statistical analysis comparing means
- High heterogeneity in individual responses
- Estimation of the net gain resulted in a (significant) prediction of increased effect of supplementation by 7000 IU/day than by 4000 IU/day for participants with baseline serum 25(OH)D concentration greater than 40.5 ng/ml

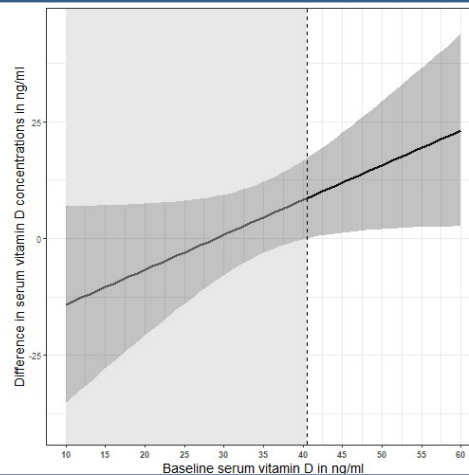


Figure 1: Fitted regression line with 95% confidence band estimating parametrically the net gain for preferring one intervention over the other, with respect to the baseline. White background for confidence band not crossing the zero.

Conclusions

- Baseline serum 25(OH)D concentrations could predict serum 25(OH)D concentrations after intervention: for individuals starting with higher baseline concentrations, the intervention by the higher dose could be needed in order to reach a further increment
- Re-evaluation of data can give new insight
- Estimation of individualized responses as first step in order to develop criteria for a potential, future personalized intervention
- Similar results could be derived for further micronutrients, for further outcomes of interest, for further designs (i.e., cross-over)

Data-availability

Statistical analyses are freely available at [zenodo.org](https://zenodo.org/10.5281/zenodo.5546570), [10.5281/zenodo.5546570](https://zenodo.org/10.5281/zenodo.5546570)

Data are freely available at

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0117123>

and at <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0071042>

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