REDUCING THE OSMOLARITY OF ORAL REHYDRATION SOLUTIONS AN EFFICIENT MANAGEMENT IN ACUTE GASTROENTEROCOLITIS IN INFANTS

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Abstract: *The aim of the scientific research is to prove the efficiency and the superiority of the osmolarity reduction of the oral rehydration solutions in the treatment of gastroenterocolitis in the new born, according to the latest research in the field. The design of the study was a randomized prospective comparative one, and the results of the study emphasize that the use of reduced osmolarity solutions, in comparison with those with standard osmolarity, led to a significant decrease of diarrhoea length, bowel frequency, hospitalization days, as well as to a superior weight with real practical, clinical, financial, economical and psycho-social benefits.*

Keywords: *diarrhoea, reduced osmolarity oral rehydration solutions*

Rezumat: *Obiectivul cercetării ştiinţifice este demonstrarea eficienţei şi superiorităţii rehidratării orale cu soluţii cu osmolaritate redusă, în tratamentul gastroenterocolitei la sugar, conform cercetărilor mai recente. Designul studiului este prospectiv comparativ randomizat, iar rezultatele studiului arată că utilizarea soluţiilor cu osmolaritate redusă, comparativ cu cele cu osmolaritate standard, a dus la scăderea semnificativă a duratei diareei, a frecvenţei scaunelor, a numărului de zile de internare, precum şi la un spor ponderal superior, cu reale beneficii practico-clinice, economice şi psiho-sociale.*

Cuvinte cheie: *diaree, rehidratare orală, soluţii de rehidratare cu osmolaritate redusă*

PURPOSE OF THE RESEARCH

The aim of the scientific research is to prove the efficiency and the superiority of the osmolarity reduction of the oral rehydration solutions in the treatment of gastroenterocolitis in the new born.

MATERIAL AND METHOD

The research method used was the sampling method. The study included 236 infants hospitalized in the Paediatric Clinic of the city of Sibiu, with the diagnosis of simple enterocolitis or mild form of acute dehydration (SDA 5%) and medium form of SDA (5-7%). The infants taken into the study were randomized in two rehydration groups: a witness batch, rehydrated with standard osmolarity solutions (Gesol solution - 311 mosm/l osmolarity, Na=90 mmol/l, glucose=111mmol/l), 118 cases, and one batch rehydrated with reduced osmolarity solutions RORS (Humana Elektrolyt solution - 230 mosm/l osmolarity, Na=60 mmol/l, glucose=89 mmol/l), 118 cases, as well. In order that the parameters be as close as possible, the infants were divided into two age groups, one age group between 0 – 6 months, 122 cases and one age group between 7 -12 months, 114 cases. In the first part of the study, we presented the study management, as well as a part of the studied parameters: origin environment, gender, form of acute enterocolitis.

In order to prove the benefits for using the reduced osmolarity solutions in the treatment of acute enterocolitis, we supervised the following parameters in the two rehydration groups:

- Evolution of the weight curve: weight upon hospitalization – day 3 – discharge
- Length of diarrhoea: average length of diarrhoea, minimum and maximum length
- Number of remitted diarrhoea cases/days
- Stools frequency/day
- Hospitalization days: average length, minimum and maximum length, total number of days

Other parameters were also supervised, such as etiology, homogeneity of the rehydration groups regarding the hospitalization parameters: weight, values of haemolecogram (haemoglobin, hematocryt, leukocyte), acidobasic equilibrium (pH), presence of associated infections.

Data processing

For the analysis of the data, we used the statistical programmes SPSS 10 and Epi Info version 3.5.1. $p \leq$ below 0,05 was considered statistically significant. Variables were presented in terms of means and standard deviation, while other parameters in terms of frequency and percentage. I used variables correlation tests, such as: *Paired Samples Statistics T-Test, Wilcoxon, Pearson* for two pair samples.

RESULTS AND DISCUSSIONS

Comparable parameters per rehydration groups – upon hospitalization

The patients taken into the study were equally divided into the two rehydration groups. Upon hospitalization, according to table I, we can say that there is a perfect homogeneity of those two rehydration and age groups, regarding the average birth weight, weight upon

hospitalization, frequency of acute enterocolitis, frequency of stools on the first day of hospitalization, as well as other parameters, such as haemoleucogram aspect (values of haemoglobin, hematocryte, number of cases with leukocytosis, leukocytes in normal limits), Ph average, frequency of the associated infections.

