

# Effects of improving diet quality on the Dietary Inflammatory Index in Rheumatoid Arthritis – The MEDRA Study



School of  
Allied Health

N.Canning<sup>1</sup>, A.Wrenne<sup>1</sup>, T. Raad<sup>1</sup>, A. Tierney<sup>1,2</sup>

<sup>1</sup>School of Allied Health, University of Limerick

<sup>2</sup> Health Research Institute, University of Limerick

## Background

- Rheumatoid arthritis (RA) is an autoimmune, inflammatory condition (1). RA affects 1 in 200 people worldwide (1), and 40,000 people in Ireland (2).
- The exact aetiology of RA remains unclear (3). Symptoms include pain, stiffness, and swelling of the joints (4).
- Anti-inflammatory diets, such as the Mediterranean Diet (MedDiet) have shown promising effects on disease activity in RA (5).
- Dietary inflammatory index (DII) describes the inflammatory potential of the diet and has been associated with risk of RA (6).
- However, to the best of our knowledge, there are no studies exploring the effects of improving diet quality on the DII in RA and its associated changes in RA symptoms and quality of life.

**Aim:** To assess the effects of adhering to a MedDiet and the Irish Healthy Eating Guidelines (HEG) on change in energy adjusted DII (eDII) and to determine whether change in eDII scores are associated with improvement in physical function and quality of life in adults with RA in Ireland.

## Methods

### The MEDRA study:

- A 12-week parallel-group, tele-health delivered RCT which analysed two dietary interventions as part of the management of RA (7).
- Participants of the MEDRA study (n=40) were randomised to a MedDiet or a HEG intervention for 12- weeks.
- Participant dietary intake data was collected via 3-day food diaries.
- Outcome measures (changes in physical function and quality of life) of the MEDRA study were assessed at baseline, week 6 and week 12.
- Participants completed self-administered validated questionnaires including the Health Assessment Questionnaire- Disability Index (HAQ-DI) and Rheumatoid Arthritis Quality of Life (RAQoL).

### Deriving DII & eDII:

- DII was calculated based on the food diaries collected. Calculation of DII and eDII scores was carried out by Connecting Health Innovations.
- To calculate the DII of the sample, 39 of a possible 45 food parameters were included.
- To account for the relationships between energy and nutrient intakes, energy-adjusted DII (eDII) was calculated.

### Data Analysis:

- Between and within group data were analysed in SPSS V.29. Data were analysed using the Kruskal-Wallis test and one-way ANOVA.
- Change in nutrient intakes across tertiles of post-intervention change in eDII score, irrespective of dietary group assignment were also analysed. Significance was set at p<0.05.

## Results

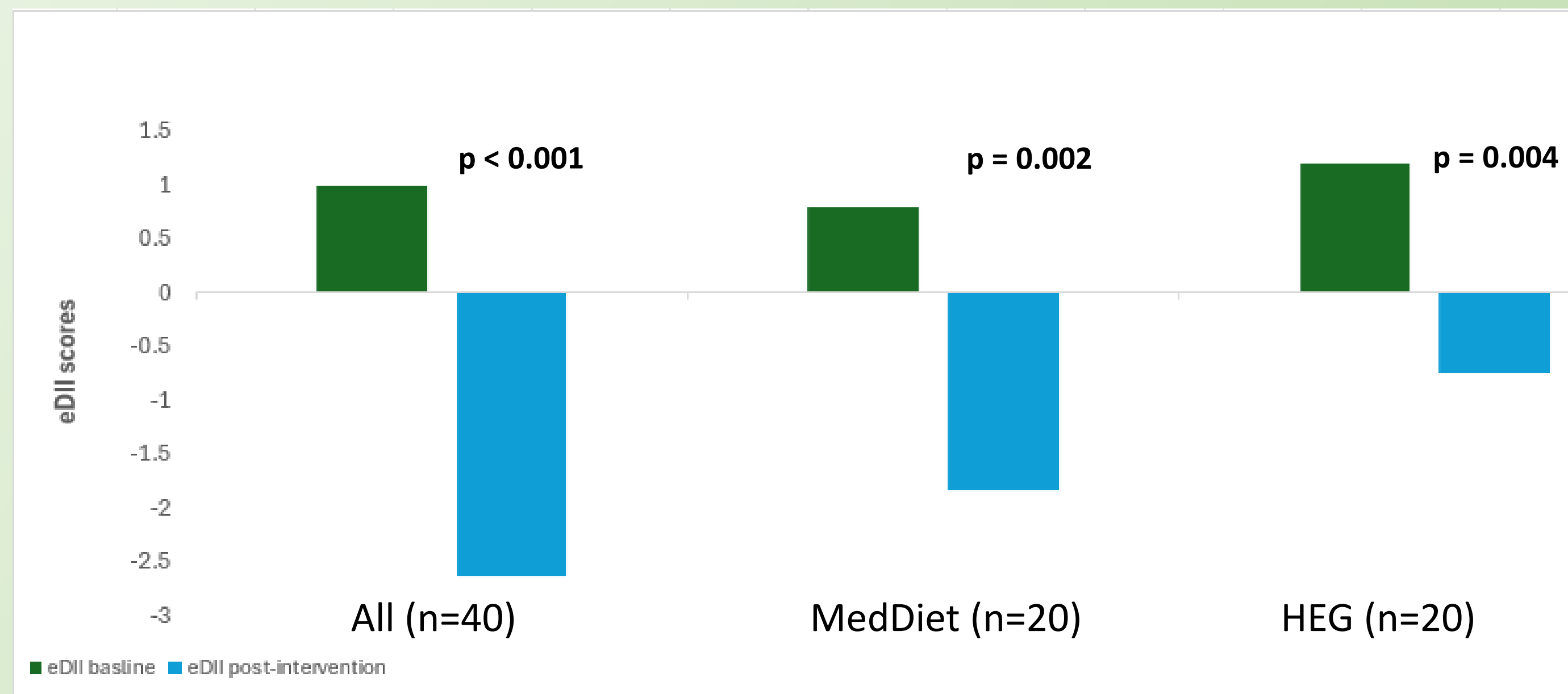
**Table 1.** Baseline Characteristics of total cohort (n=40)

