



For the most valuable in life.



PRODUCT INFORMATION

HiPP ORS 200

Carrot and Rice-based Oral Rehydration Solution

Gastroenteritis in Infants and Toddlers

Table of Contents

	page
Introduction: Gastroenteritis in Infants and Toddlers	3
Current Therapy Guidelines for Minimal to Moderate Dehydration in Acute Gastroenteritis (ESPGHAN, GPGE, AAP and WHO)	5
Oral Rehydration with HiPP ORS 200	
General Information	6
Dosing recommendation HiPP ORS 200	8
Summary of Key Studies Demonstrating the Benefit of Carrot and Rice-based Rehydration	10
Literature	12

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/ORL: Oral rehydration solution

Scientific advisors:

Dr. med. Stephan Buderus (revised in March 2015)
 Head of the Paediatrics Department, Paediatric Gastroenterologist
 St. Marien-Hospital, Bonn

Univ.-Prof. Dr. med. Almuth Christine Hauer
 Department of General Paediatrics, Paediatric Gastroenterologist
 University Clinic for Paediatrics and Adolescent Medicine of the Medical University of Graz

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 2 episodes per child (< 3 years) in Europe. The most common causes in industrialised nations are viruses. In infants and children < 5 years, these viral diarrhoeas are caused mainly by rota- and noroviruses. However, due to the widespread administration of rotavirus vaccines, the distribution by viral pathogens has shifted: Today, there are fewer rotavirus infections but more norovirus infections. The predominant bacterial pathogen causing gastroenteritis can be either Campylobacter or Salmonella, depending on the country. According to scientific publications, the pathogen can be detected in a total of 45-75% of children with acute gastroenteritis (ESPGHAN 2014).

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). Hyponatraemia 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 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.

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). The current ESPGHAN Guideline (2014) still recommends the use of reduced osmolarity (Na 50-60) oral rehydration solutions as the therapy of choice.

Practical Aspects

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 child should always be seen by a doctor if one or more of the following items apply (ESPGHAN 2014): < 2 months of age, pre-existing chronic illness, persistent vomiting, high frequency diarrhoea (> 8/day), clear signs of dehydration that are also conspicuous to the parents. 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 clinical assessment and "setting" of the infection (e.g. outbreak in a nursery or school, or to detect or rule out a hospital-acquired infection), a virological, bacteriological or parasitological stool examination may be indicated.

	Minimal or no dehydration < 3% weight loss	Mild to moderate dehydration 3-8% weight loss	Severe dehydration ≥ 9% weight loss
General condition, consciousness	Good, awake	Restless, irritable or tired	Apathetic, lethargic, unconscious
Thirst	Normal	Thirsty, greedy to drink	Drinks little or cannot drink any more
Heartbeat	Normal	Normal to increased	Tachycardia, on further deterioration bradycardia
Pulse quality	Normal	Normal to reduced	Weak to missing
Breathing	Normal	Normal to deep	Deep acidotic breathing
Eyes	Normal	Recessed	Very recessed
Tears	Present	Reduced	Missing
Mucosa (mouth, tongue)	Moist	Dry	Desiccated
Skin folds (skin turgor)	Disappear immediately	Disappear slowly, but < 2 seconds	Remain for < 2 seconds
Capillary filling	Normal	Prolonged	Very prolonged
Extremities	Warm	Cool	Cold, cyanotic
Urine output	Normal or reduced	Reduced	Minimal

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 50-60 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 they 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, ESPGHAN 2014). 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 50-60 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): 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

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 4-6 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 formulae 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 in Europe (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. This is also supported by the current ESPGHAN Guideline (2014).

IX No unnecessary medication

The possible positive significance and safety of a therapy with Ondansetron have not yet been conclusively evaluated, which is why it is not yet recommended. No alternative antiemetics should be used for the treatment of acute gastroenteritis (ESPGHAN 2014). 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).

The ESPGHAN Guideline (2014) points out that treatment of acute gastroenteritis with appropriate probiotics, in addition to oral rehydration, may have a beneficial effect on the duration and severity of the disease. The use of L. rhamnosus GG and S. boulardii should therefore be considered.

Oral Rehydration with HiPP ORS 200

General Information

Definition:

Ready to drink, standardised rehydration solution with natural, reliable ingredients. Food for special medical purposes. For the dietary management of diarrhoea in infants.

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 Paediatric Gastroenterology and Nutrition (GPGE), and the

standard of the American Academy of Pediatrics (AAP) or 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 50-60 mmol/L, and accordingly the sodium content of HiPP ORS 200 is 55 mmol/L.

Potassium:

A potassium content of 25 mmol/L acts as prophylaxis against hypokalaemia.