Differentiation parameters between the two rehydration groups

The two rehydration groups, according to table II, presented statistically significant differences, p<0,001, regarding the following parameters:

- Hospitalization weight until day 3 and until discharge - picture no. 1
- Stools frequency/day – picture no. 2
- Average of diarrhoea length
- Number of remitted diarrhoea cases/day – picture no. 3
- Average of hospitalization days
- Total number of hospitalization days – picture no. 5

There were also other differences, statistically insignificant, between the two rehydration groups, such as the maximum and minimum length of diarrhoea in days/case and the maximum number of hospitalization/case.

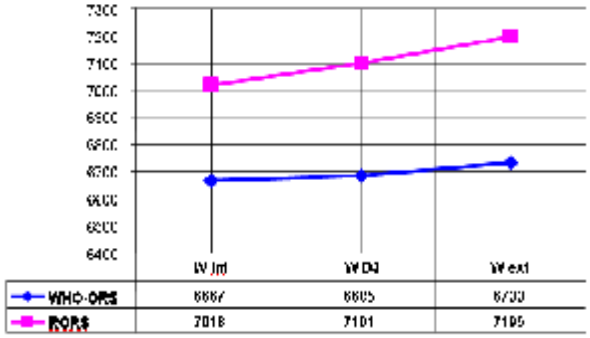
Table no 1. Hospitalization parameters per rehydration group and age group

Parameter	Age group 0-6 l		Statistically significant	Age group 7-12 l		Statistically significant
	WHO-ORS	RORS		WHO-ORS	RORS	
Mean of B/W - grams	3068,03	2978,68	p= 0,903	3113,14	3089,,82	p= 0,905
Mean W/hospitalization- grams	5470,00	5210,81	p= 0,618	7948,24	8954,63	p= 0,012
Disease factor - N						
Simple E.	18	17	p> 0,05	14	16	p> 0,05
E.with SDA 5%	31	30	p> 0,05	25	26	p> 0,05
E.with SDA 5-7%	12	14	p> 0,05	18	15	p> 0,05
pH – average per disease factor						
Simple E.	7,36	7,35	p> 0,05	7,36	7,35	p> 0,05
E.with SDA 5%	7,35	7,35	p= 1	7,35	7,35	p= 1
E.with SDA 5-7%	7,31	7,28	p> 0,05	7,29	7,29	p= 1
Hb – average g/dl	10,89	10,68	p> 0,05	10,54	11,13	p> 0,05
Ht - average %	32,93	31,95	p> 0,05	32,66	33,8	p> 0,05
No. of leukocytes / cases						
Leukocytosis	22	23	p> 0,05	19	21	p> 0,05
Leucocytes in normal limits	39	34	p> 0,05	38	36	p> 0,05
Nr. of stools/day – D1	198	212	p= 0,36	191	195	p= 0,89
Associated infections - N						
Respiratory infections	47	44	p> 0,05	42	48	p> 0,05
Mycotic infections	15	18	p> 0,05	15	10	p> 0,05
ITU	3	2	p> 0,05	3	3	p= 1

