HiPP ORS 200
Carrot and Rice-based Oral Rehydration Solution
Dietetic food for special medical purposes

Take advantage of nature’s power for

- fast and
- clinically efficient therapy

of acute gastroenteritis in infants and toddlers
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Abbreviations

WHO: World Health Organisation
ESPGHAN: European Society for Paediatric Gastroenterology, Hepatology and Nutrition
GPGE: Gesellschaft für pädiatrische Gastroenterologie und Ernährung – German Society for Paediatric Gastroenterology and Nutrition
ORS: Oral rehydration solution

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Introduction: Gastroenteritis in Infants and Toddlers

Epidemiology of Acute Gastroenteritis

Even in industrialised nations, infants and toddlers still suffer from diarrhoeal disorders quite commonly. According to a recent epidemiological overview, the annual incidence varies between 0.5 and 1.9 episodes per child (<3 years) in Europe. Worldwide, the highest prevalence rate is found in infants in the first year of life or at the time of weaning. The most common causes in industrialised nations are viruses. In infants and children <5 years, these viral diarrhoeas are caused mainly by rotaviruses (10-35%), but also by noroviruses (2-20%) or adenoviruses (2-10%) (ESPGHAN 2008). The primary bacterial causes are Campylobacter, Salmonella, Yersinia, E. coli (enteropathogenic subtype), and Shigella, which cause gastroenteritis. However, in up to 60% of cases no pathogen is found (ESPGHAN 2008).

Pathophysiology of Acute Gastroenteritis and Dehydration

Acute gastroenteritis can be especially dangerous for infants and toddlers because it causes dehydration of the infantile organism, i.e., a combined loss of fluid and electrolytes. This loss is caused by the intestinal fluid losses, and in extremely severe cases it can cause a fatal hypovolaemic shock. Severe electrolyte imbalances can affect sodium, chloride, bicarbonate and potassium levels. In the course of a diarrhoeal disorder, hyponatraemia can occur as the result of a variety of causes (e.g., volume deficit, reduced oral water intake or enhanced water reabsorption via the kidneys). Hypernatraemia is also possible (mainly due to mostly osmotic diarrhoea or feeding with high-sodium infant formulae, etc.). Generally, the total body sodium level is too low in every form of dehydration, as 8-12 mmol sodium/100 ml water/kg body weight are lost in diarrhoeal disorders. In parallel, chloride and bicarbonate is lost, as well as potassium in the case of marked renal and intestinal losses (50-90 mmol/litre potassium are lost with the stool or urine). Whilst the daily potassium supply of a healthy child is 1-2 mmol/kg body weight, the daily demand of 4-6 mmol/kg body weight is significantly higher during diarrhoeal disorders.

Historical Review of Establishment of the Pathophysiological Basis for Oral Rehydration

(Sharier M., 1994)

1902: Better Na+ absorption together with glucose
1962: Better NaCl and water absorption with 56 mmol/L glucose
1964: Effect of oral glucose electrolyte solutions on intestinal water/electrolyte balance
1968: Lowered net water loss through oral administration of solutions containing glucose
1969: Increased Na+ and water transport at a specific glucose quantum
1974: Oral glucose electrolyte solutions for therapy of cholera in children