Carbohydrates:

The polymeric carbohydrates (from carrots and rice) contained

Composition: HiPP ORS 200 (per 100 ml)	
Energy	kJ 88/kcal 21
Fat	0.1 g
of which saturated fatty acid	0.01 g
Carbohydrates	4.2 g
of which sugars	2.5 g
Fibre	1.0 g
Protein	0.3 g
Salt	0.3 g
Sodium	0.12 g
Potassium	98 mg
Osmolarity (mOsmol/l)	240
Fructose*	0.5 g
Glucose	1.2 g
Saccharose*	0.8 g
Starch	1.7 g
pH value	5.20

*from carrots

Please note the information and instructions on the packaging. This is important, as these can change due to possible recipe updates.

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 diarrhoea trigger) is reduced (Kastner U 2002, Guggenbichler JP 1983).

Citrate:

Citrate is recommended as an anion instead of bicarbonate in the treatment of acute diarrhoea. Thereby, the positive influence on taste and the associated better acceptance of the solution must be emphasised. The tendency for flatulence is also reduced. Moreover, instability of the solution caused by the reaction between bicarbonate and glucose can be avoided. The citrate content of HiPP ORS 200 is 7 mmol/L. It does not contain bicarbonate.



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

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.

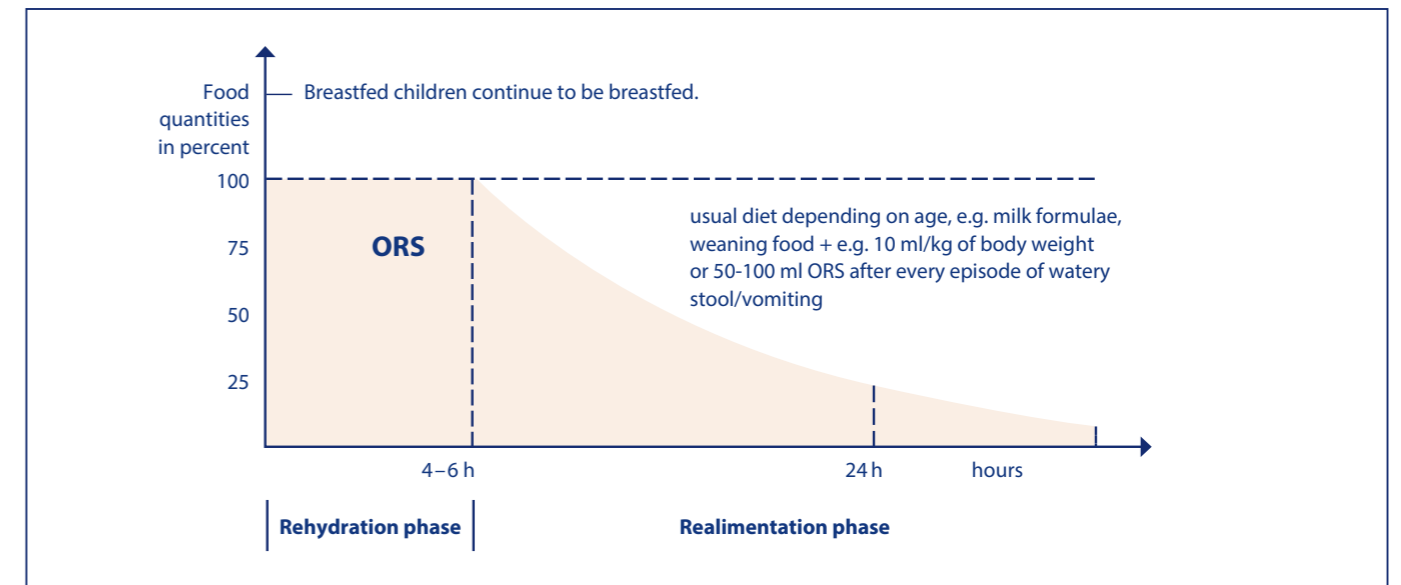
Ordering information:

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, ESPGHAN 2014)

		ESPGHAN-ORS	HiPP ORS 200
Sodium	mmol/L	50/60	55
Potassium	mmol/L	20	25
Chloride	mmol/L	60	40
Bicarbonate	mmol/L	-	-
Citrate	mmol/L	10	7
Glucose	g/L mmol/L	13.3-20.0 74-111	12 67
Osmolarity	mOsmol/L	225-260	240



Dietetic therapy: oral rehydration and subsequent realimentation (diagram)

Dosing Recommendation HiPP ORS 200

**1. Rehydration Phase
(Balancing the Fluid and Electrolyte Loss;
According to GPGE Recommendation and ESPGHAN)**

In cases of mild to moderate dehydration, infants and children receive approximately 10 ml/kg of body weight and percent of dehydration in the first 3-4 hours. Yet practice has shown that an extension of the rehydration period up to 4-6 hours is advisable.