Table no. 2. Differentiation parameters between the rehydration groups

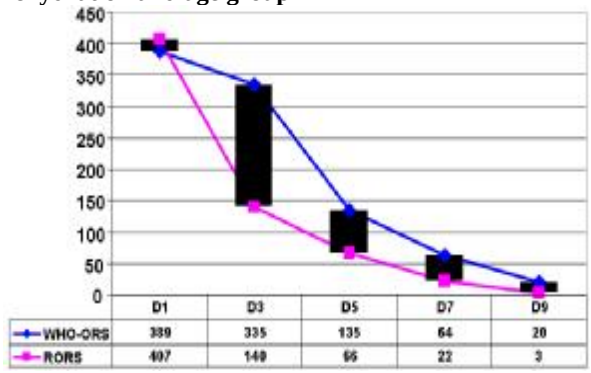
Parameter	Age group 0-6 l		Statistically significant	Age group 7-12 l		Statistically significant
	WHO-ORS	RORS		WHO-ORS	RORS	
Weight – grams						
W hospitalization – W D3	19,34	80,99	p < 0,001	18,07	84,37	p < 0,001
W D3 – W/discharge	52,79	79,33	p < 0,001	42.46	110,88	p < 0,001
W/hospitalization – W/discharge	72,13	160,33	p < 0,001	60,53	195,96	p < 0,001
Stools frequency/day						
D3	172	72	p < 0,001	163	68	p < 0,001
D5	67	30	p < 0,001	68	36	p < 0,001
D7	32	10	p < 0,001	32	12	p < 0,001
D9	8	1	p = 0,003	12	2	p < 0,001
Diarrhoea length/case- mean	4,95	2,91	p < 0,001	4,80	2,87	p < 0,001
Minimum diarrhoea length - days	3	2	NS	3	2	NS
Maximum diarrhoea length - days	8	5	NS	7	5	NS
Remitted diarrhoea cases/day						
D3	8	32	p= 0,0016	8	28	p= 0,006
D5	18	2	p= 0,0019	18	2	p= 0,002
No. of hospitalization days - mean	6,73	4,78	p < 0,001	7,10	5,22	p < 0,001
Maximum no. of hospitalization days/case	11	9	NS	12	10	NS
Total number of hospitalization days	410	292	p < 0,001	405	298	p < 0,001

Picture no. 1. Weight curve per rehydration group, at the age of 0 -12 months



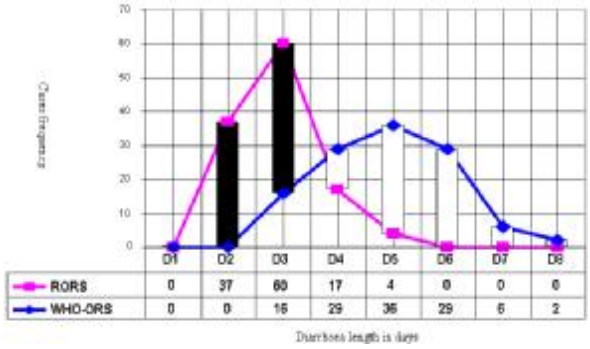
	W Jnt	W D3	W ext
WHO-ORS	6867	6905	6730
RORS	7018	7101	7195

Picture no. 2. Frequency stools curve/day per rehydration and age group



	D1	D3	D5	D7	D9
WHO-ORS	389	335	135	64	20
RORS	407	149	66	22	3

Picture no. 3. Diarrhoea length at the age of 0-12 months – stools frequency



	D1	D2	D3	D4	D5	D6	D7	D8
RORS	0	37	60	17	4	0	0	0
WHO-ORS	0	0	16	29	36	29	6	2

Picture no. 4. No. of hospitalization days at the age of 0-12 months – cases frequency

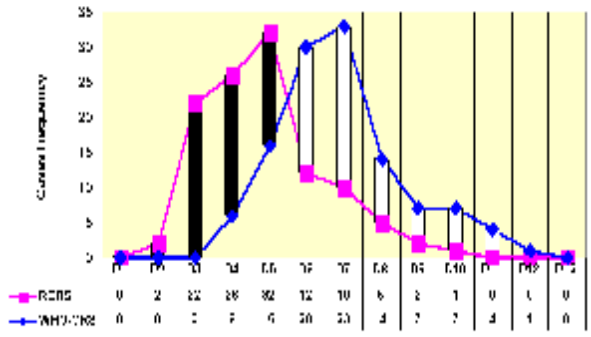


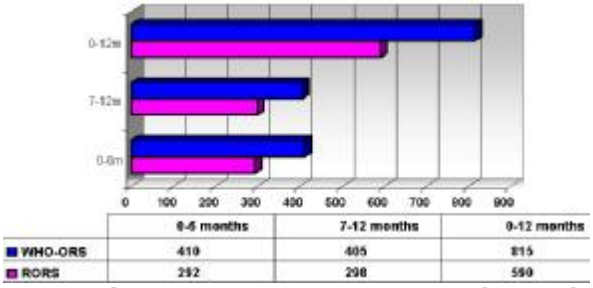
Table no. 3. Diarrhoea length and the number of hospitalization days per rehydration group – statistical data