Principle of Oral Glucose Rehydration Solutions

The understanding that water absorption in the bowel is linked to simultaneous transport of glucose and sodium, and the practical implementation of this understanding in the form of oral rehydration solutions (ORS) resulted in a dramatic decrease in the mortality rate of acute gastrointestinal infections in children worldwide (Rahaman MM 1979). By making use of the intestinal sodium co-transport, which remains intact even in infectious secretory diarrhoea, it is possible to rehydrate successfully within a relatively short time. Numerous controlled clinical studies showed that oral rehydration with a recommended ORS is equivalent to intravenous rehydration (Booth I 1992; Provisional committee on quality improvement, subcommittee on acute gastroenteritis, 1996; Hirschhorn NJ 1980). Nonetheless, WHO studies show that the form of oral rehydration therapy with an ORS has still not become as common in the so-called industrialised nations as would be desirable. A survey conducted throughout Europe only a few years ago showed that although paediatricians would treat a mildly dehydrated child without any additional clinical problems primarily with oral rehydration, only half of the general practitioners would do so (Szajewska H, 2000; Hauer AC 2003).
Acute diarrhoea is defined by changes in the frequency and/or consistency of stool which results in a greater stool volume (= stool volume over 10 g/kg body weight/day or over 200 g/day). Note: The physiological stool volume is 5-10 g/kg body weight/day or 100-200 g/day. Especially in the first months of life a change in stool consistency by comparison with the previously normal consistency is a better indication of acute gastroenteritis than a merely increased frequency of stools. Typically, acute diarrhoea lasts for less than 7 and not more than 14 days. Acute gastroenteritis is usually diagnosed clinically: The main symptoms are acute diarrhoea and/or acute vomiting. An accurate history is very important for adequate diagnostics and planning of the therapy, therefore the following should be asked: Possible underlying disorders of the child (metabolic and chronic intestinal disorders, immune deficiencies), acute illness in the environment and family, recent administration of antibiotics and other medications, as well as risk factors for bacterial infections, including EHEC (exposure through raw milk, uncooked meat, contact with cows, etc.) or dietary changes (e.g. switch to milk formulae or introduction of weaning foods in infants). In order to assess the acute clinical situation, the child’s age, the time of onset of the diarrhoea, the primary symptoms (stool frequency and consistency, especially in the last 24 hours) are very important. The current body weight (weight loss) and an estimate of the suspected fluid loss determine the further procedure. The fluid loss is assessed on the basis of the table and divided into three severities. The further (lab) diagnostics are based primarily on the severity of the diarrhoea: In the case of minimal or moderate dehydration an analysis of blood gas and electrolyte measurement is not imperative, since oral rehydration is identical and safe for both isotonic and for hypo- or hypertonic dehydration. In the case of severe dehydration the same measures as for other symptoms with threatening shock are indicated. Depending on the suspected clinical status, a virological, bacteriological or parasitological stool examination may be indicated.

<table>
<thead>
<tr>
<th></th>
<th>Minimal or no dehydration</th>
<th>Mild to moderate dehydration</th>
<th>Severe dehydration</th>
</tr>
</thead>
<tbody>
<tr>
<td>General condition, consciousness</td>
<td>Good, awake</td>
<td>restless, irritable or tired</td>
<td>Apathetic, lethargic, unconscious</td>
</tr>
<tr>
<td>Thirst</td>
<td>Normal</td>
<td>Thirsty, greedy to drink</td>
<td>Drinks little or cannot drink any more</td>
</tr>
<tr>
<td>Heartbeat</td>
<td>Normal</td>
<td>Normal to increased</td>
<td>Tachycardia, on further deterioration bradycardia</td>
</tr>
<tr>
<td>Pulse quality</td>
<td>Normal</td>
<td>Normal to reduced</td>
<td>Weak to missing</td>
</tr>
<tr>
<td>Breathing</td>
<td>Normal</td>
<td>Normal to deep</td>
<td>Deep acidotic breathing</td>
</tr>
<tr>
<td>Eyes</td>
<td>Normal</td>
<td>Recessed</td>
<td>Very recessed</td>
</tr>
<tr>
<td>Tears</td>
<td>Present</td>
<td>Reduced</td>
<td>Missing</td>
</tr>
<tr>
<td>Mucosa (mouth, tongue)</td>
<td>Moist</td>
<td>Dry</td>
<td>Desiccated</td>
</tr>
<tr>
<td>Skin folds (skinturgor)</td>
<td>Disappear immediately</td>
<td>Disappear slowly, but &lt; 2 seconds</td>
<td>Remain for &lt; 2 seconds</td>
</tr>
<tr>
<td>Capillary filling</td>
<td>Normal</td>
<td>Prolonged</td>
<td>Very prolonged</td>
</tr>
<tr>
<td>Extremities</td>
<td>Warm</td>
<td>Cool</td>
<td>Cold, cyanotic</td>
</tr>
<tr>
<td>Urine output</td>
<td>Normal or reduced</td>
<td>Reduced</td>
<td>Minimal</td>
</tr>
</tbody>
</table>