|                                                      | Mean ± SD   |
|------------------------------------------------------|-------------|
| Age (years)                                          | 47.5 ± 10.9 |
| Females, n (%)                                       | 35 (87.5)   |
| Anthropometry                                        |             |
| Height (m)                                           | 1.6 ± .01   |
| Weight (kg)                                          | 72.1 ± 14.7 |
| BMI (kg/m <sup>2</sup> )                             | 26.7 ± 5.1  |
| Disease duration (years)                             | 9.5 ± 9.6   |
| DMARD use, n (%)                                     | 39 (97.5)   |
| Patient-reported pain levels [0-100]                 | 42.6 ± 25.8 |
| Patient-reported overall health status score [0-100] | 47.9 ± 27.7 |
| RAQoL score                                          | 10.7 ± 7.3  |
| HAQ-DI score                                         | 1.1 ± 0.6   |

- 40 participants completed the intervention study. The majority of participants were female (87.5%), and the mean age +/- SD was 47.5 ± 10.9 years.
- Mean BMI was 26.7 ± 5.1kg/m<sup>2</sup> and disease duration was 9.5 ± 9.6 years.
- At baseline, there were no significant differences observed between diet intervention groups for any demographic or clinical variables, with the exception of HAQ-DI (p = 0.006), which was significantly lower in the MedDiet group (0.9±0.5) compared to the HEG group (1.4±0.7).

- Mean DII scores were not significantly different between the two diet groups at baseline (MedDiet: 1.79±2.26 vs. HEG: 2.67±2.08, p= 0.207). This was also true for mean eDII scores (MedDiet: 0.79±2.60 vs. HEG: 1.20±2.16, p=0.588).
- Post-intervention, the mean DII scores were 0.03±1.77 and 1.5±2.56 for MedDiet and HEG, respectively. For the eDII, the mean scores were MedDiet: -1.84±1.54 vs. HEG: -0.76±1.91.
- Both dietary intervention groups demonstrated significant improvements in eDII (p<0.005).