- 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. Experience shows that chilling the ORS improves tolerability. 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
(Return to Normal Diet)**

4-6 hours at the latest after starting the rehydration process, the child should be fed their usual diet again.

- Breastfed infants should continue to be breastfed through out the entire rehydration process.
- Bottle-fed infants receive their accustomed formula again after the rehydration phase.
- Older children can quickly return to their regular diet after rehydration, starting with foods containing complex carbohydrates, such as potato or rice dishes, carrot soup, porridge or semolina pudding, and bread with a spread on it. If they don't vomit afterwards, they can completely switch to their regular diet. Juices with a high sugar content (sucrose, fructose, sorbitol) should be avoided.

Continued fluid loss is compensated with e.g. 10 ml/kg of body weight or 50-100 ml ORS for each new watery stool/vomiting episode. 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.

How Much HiPP ORS 200 Does a Child Need When Suffering from Diarrhoea?

1. Rehydration phase

kg body weight	Mild to moderate dehydration (3-8% weight loss)					
	3% weight loss: during the first 3-4 hours		5% weight loss: during the first 3-4 hours		8% weight loss: during the first 3-4 hours	
	ml HiPP ORS	Bottles HiPP ORS (200 ml)	ml HiPP ORS	Bottles HiPP ORS (200 ml)	ml HiPP ORS	Bottles HiPP ORS (200 ml)
5	150	1	250	2	400	2
6	180	1	300	2	480	3
7	210	2	350	2	560	3
8	240	2	400	2	640	4
9	270	2	450	3	720	4
10	300	2	500	3	800	4
11	330	2	550	3	880	5
12	360	2	600	3	960	5
13	390	2	650	4	1040	6
14	420	3	700	4	1120	6
15	450	3	750	4	1200	6
16	480	3	800	4	1280	7
17	510	3	850	5	1360	7
18	540	3	900	5	1440	8

Table: Calculation of the recommended amount of HiPP ORS 200 during the rehydration phase in cases of mild to moderate dehydration. Unless otherwise recommended, infants and children should receive 10 ml per kg of body weight and percent of dehydration.

2. Realimentation Phase

The administration of easily digestible food should be resumed no later than 4-6 hours after starting with rehydration. **Additionally, HiPP ORS 200 is given until the diarrhoea stops: to compensate for further fluid loss due to watery stools or vomiting: e.g. 10 ml/kg of body weight or 50-100 ml after each watery stool/vomiting episode.**

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),
- a 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 intra venous rehydration therapy (Hartling L et al. 2006, Fonseca BK 2004).

Acute Diarrhoea – Treatment with Carrot and Rice-based Rehydration Solution is more Effective than ORS

Pietschnig B et al. 1992

Summary:

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, $p < 0.05$) 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 ($p < 0.01$) and the mean fluid uptake ($p < 0.001$) 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.

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 (X^2 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.

On the Therapy of Acute Diarrhoea. Intravenous Rehydration vs. Carrot and Rice-based Rehydration.

Storr U et al. 1993

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.

Can the Balanced Glucose-electrolyte Solution for Treatment of Acute Diarrhoea Still be Improved?

Storr U, Guggenbichler JP 1995

Summary:

The initial treatment of acute diarrhoea consists of rapid fluid and electrolyte replacement. In a bi-centre study, a total of 150 patients with mild to moderate diarrhoea were randomised to receive either intravenous rehydration or oral rehydration with

a newly developed carbohydrate electrolyte solution in which the glucose monohydrate had been replaced by complex oligo- and polysaccharides from carrots and rice pudding. The studies showed a more rapid cessation of diarrhoeal stools and shorter duration of treatment in the group receiving carrot and rice-based rehydration than in the group with intravenous rehydration. All patients showed normal electrolyte and acid-base balance values after 24 hours. Tolerance and acceptance of the solution were good. In a survey conducted after the end of therapy, the parents said that they would prefer an oral therapy in a renewed case of illness.

Acid Oligosaccharides as the Principle of Action of Aqueous Carrot Preparations in the Prophylaxis and Therapy of Gastrointestinal Infections

Kastner U et al. 2002

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.

