Diet Quality Assessment in Adults with Cystic Fibrosis


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Project Funding

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Project Design

• Application placed a large emphasis on PPI.
• Case study of excellence.
Background

**Advancements in Treatments & Clinical Practice**

Improved Lung & pancreatic function [1]; Intestinal pH [2]. Resulting in:
- Reduced resting energy expenditure.
- Improved food & nutrient absorption.
- Improved nutritional status (BMI).
- Increased life expectancy:
  - *F508del-CFTR* genotype & Kaftrio: 71.6 years old predicted survival age [3].

**Emerging Metabolic Clinical Comorbidities**

Prevalence of overweight / obesity: 40% [4]
- 2001-2018: +1.1%/year.
- 2018-2021: +3.5%/year.

Prevalence of cardiovascular disease (CVD) risk factors:
- Dyslipidaemia: 62% (*n* = 108; pancreatic insufficiency (PI): 81%) [5].
- History of Ischaemic heart disease: 22.5% (*n* = 422) [6].
Systematic Review (SR) on Diet in CF

SR Title
- What do people with cystic fibrosis eat? Diet quality, macronutrient and micronutrient intakes (compared to recommended guidelines) in adults with cystic fibrosis – a systematic review (Submitted for publication in JCF) [7].

SR Aim
- To synthesise and assess existing literature on dietary intakes of adult PWCF, focusing on macro- and micro-nutrient intakes and diet quality in relation to nutrition guidelines.

Inclusion Criteria
- Studies examining clinically stable (no previous lung transplant or recent pulmonary exacerbations) adults with CF which included assessment of nutritional intake, habitual diets, diet patterns or diet quality using dietary assessment methods.

Key Findings
1. 19 cohorts: 724 adults with CF.
2. Overall, poor diet quality was reported for adults with CF.
3. Lack of data available on diet quality in CF.
4. Most adult CF cohorts achieved adequate energy intakes (Europe / Australasia: 110-200%; USA: 125%).
5. Studies reporting total energy intake (TEI) from fat (30.0-39.4%) were above CF guidelines (clinically stable: 20-30%).
6. Micronutrient & oral nutritional supplements helpful in achieving most micronutrient recommendations.
7. In the current era of variant-specific therapies, intakes reported may pose a risk for developing diet related chronic diseases (i.e., obesity, CVD, type-II diabetes).
### SR on Diet in CF

Table 1. Diet quality assessment using validated tool (HEIFA-2013 / HEI-2015) and food serves/day.

<table>
<thead>
<tr>
<th>Dietary Measure</th>
<th>Bass et al.* (USA)</th>
<th>Bellissimo et al.~ (USA)</th>
<th>USA Guidelines(^a)</th>
<th>Armaghanian et al.* (Australia)</th>
<th>Alfred Group* (Australia)</th>
<th>Australian Guidelines(^b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DQS (0-100)</td>
<td>46.0 (13.2)</td>
<td>48.3 (9.9)</td>
<td>59(^c)</td>
<td>-</td>
<td>63.5 (8.2)(^d)</td>
<td>-</td>
</tr>
<tr>
<td>Wholegrains (%)</td>
<td>-</td>
<td>18 (6)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Refined grains (%)</td>
<td>-</td>
<td>82 (16)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Grains (serves)</td>
<td>-</td>
<td>-</td>
<td>6</td>
<td>8.2 (2.6)</td>
<td>-</td>
<td>4-6</td>
</tr>
<tr>
<td>Fruit (serves)</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1.9 (1.4)</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>_ % met guidelines</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>8.3</td>
<td>-</td>
</tr>
<tr>
<td>Vegetables (serves)</td>
<td>-</td>
<td>-</td>
<td>2.5</td>
<td>5.2 (2.8)</td>
<td>1.4</td>
<td>5-6</td>
</tr>
<tr>
<td>_ % met guidelines</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>Protein foods (serves)</td>
<td>-</td>
<td>-</td>
<td>5.5</td>
<td>3.7 (1.6)</td>
<td>-</td>
<td>2-3</td>
</tr>
<tr>
<td>Dairy (serves)</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>2.5 (1.5)</td>
<td>2.6</td>
<td>2.5</td>
</tr>
<tr>
<td>_ % met guidelines</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>45.8</td>
<td>-</td>
</tr>
<tr>
<td>Discretionary foods (%E)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>29</td>
<td>-</td>
</tr>
</tbody>
</table>