**Figure 1.** eDII post 12-week dietary intervention for the MEDRA participants.



## Results

**Figure 2.** Change in DII and eDII between HEG and MedDiet.

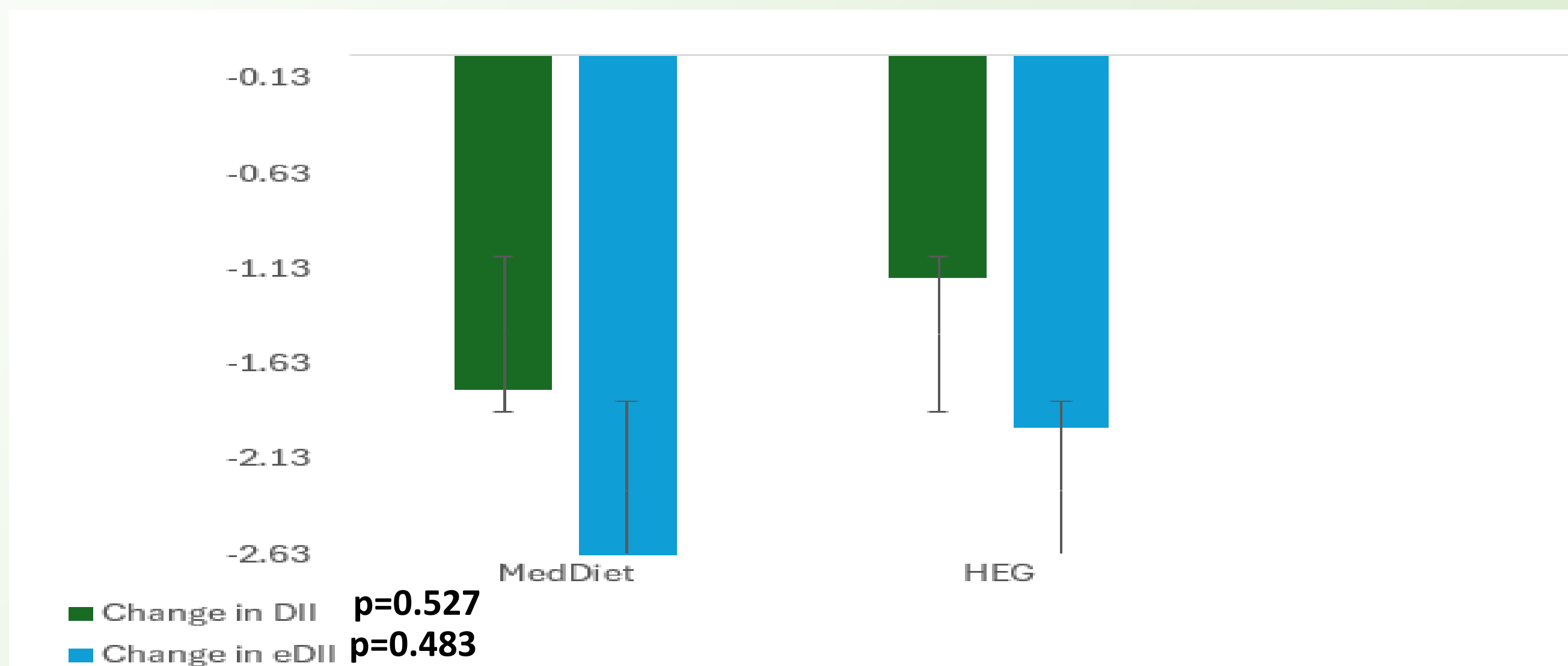


Figure 2 demonstrates the degree of change in DII and eDII post-intervention in each assigned diet group. The observed change in DII and eDII was greater in the MedDiet group (-1.76 ± 3.14, -2.63 ± 3.22, respectively) compared to the HEG group (-1.18 ± 2.64, -1.96 ± 2.69, respectively), but change between groups was not statistically significant (p>0.05).

**Table 2.** Patient reported outcome measures at 12 weeks, post-dietary intervention, across tertiles of change in eDII score.

| Variable                                             | T1 (≤-3.23)<br>n= 14 | T2 (-3.23- -0.69)<br>n= 12 | T3 (-0.68+)<br>n= 14 | p-value |
|------------------------------------------------------|----------------------|----------------------------|----------------------|---------|
| Patient-reported pain levels [0-100]                 | 19.1 ± 19.6          | 34.2±35.4                  | 19.7±24.2            | 0.821   |
| Patient-reported overall health status score [0-100] | 21.4±26.4            | 28.3±28.1                  | 36.6±33.7            | 0.496   |
| RAQoL score                                          | 4.6±6.0              | 6.1±6.0                    | 7.1±5.9              | 0.328   |
| YPAS- Summary Index                                  | 70.5±30.5            | 64.6±31.3                  | 52.5±27.1            | 0.366   |
| HAQ-DI score                                         | 0.7±0.7              | 0.8±0.5                    | 0.9±0.5              | 0.199   |

- There were no significant differences observed for patient-reported outcome measures across tertiles of eDII change, irrespective of dietary assignment. However, participants categorised into T1 – who's diet was the most anti-inflammatory at 12 weeks, post-intervention, had a lower HAQ-DI and patient-reported overall health score, indicating better physical function and better health status.

