

# The suitability of dietary recommendations suggested By artificial intelligence technology via a novel personalised nutrition mobile application

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A healthy lifestyle is essential to prevent non-communicable diseases<sup>(1)</sup> and new advances in information computer technology and artificial intelligence (AI) offer the possibility to create personalised tools to better support healthy living. This analysis aims to assess the appropriateness of AI recommended dietary goals as part of the EU PROTEIN project<sup>(2)</sup>, which combines the latest AI technology with expertise in nutrition to develop an advanced and dynamic personalisation tool.

A knowledge base to underpin the PROTEIN application was generated by nutrition experts, creating a novel evidence-based set of EU-relevant dietary 'rules' and 'targets' for specific user groups. The AI advisor, which is an autonomous intelligent entity, incorporates a deep learning component to generate and update recommendations for the user's dietary intake based upon their dietary preferences, daily intake, lifestyle and physiological variables. Initial piloting of the system used virtual users to evaluate and verify the first prototype. 'Extreme' virtual participants were developed to capture specific food allergies/ dietary preferences from three separate target groups: 1) adults who are overweight (OW, BMI 25-29.9 kg/m<sup>2</sup>); 2) adults with iron-deficiency anaemia (ID, haemoglobin <120 mg/L) and 3) adults with poor quality diets (PQD, <2-3 portions fruit and veg per day) and registered on the system for up to 2 weeks each. Data on the meal plans generated for each user were extracted from PROTEIN and compared quantitatively and qualitatively to the nutrition guidelines developed by the experts. Statistical analysis was performed using one-way ANOVA, significance was set at  $p \leq 0.05$ .

The PROTEIN-app generated iron intakes were conservative for the male ID group ( $15.7 \pm 2.3$  mg/d) but not the female ( $13.0 \pm 2.8$  mg/d) when contrasted to the expert-established targets (16 and 11mg/d respectively). PROTEIN app-suggested daily protein intakes were non-significantly higher than recommendations for all groups ( $1.1-1.4 \pm 0.3$ g/kg/BW 'v'  $0.66$ g/kg/BW). Whilst mean fat recommendations were within target ranges for all groups (OW:  $28.6 \pm 1.8$ , ID:  $29.7 \pm 1.3$ , PQD:  $29.5 \pm 1.2$ ) proposed intakes for individual users exceeded the <30%EI upper limit. Qualitative analysis of meal plans identified some inappropriate items not adhering to the user restrictions or preferences entered at set up.

Pilot testing of the personalised nutrition application via 'extreme' virtual users has proved essential in confirming system adherence to the established rule set, the feasibility of that rule set across multiple goals and in identifying safety issues. Ongoing development work will identify the foods contributing to total fat intake, as the only sub-optimal aspect of the app-generated nutrient profiles, and test possible solutions, including food substitution and portion adjustment. Qualitative errors in recommended foods are being used to further train the system, human trials of which will subsequently assess its ability to support behaviour change.

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## References

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