Table: Levels of severity of exsiccosis in dehydration (according to WHO), source: www.gpge.de, 2008
**Current Therapy Guidelines for Minimal to Moderate Dehydration in Acute Gastroenteritis**

(ESPGHAN, GPGE, AAP and WHO)

### “Nine Pillars of Adequate Treatment” for Acute Gastroenteritis

I. **Use of an oral rehydration solution**

II. **Hypotonic solution (Na 60 mmol/L, glucose 74-111 mmol/L)**

III. **Rapid oral rehydration in approx. 4 hours**

IV. **Subsequently rapid realimentation with normal diet (including weaning food)**

V. **Use of special formulas is not justified**

VI. **Use of water-diluted infant formulae is not justified**

VII. **Continue breastfeeding (at any time during illness)**

VIII. **Fluid replacement with oral rehydration solution**

IX. **No unnecessary medication**

###Comments on Selected Points

####I. **Use of an oral rehydration solution**

Beverages such as sweetened tea, cola, fruit juice and chicken broth have totally inadequate electrolyte and glucose concentrations. They are often highly hyperosmolar and therefore may even be dangerous when used to treat a dehydrated child. Therefore, paediatric societies recommend using a special ORS solution for the treatment of diarrhoeal disorders (Sandhu BK 2001, Farthing MJG 2002).

An ORS made at home by the parents is equally unsuitable, as the preparation may be fraught with significant errors with regard to composition and osmolarity (Santosham M 1984).

####II. **Hypotonic Solution**

(Na 60 mmol/L, glucose 74-111 mmol/L)

Comparative studies investigating the former so-called “WHO ORS” (90 mmol Na+/L), which was used very successfully in developing countries, showed that an ORS with 50-60 mmol Na+/L is preferable in industrialised nations (Santosham M 1982, Isolauri E 1985, Rautanen T 1993): Here, acute diarrhoea is usually of viral genesis and not caused by cholera, and in this scenario the ORS with reduced osmolarity proved favourable inasmuch as both the stool volume and the need for intravenous fluid replacement in the sick child could be reduced (Santosham M 1996; Chatterjee A 1978). Since 2002 the WHO now recommends an ORS with a sodium content lowered to 75 mmol/L (Centres for Disease Control and Prevention 2003), and the ESPGHAN as well as the GPGE both recommend an ORS with a sodium content of 45-60 mmol/L.

####III. **Rapid Oral Rehydration in 3-4 hours**

Basically, the treatment of acute gastroenteritis in childhood is the same as treatment of dehydration, which is provided mainly by mouth in the case of minimal to moderate dehydration: Thereby the fluid deficit is first calculated (rule of thumb: approx. 10 ml per kg body weight and percent dehydration), and this volume is replaced by means of an ORS given in small portions within 3-4 hours. If the child is in good general condition, it will determine the required volume itself. In the case of severe dehydration, intravenous rehydration is usually unavoidable, and intensive care monitoring of the ill child may even be indicated. The initial rehydration is followed by maintenance therapy: In this phase, realimentation (s. below) is initiated on the one hand, and on the other hand further fluid losses (due to diarrhoea and/or vomiting) are to be balanced by an ORS (e.g. 50-100 ml ORS per watery stool) until the diarrhoea stops.

####IV. **Subsequently rapid realimentation with normal diet (including weaning food)**

Several studies (including one conducted by the ESPGHAN working group) very clearly showed the positive effects of early realimentation (Sandhu BK 1997, Sandhu BK 2001). Therefore there should be no fasting and realimentation should be initiated immediately after initial rehydration. Breastfed infants should continue to be breastfed during rehydration, and “bottle-fed” children should continue to receive their usual formula without dilution. As of the weaning food age, age-adequate foods rich in carbohydrates and protein, e.g. bread, rice, mashed potato, banana, chicken or turkey, can be given.
Due to the high sugar content, fruit juices with a high fructose, saccharose or sorbitol content or so-called “soft drinks” should not be given.