Literature

- Anonymous: Oral therapy for acute diarrhoea. *Lancet* 1981; 2: 615–7.
- Armitstead J, Kelly D, Walker-Smith JA: Evaluation of infant feeding in acute gastroenteritis. *J Paediatr Gastroenterol Nutr* 1989; 8: 240–4.
- Ashkenazi S, Cleary T: Antibiotic treatment of bacterial gastroenteritis. *Pediatr Infect Dis J* 1991; 10: 40–8.
- Brown KH, Gastanaduy AS, Saavedra JM: Effect of continued oral feeding on clinical and nutritional outcomes of acute diarrhoea in children. *J Pediatr* 1988; 112: 191–200.
- Brown KH, Peersson JM, Fontaine O: Use of nonhuman milks in the dietary management of young children with acute diarrhoea: A meta-analysis of clinical trials. *Pediatrics* 1994; 93: 17–27.
- Centers for disease control and prevention: Managing acute gastroenteritis among children: oral rehydration, maintenance and nutritional therapy. *MMWR* 2003; 52 (No. RR-16): 1–16.
- Chatterjee A, Mahalanabis D, Jalan KN et al.: Oral rehydration in infantile diarrhoea: Controlled trial of a low sodium glucose-electrolyte solution. *Arch Dis Child* 1978; 53: 284–9.
- Conway SP, Ireson A: Acute gastroenteritis in well nourished infants: Comparison of four feeding regimens. *Arch Dis Child* 1989; 64: 87–91.
- Conway SP, Phillips RR, Panday S: Admission to hospital with gastroenteritis. *Arch Dis Child* 1990; 65: 579–84.
- ESPGHAN: Evidence-based Guidelines for the Management of Acute Gastroenteritis in Children in Europe, 2008. *JPGN* 46: 81–122.
- ESPGHAN: Evidence-based Guidelines for the Management of Acute Gastroenteritis in Children in Europe: Update 2014. *JPGN* 2014; 59: 132–152.
- Farthing MJG: Oral Rehydration: an evolving solution. *J Pediatr Gastroenterol Nutr* 2002; 34: 64–67.
- Fonseca BK, Holdgate A, Craig JC: Enteral vs. intravenous rehydration therapy for children with gastroenteritis. A Meta-analysis of randomized controlled trials. *Arch Pediatr Adolesc Med.* 2004; 158: 483–490.
- GPGE: Leitlinie akute Gastroenteritis, 2008: www.gpge.de, besucht am 20.03.09
- GPGE: Leitlinie akute infektiöse Gastroenteritis im Säuglings- und Kleinkindalter, 2019. www.gpge.eu/leitlinien, besucht am 15.11.2019
- Guarino A, Albano F, Guandalini S and the Working Group on Acute Gastroenteritis. Oral rehydration: Toward a real solution. *J Pediatr Gastroenterol Nutr* 2001; 33: 2–12.
- Guggenbichler JP: Adherence as major pathogenetic mechanism of *E. coli* in enteric infections and modes to block adherence. *Infection* 1983; 17: 173–177.
- Guggenbichler JP, Kogler B: Behandlung akuter Diarrhöen bei Säuglingen und Kleinkindern mit einer neu zusammengesetzten oralen Rehydrierungslösung. *Med Wschr* 1989; 139: 285–287.
- Hauer AC, Hoekstra JH, Sandhu W, Szajewska H: Behandlung der akuten Gastroenteritis in Österreich im europäischen Vergleich: Ergebnisse im Rahmen einer multizentrischen Studie der ESPGHAN. *Monatsschr Kinderheilkd* 2003; 151: 532–538.
- Hartling L, Bellemare S, Wiebe N, Russell K, Klassen TP, Craig W: Oral versus intravenous rehydration for treating dehydration due to gastroenteritis in children. *Cochrane Database Syst Rev* 2006; 19; 3: CD004390.
- Heine W, Mohr C, Walther F, Radke M: Glukose-Elektrolyt-Lösung, Reisschleim oder Möhrensuppe? Mikrobiologische Aspekte der Diätbehandlung der Säuglingsgastroenteritis. *Akt Ern Med* 1993; 18: 380–384.
- Hirschhorn NJ: The treatment of acute diarrhoea in children. An historical and physiological perspective. *Am J Clin Nutr* 1980; 33: 637–63.
- Isolauri E: Evaluation of an oral rehydration solution with Na⁺ 60 mmol/L in infants hospitalised for acute diarrhoea or treated as outpatients. *Acta Paediatr Scand* 1985; 74: 643–9.
- Kastner U, Glasl S, Follrich B, Guggenbichler JP, Jurenitsch J: Saure Oligosaccharide als Wirkprinzip von wässrigen Zubereitungen aus der Karotte in der Prophylaxe und Therapie von gastrointestinalen Infektionen. *Wien. Med. Wschr* 2002; 152: 379–381.