*uses mean (SD). ~ uses median (IQR). a Dietary Guidelines for Americans - RDA per 2000kcal (8). b Australian Dietary Guidelines (47). c USA population HEI-2015 score (8). d Obtain through assessment against HEIFA-2013. DQS are obtained through assessment against HEI-2015 unless stated otherwise. Abbreviations: DQS Diet Quality Score, SD Standard Deviation, IQR Interquartile Range, RDA Recommended Daily Allowance HEI Healthy Eating Index, HEIFA Healthy Eating Index for Australian Adults.
To analyse habitual **dietary intakes** of clinically stable Irish adults with CF, comparing to **CF dietary guidelines** and assess **diet quality** with **population specific healthy eating guidelines**.
## Methods

**Study design:** Observational, cross-sectional study.

**Eligibility assessment:** Online screening questionnaire.

**Quantitative data:** Demographic & self-reported health questionnaire.

**Dietary data:** 3-day food diary via Libro from Nutritics (mobile app) & food frequency questionnaire.

**Inclusion Criteria:** Adults ≥18 years of age with a diagnosis of CF, living in Ireland.

**Exclusion criteria:**
1. Not on stable regimen for ≥4 weeks prior to commencing the study with no recent pulmonary exacerbations involving the administration of oral or intravenous antibiotics or glucocorticoids.
2. Following a prescription diet for another medical condition (e.g., coeliac disease, are pregnant).

1. EQ-5D-5L
2. PAGI/PAC-SYM
3. CFQ-R
Methods: Participant Recruitment

Irish CF Hospital Clinics
- Ospidéil OL UL Hospitals
- Cork University Hospital
- Galway University Hospitals
- St. Vincent’s University Hospital
- University Hospital Cork
- University Hospital Limerick
- St. Vincent’s University Hospital

Online Recruitment
- CF Ireland membership forums & social media profile advertisements

Researchers in University of Limerick are exploring Diet Quality in Cystic Fibrosis.

- Complete a 20-minute survey & a diet diary and receive a €50 ‘One4All’ gift card!

We would love to hear from you. If you want to find out more or to check your eligibility you can call, text our email or research team.

Contact our research assistant Cian at:
- Cian.Greaney@ul.ie
- 0831374554

Principal Investigator
Prof. Audrey Tierney (UL)
Methods: Data Collection

- Questionnaires
- Libro from Nutritics Ltd.
- 3-Day Food Diary
- Castor Electronic Data Capture System
Methods: Data Assessment

SPSS Statistics

Nutrition Guideline Comparisons
Results: Demographics & Self-Reported Health

- **No. of Participants**: n = 42 (35.7% male)
- **Age (years)**: 33.8 ± 10.8
- **FEV1%**: 79.4 ± 22.6
- **Pancreatic Insufficiency**: 52.4%
- **CF-Related Diabetes**: 26.2%
- **Fat-Soluble Vit. Supp.**: 85.6%
- **BMI (kg/m²)**: Mean ± SD: 23.8 ± 3.4
  - Underweight (<20): 9.5%
  - Normal (20-24.9): 57.1%
  - Overweight/obese (>25): **33.4%**
Macronutrient & Micronutrient Intakes

Table 2. Energy, macronutrient and micronutrient intakes in Irish adults with CF compared to CF nutrition guidelines.

<table>
<thead>
<tr>
<th>Nutrient Measure</th>
<th>Dietary Intake (mean ± SD)</th>
<th>CF Nutrition Guidelines (1, 8, 9)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>Energy (% gen. pop. guideline)</td>
<td>119.9 ± 45.3</td>
<td>0.168</td>
</tr>
<tr>
<td>Fat (% TEI)</td>
<td>37.6 ± 5.3</td>
<td>0.546</td>
</tr>
<tr>
<td>Carbohydrate (% TEI)</td>
<td>42.8 ± 6.2</td>
<td>0.890</td>
</tr>
<tr>
<td>Protein (% TEI)</td>
<td>18.5 ± 4.1</td>
<td>0.444</td>
</tr>
<tr>
<td>Saturated Fat (% TEI)</td>
<td>14.0 ± 2.9</td>
<td>0.101</td>
</tr>
<tr>
<td>Total Sugar (% TEI)</td>
<td>16.9 ± 5.6</td>
<td>0.927</td>
</tr>
<tr>
<td>Free Sugar (% TEI)</td>
<td>7.1 ± 4.0</td>
<td>5.0 ± 3.3</td>
</tr>
<tr>
<td>Fibre (g)</td>
<td>23.4 ± 9.6</td>
<td>0.072</td>
</tr>
<tr>
<td>Vitamin A (µg) ret. eq.</td>
<td>968.5 ± 641.1</td>
<td>1060.6 ± 732.7</td>
</tr>
<tr>
<td>Vitamin D (µg)</td>
<td>6.9 ± 9.0</td>
<td>0.646</td>
</tr>
<tr>
<td>Vitamin E (mg)</td>
<td>9.9 ± 3.7</td>
<td>9.9 ± 6.5</td>
</tr>
<tr>
<td>Vitamin K (µg)</td>
<td>59.4 ± 65.1</td>
<td>0.537</td>
</tr>
<tr>
<td>Calcium (mg)</td>
<td>1049.6 ± 538.9</td>
<td>0.989</td>
</tr>
<tr>
<td>Iron (mg)</td>
<td>12.6 ± 4.3</td>
<td>10.7 ± 5.4</td>
</tr>
</tbody>
</table>