V+VI Use of special and water-diluted milk formulae is not justified

A meta-analysis of more than 20 clinical studies on the use of milk formulae for realimentation after acute diarrhoea showed that undiluted milk formulae containing lactose is well tolerated by most ill children with a good alimentation status (Brown KH 1994). A European multi-centre study conducted by ESPGHAN, in which virtually all the children also tolerated an undiluted normal milk formula containing lactose, showed the same results (Walker-Smith JA 1997). This increasing evidence was therefore already reflected in the recommendations by ESPGHAN (WHO 1990) and the American Academy of Pediatrics (AAP) years ago. It should also be pointed out that intolerance of cow’s milk protein or lactose after acute diarrhoea is now very rare (Conway SP 1990, Armitstead J 1989), and that undiluted milk formulae also have a positive effect on the duration of the diarrhoea, the nitrogen balance and weight gain (Santosham M 1985, Brown KH 1988, Conway SP 1989). Giving so-called “remedial foods” or special foods (e.g. with a reduced lactose or fat content, soy formula or hydrolysate formula) is not recommended in this context.

IX No unnecessary medication

There is consensus that antimicrobial medication is generally unnecessary in the treatment of acute diarrhoea – even if bacterial genesis is suspected – as most cases of acute diarrhoea are self-limiting. Inadequate antibiotic treatment is more likely to prolong than shorten the duration of the diarrhoea, as it causes dysregulation of the intestinal microflora or even antibiotic-associated colitis. In the case of uncomplicated Salmonella enteritis, giving antibiotics may even prolong the carrier status (Ashkenazi S 1991). On the other hand, antibiotic therapy is obligatory in the case of infection with the following pathogens: Salmonella typhi, Vibrio cholerae, Entamoeba histolytica, Giardia lamblia, and toxin-positive Clostridium difficile colitis (in children > 1 year).

With regard to the use of probiotics in acute gastroenteritis, it should be mentioned that they might be an additional therapeutic option at best. Thereby the earliest possible administration at the highest possible dose appears to be beneficial. However, only those probiotic strains for which a clear positive effect has been shown in randomised controlled clinical studies should be used.

**Oral Rehydration with HiPP ORS 200**

**General Information**

**Definition:**
Ready to drink, standardised rehydration solution with natural, reliable ingredients. Dietetic food for special medical purposes.

**Ingredients:**
Water, carrots (26%), rice (2%), glucose syrup, iodized table salt, sodium citrate, potassium citrate, acid regulator citric acid.

**Indication:**
For treatment of acute gastroenteritis in infants and toddlers as prescribed by the physician. Suitable for oral fluid and electrolyte supply in diarrhoeal disorders and for concomitant substitution during the subsequent realimentation phase. The therapy depends on the severity of the diarrhoea. HiPP ORS 200 is usually given to infants after the completed 4th month at the earliest, depending on whether the child is already on weaning foods. In individual cases, HiPP ORS 200 may also be given earlier as instructed by the doctor.

**Contraindication:**
Acute and chronic kidney failure, metabolic alkalosis, uncontrollable vomiting, clouded consciousness/shock, carbohydrate resorption disorders (monosaccharide malabsorption), bowel occlusion. Not suitable in case of allergy or intolerance to any of the ingredients contained in the product (e.g. disturbed fructose metabolism).

**Recommendations:**
The composition of HiPP ORS 200 is generally in compliance with the recommendations of the European Society for Paediatric Gastroenterology, Hepatology and Nutrition (ESPGHAN), the German Society for Pae-
diatric Gastroenterology and Nutrition (GPGE), and the standard of the American Academy of Pediatrics (AAP) for oral rehydration solutions. In addition, the World Health Organisation (WHO) recommends using natural foods as the basis for oral rehydration.

**Composition and Properties:**
In terms of carbohydrate and electrolyte composition, HiPP ORS 200 is adapted to the special needs when regulating a disturbed fluid and electrolyte balance.

**Sodium:**
The ESPGHAN recommends rehydration solutions with a sodium content of up to 60 mmol/L, and accordingly the sodium content of HiPP ORS 200 is 55 mmol/L.

**Potassium:**
A potassium content of 20 mmol/L acts as prophylaxis against hypokalaemia.

**Carbohydrates:**
The polymeric carbohydrates (from carrots and rice) contained in HiPP ORS 200 are particularly beneficial in the treatment of diarrhoeal disorders due to their low osmotic effect by comparison with monomer substances. Their advantage over monomer glucose has been confirmed in clinical studies (Kastner U 2002, Heine W 1993).