**Table 3.** Significant change in nutrient intakes across tertiles of post-intervention change in eDII score.

| Intake Change Variable | T1 (≤-3.23)<br>n= 14 | T2 (-3.23- -0.69)<br>n= 12  | T3 (-0.68+)<br>n= 14        | p-value |
|------------------------|----------------------|-----------------------------|-----------------------------|---------|
| Omega-3 (g)            | 1.4±1.3              | 1.9±2.2 <sup>‡</sup>        | -0.3±0.9 <sup>‡</sup>       | 0.002   |
| Dietary Fibre (g)      | 7.7±6.6              | 2.2±7.9                     | -1.1±6.5 <sup>‡</sup>       | 0.008   |
| Vitamin A (µg)         | 1276.4±1510.7        | -349.7±792.4 <sup>‡</sup>   | -138.8±776.6 <sup>‡</sup>   | 0.003   |
| Vitamin E (mg)         | 5.4±7.1              | 1.4±5.9                     | -1.3±2.8 <sup>‡</sup>       | 0.001   |
| Folic Acid (µg)        | 84.6±134.0           | 87.4±66.2 <sup>‡</sup>      | -675.8±2365.6               | 0.006   |
| Beta Carotene (µg)     | 7140.6±7565.4        | -1288.9±4666.0 <sup>‡</sup> | -1292.6±4686.3 <sup>‡</sup> | 0.004   |

<sup>‡</sup>Significant difference between tertile 1 and 2, P < .0017 (Bonferroni correction).

<sup>‡</sup> Significant difference between tertile 1 and 3, P < 0.017 (Bonferroni correction).

<sup>‡</sup> Significant difference between tertile 2 and 3, P < 0.017 (Bonferroni correction).

- Significant differences were observed between change in eDII tertiles for intakes of the nutrients outlined in Table 3. The significant differences were most frequently observed between tertile 1 and 3.
- Participants in T1 had the greatest increase in their intake of dietary fibre, vitamin A, vitamin E and beta carotene. T2 had the greatest increase in omega-3 and folic acid intake. Intake of all these nutrients decreased in T3.

## Limitations

- Only 39 out of 45 food parameters were employed when calculating the DII, which may under/over-estimate the inflammatory potential of the diet.
- No biochemical data was collected, therefore objective measures such as inflammatory markers could not be assessed.

## Conclusion

- Following a MedDiet or the Irish HEG significantly reduced DII and eDII scores in patients with RA.
- No significant difference between eDII scores in relation to RA patient-reported outcomes post-intervention were observed in this study.
- Further research is warranted to investigate the impact of the MedDiet and HEG on change in DII and eDII scores with associated changes in more objective measures of RA with larger numbers required for subjective measures.

## References

- Aletaha D, Neogi T, Silman AJ, Funovits J, Felson DT, Bingham CO, et al. 2010 Rheumatoid arthritis classification criteria: An American College of Rheumatology/European League Against Rheumatism collaborative initiative. *Arthritis & Rheumatism*. 2010;62(9):2569–81.
- Bevan, S., McGee, R. & Quadrello, T. (2009) Fit for Work? Musculoskeletal Disorders and the Irish Labour Market, London: The Work Foundation CARD (2018). Arthritis in Ireland. [online] The Centre for Arthritis and Rheumatic Diseases. Available at: <https://arthritisvuh.com/arthritis-in-ireland/>.
- Radu, A.-F. and Bungau, S.G. (2021). Management of Rheumatoid Arthritis: An Overview. *Cells*, [online] 10(11), p.2857. doi:<https://doi.org/10.3390/cells10112857>.
- Wasserman AM. Diagnosis and management of rheumatoid arthritis. *American Family Physician* [Internet]. 2011 Dec 1;84(11):1245–52. Available from: <https://pubmed.ncbi.nlm.nih.gov/22150658>
- Old 6)Vadell, A.K.E., Bärebring, L., Hulander, E., Gjerdtsson, I., Lindqvist, H.M. and Winkvist, A. (2020). Anti-inflammatory Diet In Rheumatoid Arthritis (ADIRA)—a randomized, controlled crossover trial indicating effects on disease activity. *The American Journal of Clinical Nutrition*, 111(6). doi:<https://doi.org/10.1093/ajcn/nqaa019>.
- Hebert JR, Shivappa N, Wirth MD, Hussey JR, Hurley TG. Perspective: The Dietary Inflammatory Index (DII®): Lessons Learned, Improvements Made and Future Directions. *Adv Nutr*. 2019;10:185-95.
- Raad, T., George, E., Griffin, A., Larkin, L., Fraser, A., Kennedy, N. and Tierney, A. (2022). A randomised controlled trial of a Mediterranean Dietary Intervention for Adults with Rheumatoid Arthritis (MEDRA): Study protocol. *Contemporary Clinical Trials Communications*, 28, p.100919. doi:<https://doi.org/10.1016/j.conctc.2022.100919>.