Micronutrient intakes provided exclude supplementary contribution. Values are represented as male/female in cases where gender-specific nutrition guidelines exist, or significant differences were found. Abbreviations: SD standard deviation, gen. pop. general population, % TEI percentage of total energy intake, ret. Eq. retinol equivalent.
## Results: Serve intake compared to Irish Food Serve Guidelines

<table>
<thead>
<tr>
<th>Food Group</th>
<th>Serves/day (Mean ± SD)</th>
<th>% of Participants Meeting / Over Guidelines</th>
<th>Irish Food Serve Guidelines [9]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fruits &amp; Vegetables</td>
<td>2.6 ± 1.7 serves/day</td>
<td>11.9% met</td>
<td>5-7 serves/day</td>
</tr>
<tr>
<td>Grains</td>
<td>2.4 ± 1.2 serves/day</td>
<td>21.4% met</td>
<td>3-5 serves/day (males 19-50 years old: up to 7)</td>
</tr>
<tr>
<td>Dairy Products</td>
<td>2.0 ± 1.4 serves/day</td>
<td>14.3% met</td>
<td>3 serves/day</td>
</tr>
<tr>
<td>Protein Sources</td>
<td>2.7 ± 1.3 serves/day</td>
<td>52.4% over</td>
<td>2 serves/day</td>
</tr>
<tr>
<td>Fats, Spreads &amp; Oils</td>
<td>2.0 ± 1.6 serves/day</td>
<td>61.9% over</td>
<td>Very small amounts</td>
</tr>
<tr>
<td>Discretionary Foods</td>
<td>5.7 ± 2.9 serves/day</td>
<td>97.6% over</td>
<td>Not every day</td>
</tr>
</tbody>
</table>

Highlighted sections indicate where a **nutrient** is **above** or **below** the recommended **dietary intake** relative to nutrition **guidelines**.
Implications of Findings

**Diet Quality**

Based on comparisons to serving guidelines in Ireland, diet quality would seem suboptimal in adults with CF, with high fat & EDNP foods being overconsumed to achieve energy targets.

**Risk of Diet-Related Chronic Disease**

Saturated fat & sugar intakes are above heart health guidelines, indicating a potential risk for adults with CF to develop metabolic type diseases with sustained intakes & at risk phenotypes.

**Importance of Micronutrient Supp.**

Intakes of fat-soluble vitamins D, E & K are all suboptimal, highlighting the importance fat-soluble vitamin supplementation in CF. This study indicates that females with CF in Ireland are far below iron intake recommendations.
Future Directions & Take-Home Message

Future Directions

To assess interrelationship between diet quality & patient reported outcome measures

Collect experiences & views on nutrition in adults with CF to assess drivers of food & dietary choices, & enablers & barriers to dietary change.

Take Home Message

• Long-term consequences of EDNP diets in people with CF are unknown.
• Adverse effects associated with long-term suboptimal dietary intakes could pose equal risk to people with CF in diet-related chronic disease development as for the general population.
• Revision of dietary guidelines & practice change in the medical nutritional therapy of CF for optimal nutritional & health outcomes is necessary.
Acknowledgement & References

Acknowledgements

The authors would like to acknowledge the Health Research Board & Health Research Charities Ireland grant initiative with Cystic Fibrosis Ireland for funding this project as part of the HRB-HRCI Joint Funding Scheme 2020 [HRCI-HRB-2020-025]. This projects recruitment was completed in collaboration with Cystic Fibrosis Ireland membership forums & national cystic fibrosis hospital clinics across Ireland which included Cork University Hospital, University Hospital Galway, St. Vincent’s University Hospital & University Hospital Limerick.

Key References