**Carrots:**
Due to the adhesion-inhibiting properties of the carrot, the adhesion capacity of pathogenic micro-organisms in the upper intestinal tract (common diarrheoa trigger) is reduced (Kastner U 2002, Guggenbichler JP 1983).

**Composition: HiPP ORS 200 (per 100 ml)**

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy</td>
<td>88 kJ/ 21 kcal</td>
</tr>
<tr>
<td>Carbohydrates</td>
<td>4,2 g</td>
</tr>
<tr>
<td>of which</td>
<td></td>
</tr>
<tr>
<td>Fructose*</td>
<td>0,5 g</td>
</tr>
<tr>
<td>Glucose</td>
<td>1,2 g</td>
</tr>
<tr>
<td>Saccharose*</td>
<td>0,8 g</td>
</tr>
<tr>
<td>Starch</td>
<td>1,7 g</td>
</tr>
<tr>
<td>Protein</td>
<td>0,3 g</td>
</tr>
<tr>
<td>Fat</td>
<td>0,1 g</td>
</tr>
<tr>
<td>Fibre</td>
<td>1,0 g</td>
</tr>
<tr>
<td>Sodium</td>
<td>120 mg</td>
</tr>
<tr>
<td>Potassium</td>
<td>98 mg</td>
</tr>
<tr>
<td>Chloride</td>
<td>160 mg</td>
</tr>
<tr>
<td>Osmolarity</td>
<td>240 mOsmol/L</td>
</tr>
<tr>
<td>pH value</td>
<td>5,2</td>
</tr>
</tbody>
</table>

*from carrots

The analysis values are subject to the variations common in the use of natural products

HiPP ORS 200 is without added milk protein, without added lactose and gluten-free.

**Information for diabetic patients:** 100 ml HiPP ORS 200 contain 4,2 g carbohydrates (0.35 bread units).
Once open, the closed bottle can be kept in the refrigerator for up to 24 hours.

**Ordering information:**
HiPP ORS 200 is available at every pharmacy. 1 PU = 6 bottles á 200 ml.
Article number: 2300 (PZN: 7508641, only valid for Germany).
Composition of HiPP ORS 200 by comparison with ESPGHAN recommendation for composition of an oral rehydration solution for children in Europe (Guarino A, 2001; Sandhu BK 2001)

<table>
<thead>
<tr>
<th></th>
<th>ESPGHAN ORS</th>
<th>HiPP ORS 200</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium mmol/L</td>
<td>60</td>
<td>55</td>
</tr>
<tr>
<td>Potassium mmol/L</td>
<td>20</td>
<td>25</td>
</tr>
<tr>
<td>Chloride mmol/L</td>
<td>60</td>
<td>40</td>
</tr>
<tr>
<td>Bicarbonate mmol/L</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Citrate mmol/L</td>
<td>10</td>
<td>7</td>
</tr>
<tr>
<td>Glucose g/L/mmol/L</td>
<td>13.3–20.0</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>74–111</td>
<td>67</td>
</tr>
<tr>
<td>Osmolarity mOsmol/L</td>
<td>225–260</td>
<td>240</td>
</tr>
</tbody>
</table>

Dosing recommendation
HiPP ORS 200

1. Rehydration phase (balancing the fluid and electrolyte loss; according to GPGE recommendation)

Unless prescribed otherwise, infants and children are given about 10 ml per kg body weight and percent dehydration in the first 3 – 4 hours:

- in the case of minimal dehydration (= loss of up to 3% of the body weight) HiPP ORS 200 in a quantity of 20-30 ml/kg body weight.
- in the case of mild to moderate dehydration (= loss of 3-8% of the body weight) 30-80 ml HiPP ORS 200 per kg body weight.

Example: A child weighing 10 kg with 5% dehydration is given about 500 ml HiPP ORS 200 in 3-4 hours, i.e. about 125-165 ml/hour.

Breastfed infants should continue to be breastfed ad lib from the beginning in parallel to the administration of HiPP ORS 200. Between breastfeeds, HiPP ORS 200 is given in small portions.

