Impact of glycomacropeptide-based medical foods used over 12 months by paediatric patients with phenylketonuria: a retrospective chart review

Allison Grech¹, Sarah Watkins¹,², Kiera Batten¹,³, Susan Thompson²,⁴

¹ – Department of Nutrition and Dietetics, The Children’s Hospital Westmead, Sydney
² – Nutrition and Dietetics Group, School of Life and Environmental Sciences, The University of Sydney,
³ – Genetic Metabolic Disorders Service, The Children’s Hospital Westmead, Sydney
⁴ - Sydney Nursing School, Faculty of Medicine and Health, The University of Sydney

Background

Dietary management of phenylketonuria (PKU) includes individualised dietary protein restriction supplemented by appropriate medical foods to maintain blood phenylalanine (phe) levels within therapeutic range. Poor adherence to protein-restricted diet and prescribed intake of PKU medical foods is common, particularly in the adolescent age group.

Traditionally, medical foods for PKU have been based on phenylalanine (phe)-free synthetic amino acids (AA). A recent addition are glycomacropeptide (GMP)-based products. GMP is an intact protein isolated from cheese whey which is naturally low in phe. PKU medical foods based on GMP are supplemented with essential amino acids and have a different flavour profile compared to AA products.

GMP based products have been available in Australia since 2012. Despite residual phe present in GMP products, studies have been mixed regarding their impact on blood phe levels. We reviewed the use and impact of GMP-based products on phe control for 2-18 year-olds managed at the Children’s Hospital at Westmead.

Method

Retrospective chart review of patients with PKU aged 2-18 years with at least 3 monitoring DBS per year (n=86):

- GMP group consumed GMP products for >12 months (n=13). Phe levels were compared at baseline (mean DBS phe for 12 months prior to consuming GMP product) and at 6 months (mean DBS phe 0-26 weeks) and 12 months (mean DBS phe 27-52weeks) following introduction of GMP
- Age-matched controls consumed AA products only (n=25)

SCHN Ethics Approval reference 2019/ETH12666
No conflict of interests to declare
Grateful thanks to Elizabeth Barnes, Biostatistician, The Children’s Hospital at Westmead for statistical support, and to ASIEM for funding conference attendance.
Results
A total of 28 patients (33%) trialed GMP products between 2012 and 2019, however, 15 were excluded due to inadequate DBS monitoring, lack of diet review, GMP use for less than 12 months or because of introduction of sapropterin pharmacotherapy. Of the remaining 13 patients, 58% had a diagnostic phe >1200µmol/L compared to 40% of the control group (NS, p=0.27).

The most common reason for change of medical food was poor historical compliance with AA based product (31%) and dislike of current AA product taste (23%). GMP-based products contributed 100% of medical food intake for 10 patients, and 20% for the remaining three patients. There was no significant difference in the protein equivalent prescribed from GMP or AA based products: (1.98±0.99g/kg at baseline and 1.85±0.52 g/kg at 12 months for GMP; 1.55±0.46g/kg at baseline and 1.48±0.49g/kg at 12 months for AA products).

| Change in phe level and percentage of phe levels outside therapeutic range between baseline and 12 months later were not significantly different between those consuming GMP or all AA products. There was a trend for higher mean phe for the GMP group compared to the AA group at baseline (373 and 287 µmol/L respectively) and at 7-12 months (399 and 294 µmol/L respectively).

<table>
<thead>
<tr>
<th>GMP group</th>
<th>AA group</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-7 years</td>
<td>6</td>
<td>11</td>
</tr>
<tr>
<td>8-12 years</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>13-18 years</td>
<td>3</td>
<td>5</td>
</tr>
</tbody>
</table>

Table 1. Age and gender of study group. (M = male).

![Figure 1. Phe levels (µmol/L) for AA and GMP groups at 3 time points: baseline (mean of previous 12 months), 6 months (mean of months 0-6), 12 months (mean of months 7-12). median and Q1-Q3 = horizontal line and box Mean = symbol Whiskers extend to 1.5x IQ range with points further out as outliers](image)
Results (continued)

Mean phe levels were higher in the 13–18 year old age group (n=3) than younger children, for those consuming GMP product.

**Figure 2.** Phe levels (µmol/L) by age:
1. 2-7 years (n=6),
2. 8-12 years (n=4)
3. 13-18 years (n=3)

- Therapeutic range (120-360)

Individually, the impact of 100% GMP introduction on phe levels was inconsistent. Despite a reduced dietary protein prescription, 4 patients had a mean phe above the therapeutic range following GMP introduction. Meanwhile, six children maintained levels in the therapeutic range after GMP introduction, with the same or increased dietary protein allowance.

**Figure 3.** Phe levels (µmol/L) of individual patients who consumed 100% medical food as GMP (n=10) at baseline (mean of previous 12 months), 6 months (mean of 0-6 months), 12 months (mean of 7-12 months).

**Conclusion**

In the clinical setting, GMP-based products may be acceptable and maintain phe control for some paediatric patients with PKU over a 12-month period. The impact of the residual phe content needs to be assessed individually and a slow introduction may be preferable. Further investigations with larger sample sizes are warranted.