Group		N	Amplitude	Minimum	Maximum	Mean	Std. deviation
WHO-ORS	diarrhoea length	118	5.00	3.00	8.00	4.8814	1.1779
	no. of hospitalization days	118	8.00	4.00	12.00	6.9153	1.7076
	Valid N	118					
RORS	diarrhoea length	118	3.00	2.00	5.00	2.8983	.7667
	no. of hospitalization days	118	8.00	2.00	10.00	5.0000	1.6997
	Valid N	118					

Table no 4. Correlation between diarrhoea length and no. of hospitalisation days

Group	Age		Average	Std. deviation	N
WHO-ORS	0-6 months	diarrhoea length	4,9508	1,2169	61
		no. of hospitalization days	6,7377	1,5265	61
	7-12 months	diarrhoea length	4,8070	1,1408	57
		no. of hospitalization days	7,1053	1,8773	57
	0-6 months	diarrhoea length	2,9180	,7593	61
		no. of hospitalization days	4,7869	1,7041	61
	7-12 months	diarrhoea length	2,8772	,7808	57
		no. of hospitalization days	5,2281	1,6799	57

Picture no. 5. Total number of hospitalisation days



	0-6 months	7-12 months	0-12 months
WHO-ORS	410	405	815
RORS	292	298	590

The origin environment was predominantly rural, 58,5%, as against the urban environment, 41,5%, with a statistically significant difference p = 0,04.

Cases repartition per gender show an increased frequency of illnesses due to acute enterocolitis, in the males infants, of 56,8%, as against the female gender 43,2%, an insignificant difference from the statistical point of view.

Enterocolitis **etiology** was predominantly viral, in a percentage of 61,86% - 66,10% of the cases, which corresponds to the latest statistical data regarding the frequency of the viral gastroenterocolitis, as Blacklow et al reveal in a study made in March 2008. On the second place, the mycotic etiology is placed with a percentage of 14,4%, while on the second place, there is the bacterial etiology, with a percentage of 5,1%.On the fourth place, there is the parasitary etiology - 3,8%.

CONCLUSIONS

The infants rehydrated with reduced osmolarity solutions, as against those rehydrated with standard solutions registered:

- **Significantly low stools frequency, with 58% less, starting from the third day of treatment.** The curve of the stools frequency/day registered a decreasing trend between the first and the third day of treatment in the RORS rehydrated group. The WHO-ORS group registered a decreasing trend between the third and the fifth day. The differences were highly statistically significant between those two rehydration groups, starting with the third day and during the entire hospitalization period of time (p <0,001).

- **The average diarrhoea length was much reduced, with 40 %** - an average between 2,89 ± 0,76 days, as against 4,88 ± 1,17 days, a statistically significant difference p <0,001).
- **The maximum length of diarrhoea was reduced with 37,5%** - 5 days as against 8 days.
- **The number of hospitalization days/reduced case, with 31%** – an average of 5 ± 1,6 days as against 6,91 ± 1,7 days, a statistcally significant difference (p <0,001).
- **The maximum number of hospitalization days/reduced case, with 17%** - 10 days as against 12 days.
- **The total number of hospitalization days was reduced by 27%** - 590 days, as against 815 days, a difference which was considered statistically significant (p <0,001).
- **The evolution of the weight curve from hospitalization until the third day and discharge registered a high statistical increase in the RORS group as against the WHO-ORS group,** with a strong statistical significance (p<0,001).

Reduced osmolarity rehydration solutions RORS decrease the intraluminal osmolarity, favouring the abortion of water and electrolytes through the solvent drag action, while their use brings about real benefits in the treatment of acute gastroenterocolitis in infants, shortening both the diarrhoea length, stools frequency, and during the hospitalization period of time, representing a economical advantage regarding the cost-benefit relation, as well as a psycho-social advantage, the infant being more rapidly integrated within the family. The favourable evolution of the weight curve in the infants rehydrated with reduced osmolarity solutions decrease the risk for complications due to dehydration, rendering opportune the use of RORS in the acute enterocolitis treatment at home, as well.

- **The final conclusion is to recommend in the medical practice as a first stage in the therapeutic protocol in acute diarrhoea, the oral rehydration with hypo-osmotic solutions, with an osmolarity of 200-230 mosm/l, a reduced osmolarity due to the reduced contents of sodium of 60 mmol/l and glucose of 89 mmol/l. Oral rehydration with hypo-osmotic solutions represent a safe and efficient management in the treatment of acute gastroenterocolitis in infants.**

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