It is best if HiPP ORS 200 is given in several small portions, possibly even by the spoonful. When the diarrhoea improves and depending on the child’s condition, the quantity of HiPP ORS 200 may be reduced slowly until the diarrhoea has disappeared. In case of persistent diarrhoea, admission to hospital and possibly even intravenous therapy should be considered (King CK et al. 2003; GPGE Gastroenteritis Guideline).

Note: If vomiting occurs, the refrigerated HiPP ORS 200 (4 to 8°C) is given in small quantities and at short intervals, or ideally repeatedly by the spoonful (e.g. every 5 to 10 minutes 5-10 ml, which is equivalent to about 1 to 2 teaspoons).

2. Realimentation Phase

In this phase, feeding with well-tolerated foods is started again:

- Breastfed infants continue to be breastfed.
- Bottle-fed infants in the 1st half year of life receive their accustomed formula again after the rehydration phase.
- Infants that are already on weaning foods receive their usual formula and weaning food in full quantity and concentration after the rehydration phase. In severe cases, however, realimentation may also be provided in increments.
- Older children initially receive a light diet and teas, starting e.g. with HiPP Baby’s First Carrot, HiPP Baby Carrots with Potatoes, HiPP Baby’s First Pumpkin, HiPP Pumpkin with Potatoes, HiPP Baby’s First Parsnip, HiPP Baby’s First Banana or HiPP Apple and Banana. Juices with a high sugar content (saccharose, fructose, sorbitol) should be avoided. The diet should return to a normal age-appropriate diet after two to not more than five days.

Further fluid losses (due to persistent diarrhoea and/or vomiting) are replaced with HiPP ORS 200 in a quantity of 50 – 100 ml after every further watery stool/vomiting episode (in children < 3 months or in the case of massive diarrhoea, this quantity can be increased to 10-20 ml/kg body weight/hour until the diarrhoea stops). HiPP ORS 200 contains carrots and rice, providing the child with an easily digestible polymer carbohydrate diet and thus with adequate energy right from the start.
Breastfed children continue to be breastfed.

usual diet depending on age, e.g. milk formulae, weaning food +50 - 100 ml ORS (or 10-20 ml per kg body weight) after every episode of watery stool/vomiting

Dietetic therapy: oral rehydration and subsequent realimentation (diagram)
Summary of Key Studies Demonstrating the Benefit of Carrot and Rice-based Rehydration

HiPP ORS 200 has been tested in several research studies. As a result of the use of HiPP ORS 200 or carrot and rice-based rehydration solutions of similar composition:

- the duration of diarrhoea was significantly shortened (Pietschnig B et al. 1992),
- a lower mean stool frequency was achieved (Pietschnig B et al. 1992),
- the stool quantity was already markedly reduced within the first 24 to 48 hours (Pietschnig B et al. 1992),
- the stay in hospital was reduced by one day on average (Storr U et al. 1993),
- good taste acceptance was achieved (Storr U, Guggenbichler JP 1995),
- safe and effective rehydration therapy was possible,
- the beneficial clinical effect and superiority over realimentation methods with glucose-electrolyte solutions and 6% rice powder solution with regard to restoration of microbial homeostasis was confirmed (Heine W 1993),
- a significantly shorter hospitalisation time and significantly fewer side effects were observed by comparison with intravenous rehydration therapy (Hartling L et al. 2006, Fonseca BK 2004).

<table>
<thead>
<tr>
<th>Summary:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infants and children with acute diarrhoea can be rehydrated with oral glucose-electrolyte solutions, but this does not reduce the duration and severity of the illness. In German-speaking countries, carrot and rice-based oral rehydration solutions have a long tradition in the treatment of diarrhoea. With these solutions, the stool volume and the duration of illness can be reduced. In a prospective study, we therefore investigated the efficiency and therapy safety of a carrot and rice-based rehydration solution (Na 57 mmol/L, n = 70) and two conventional glucose-based solutions with high or low sodium concentrations (Na 90 mmol/L, n = 48 or Na 55 mmol/L, n = 60). The study patients were Pakistani boys and girls aged 3 to 48 months with mild to moderate dehydration. The duration of diarrhoea, stool and urine volume, fluid intake and serum electrolytes were measured. When carrot and rice-based rehydration solution was given, the duration of the diarrhoea was significantly shorter (59.5±30.9 h, p&lt;0.05) than if glucose-electrolyte solutions with high Na concentration (75.5±30.5 h) or low Na concentration (74.8±32.5 h) were given. The mean stool volume (p&lt;0.01) and the mean fluid uptake (p&lt;0.001) were also significantly lower in the group given the carrot and rice-based solution. Severe electrolyte imbalances were not observed in any of the 3 groups. The carrot and rice-based rehydration solution thus proved to be a safe and more effective rehydration therapy than the two glucose-electrolyte solutions.</td>
</tr>
</tbody>
</table>