- Keller KM: Behandlung einer Enteritis – „Heilnahrung“ nicht erforderlich. *Pädiat. Prax.* 2006/2007; 69: 278.
- Pietschnig B, Javadi N, Haschke F, Huemerl C, Schuster E: Akute Durchfallserkrankungen. Behandlung mit Karotten-Reisschleim ist effektiver als ORS-Lösung. *Monatsschr. Kinderheilkd.* 1992; 140: 426–430.
- Provisional committee on quality improvement, subcommittee on acute gastroenteritis practice parameter: The management of acute gastroenteritis in young children. *Pediatrics* 1996; 97: 424–36.
- Rahaman MM, Aziz KMS, Patwari Y, Munshi MH: Diarrhoeal mortality in two Bangladeshi villages with and without community-based oral rehydration therapy. *Lancet* 1979; 2: 809–12.
- Rautanen T, El-Radhi S, Vesikari T: Clinical experience with a hypotonic oral rehydration solution in acute diarrhoea. *Acta Paediatr* 1993; 82: 52–4.
- Sandhu BK, Isolauri E, Walker-Smith JA et al.: Early feeding in childhood gastroenteritis. *J Paediatr Gastroenterol Nutr* 1997; 24: 522–7.
- Sandhu BK for the European Society of Pediatric Gastroenterology, Hepatology and Nutrition Working Group on Acute Diarrhoea: Rationale for early feeding in childhood gastroenteritis. *J Pediatr Gastroenterol Nutr* 2001; 33: 13–16.
- Sandhu BK for the European Society of Pediatric Gastroenterology, Hepatology and Nutrition Working Group on Acute Diarrhoea: Practical guidelines for the management of gastroenteritis in children. *J Pediatr Gastroenterol Nutr* 2001; 33: 36–39.
- Santosham M, Daum RS, Dillman L et al.: Oral rehydration therapy of infantile diarrhoea: A controlled study of well nourished children hospitalised in the United States and Panama. *N Engl J Med* 1982; 306: 1070–6.
- Santosham M, Foster S, Garrett S, Croll L, Evans S, Spira WM, Black RE: Outpatient use of oral rehydration solutions in an Apache population: Effect of instructions on preparation and contamination. *J Paediatr Gastroenterol Nutr* 1984; 3: 687–91.
- Santosham M, Foster S, Reid R et al.: Role of soy-based, lactose-free formula during treatment of acute diarrhoea. *Pediatrics* 1985; 76: 292–8.
- Santosham M, Goepp J, Burns B et al.: Role of soy-based lactose-free formula in the outpatient management of diarrhoea. *Pediatrics* 1991; 87: 619–22.
- Santosham M, Fayad I, Abu Zikri M et al.: A double-blind clinical trial comparing World Health Organisation oral rehydration solution with a reduced osmolality solution containing equal amounts of sodium and glucose. *J Pediatr* 1996; 128: 45–51.
- Sharier M: Oral rehydration therapy and its under-utilization. In: *Paediatric Gastroenterology. Bailliere's international practice and research.* Ed: Kirschner BS, Walker-Smith JA. 1994; 611–624.
- Storr U, Guggenbichler JP: Kann die bilanzierte Glukoseelektrolytlösung zur Behandlung akuter Durchfallerkrankungen noch verbessert werden? *pädiat prax* 1995; 49: 253–262.
- Storr U, Überall M, Aydin I, Renner C und Peter J, Guggenbichler JP: Zur Therapie bei akuten Durchfallerkrankungen Vergleich einer intravenösen mit einer oralen Rehydrierung auf Karotten-Reisschleim-Basis. *Sozialpädiatrie* 1993; 15: 294–297.
- Szajewska H, Hoekstra JH, Sandhu B, Hauer AC et al. Management of acute Gastroenteritis in Europe and the impact of the new recommendations: A multicenter study. *J Pediatr Gastroenterol Nutr* 2000; 30: 522–527.
- Szajewska H, Guarino A, Hojsak I et al. Use of Probiotics for Management of Acute Gastroenteritis: A Position Paper by the ESPGHAN Working Group for Probiotics and Prebiotics. *JPGN* 2014; 58: 531–539.
- Walker-Smith JA, Sandhu B, Isolauri E et al.: Recommendations for feeding on childhood gastroenteritis: Guidelines prepared by the ESPGHAN Working Group on Acute Diarrhoea. *J Pediatr Gastroenterol Nutr* 1997; 24: 619–20.
- World Health Organisation A manual for the treatment of diarrhoea. Rev. 2. WHO/CDD/SER/80, 1990.

hipp.com/hcp



For the most valuable in life.