**Glucose-Electrolyte Solution, Rice-Powder-Solution or Carrot Soup for Oral Rehydration? Micro-ecological Aspects of Dietary Treatment of Infantile Enteritis.**

Heine W et al. 1993

Summary:
The micro-ecological effect of carrot and rice-based oral realimentation (CRB) versus oral electrolyte solution (ORS 40) and 6% rice powder solution (RP) was investigated in a total of 30 infants with mild to moderate diarrhoea (in groups of 10 children each). Realimentation was carried out over a period of four days with initial quantities of 150-180 ml rehydration solution/kg/day and incremental replacement with 30 to 50 ml infant formulae per day. The stool samples were obtained with a bowel tube on days 1 and 4 of treatment and tested for aerobic and anaerobic bacteria content using the Haenel method. The patients’ age ranged from 17 to 208 days, the mean body mass was 4927 g in the CRB group, 4986 g in the ORS 40 group, and 5717 g in the RP group. Rotavirus, pathogenic Coli and Pseudomonas aeruginosa were detected as the causes of the enteritis. In the majority of cases, no pathogen was detected. The time from the beginning of realimentation until passing of the first soft or formed stool was significantly shorter in the CRB group with a mean of 1.6 days than in the control groups (ORS 40 – 3.0 days, rice powder solution = 3.7 days). In the CRB group, bifidobacteria dominance (> 90%) could be detected in the stools of 7 out of 10 infants on day 4 of the treatment (X² test = CRB vs. ORS 40 p < 0.05; CRB vs. RP p < 0.05). The Bacteroides counts were significantly lower in the CRB group than in the ORS 40 group and the rice powder solution group. The pH of the stools and the Proteolyte counts tended to decrease most strongly in the CRB group. These results confirm the beneficial clinical effects of the carrot and rice-based diet and demonstrate its superiority over realimentation methods with glucose-electrolyte solutions and rice powder solution with regard to restoring microbial homeostasis.
Summary:
The initial treatment of acute diarrhoea consists of rapid fluid and electrolyte replacement. In a multi-centre study, a total of 72 patients with mild to moderate diarrhoea were randomised to receive either intravenous rehydration or oral rehydration with a balanced electrolyte solution in which the glucose monohydrate had been replaced by complex oligo- and polysaccharides from carrots and rice-based. This solution contains 57 mmol sodium/L and 20 kcal/100 ml with an osmolarity of 230 mosm/L. The studies showed a more rapid cessation of diarrhoeal stools and shorter duration of treatment in the group receiving carrot and rice-based rehydration. All patients showed normal electrolyte and acid-base balance values after 24 hours. Tolerance and acceptance of the solution were good.

Summary:
An important initial step in the pathogenesis of gastrointestinal infections is the adherence of microbes to the surface of the intestinal mucosa, which is mediated by carbohydrate structures on the side of the intestinal epithelium. With the use of receptor analogues, the adherence of bacteria can be blocked. Aqueous carrot preparations contain acid oligosaccharides that inhibit the adherence of various intestinally pathogenic microbes to Hep-2 cells and human intestinal epithelium cells in vitro. The intensity of the effect depends on the degree of polymerisation, whereby trigalacturonic acid proved to be most effective. In clinical studies, it could be shown that the use of aqueous carrot preparations is superior to balanced glucose-electrolyte solution for acute gastrointestinal infections in children.
GPGl: Leitlinie akute Gastroenteritis, 2008: www.gpg.de, besucht am 20.03.09.

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