

DIGESTIVE HEALTH AND FACTORS THAT IMPACT IT: AN OBSERVATIONAL CASE-STUDY OF THE PEDIATRIC PATIENTS HOSPITALIZED FOR GUT DISEASES AT A PEDIATRIC HOSPITAL FROM TIMISOARA, ROMANIA

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DIGESTIVE HEALTH AND FACTORS THAT IMPACT IT: AN OBSERVATIONAL CASE-STUDY OF THE PEDIATRIC PATIENTS HOSPITALIZED FOR GUT DISEASES AT A PEDIATRIC HOSPITAL FROM TIMISOARA, ROMANIA (Abstract): The **aim** of the study was to investigate whether personal, perinatal and early nutritional factors have an impact on digestive health. **Materials and methods:** An observational case-study was performed on a sample of 248 pediatric patients (51.2% males), admitted into a pediatric hospital over the course of two years. The gathered data (the prespecified gut diseases, personal, perinatal factors and early nutrition) from the patients` files were used to build a data base. Statistical analysis (binomial logistic regression) was performed with the aid of SPSS20 Program. Two statistically significant age-groups (0-3 years, 3-18 years) were considered. **Results:** Differences were revealed between the two significant age-groups: 0-3 years (predominance of: enterocolitis, gastroenteritis-GE, cow milk allergy-CMA, acute dehydration syndrome-ADS and bacterial diseases, females, caesarian section, breast feeding 0-2 months) and 3-18 years (predominance of: GE, ADS and parasitic diseases, males, natural birth, breast feeding over 12 months). The outcome variables were gut diseases (enterocolitis, GE, CMA, ADS), the independent variables were personal (gender, age, residence), perinatal (gestational age, delivery type), early nutrition (duration of breast feeding, milk formulas, diversification age). Statistically significant associations were demonstrated between: natural feeding 0-2 months (NF-2)-CMA (OR=13.51, p=0.007-entire sample, OR=7.48, p=0.002-age group 0-3 years), NF-2-enterocolitis (OR=5.47, p=0.005-age group 0-3 years), NF-2-GE (OR=0.185, p=0.009-age group 0-3 years). Age, residence and delivery type also related to gut diseases. **Conclusions:** There is an association between gut diseases as dependent variables and personal (age, residence), perinatal (type of birth) and early nutrition (NF-2) independent variables. **Keywords:** GUT DISEASES, PERSONAL FACTORS, EARLY NUTRITION, OBSERVATIONAL CASE-STUDY.

INTRODUCTION

Gut diseases are frequently found and they differentiate within the child popula-

tion depending on etiology, localization and effects. In a study performed in The United States the results showed that two-

thirds of the surveyed Americans are burdened by gastrointestinal symptoms (1). There are gaps in our knowledge in understanding of infection/immunity throughout the human life cycle, focusing on focusing on early childhood growth (2). In the western region of Romania there is an increased burden of digestive pathology in pediatric patients, with an unknown area regarding factors that impact digestive health. In the performed study we aimed to investigate digestive health and factors that impact it in a population of pediatric patients hospitalized for gut diseases at a pediatric hospital in Timisoara, Romania, over the course of 2 years of study.

MATERIALS AND METHODS

The study was performed on a sample of 248 pediatric patients (51.2% males, aged between 1 day and 18 years) hospitalized at the “Pius Brinzeu” Clinical Emergency County Hospital Timisoara, Bega Clinic - Pediatric for gut diseases. The enrollment period was between January 1st, 2018 and December 31st, 2019. Each patient was hospitalized only once. It was a non-probability purposive sample, children with gut diseases being selected. Two age groups (0-3 years - 133 patients: 48.9% males), and 3-18 years - 115 patients: 53.9% males) and their recorded pathology gastroenteritis –(GE), enterocolitis, cow milk allergy (CMA), and acute dehydration syndrome (ADS) were considered in this analysis. The main inclusion criterion for the study sample was the hospitalized pediatric patients with diarrhea, vomiting or/and dehydration due to infectious or allergic disorders with location in the intestinal tract. Diagnoses of these intestinal diseases were collected from the children-

patients` files. The exclusion criteria were: more than one admission and incomplete files.

The method consisted of an observational case-study (combined approach: cohort and cross-sectional) of the hospitalized pediatric patients for gut diseases during these two years of study. The primary medical records were gathered for this investigation. The gathered data (certain gut diseases, personal, perinatal factors and early nutrition) from these patients` files were used to build a data base. The agreement of the County Hospital Leadership was asked for and received in order to access primary medical records while I agreed to keep them confidential and to respect the personal data protection law. The medical data were already considered for medical and statistical purpose, with the requested and received individual consent of the patients. The agreement (no. 10/ 02.04.2019) of the “Victor Babes” University of Medicine and Pharmacy’s Ethical Commission was requested and obtained for this statistical clinical study. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments.

Statistical analysis was performed by the aid of software *SPSS version 20* (3). Binomial logistic regression used the dependent variable that consisted of only two nominal categories (absence/presence of one specific gut disease), and the independent nominal (categorical: personal - gender, age-groups according to developmental stages criterion and residence, peri-

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natal factors - type of birth and gestational age, and early nutrition - duration of breast feeding, milk formulas and diversification age) variables that can be analyzed as possible predictors.

RESULTS

Gut diseases - by localization and etiology

Of the studied population 35% had enterocolitis and 29.9% gastroenteritis. At the age group *0-3 years* the most frequently were patients with enterocolitis (51.8%) and patients with GE (28.6%) and at the age group *3-18 years* the most frequently were patients with GE (31.3%).

Main gut diseases by *etiologies* were CMA (20.2%), bacterial (14.5% with: *E. coli* and *Helicobacter pylori*), parasitic (10.5% with: *Giardia lamblia*, *Toxocara canis* and *Enterobius vermicularis*) and viral (6.9% of patients with: Rotavirus and Adenovirus) diseases. At the age group *0-3 years* the most frequently met were CMA (34.6%) and bacterial diseases (15% of patients). At the age group *3-18 years* most frequently were found parasitic diseases (18.3%).

A generalized effect was ADS (31% of patients: 16.5% with gut diseases and 14.5% as result of other diseases). ADS was found in 27.8% patients aged 0-3 years, and in 34.8% patients aged 3-18 years.

Personal factors

(gender, age-groups and residence)

The *gender* distribution in the two statistically significant samples chosen by *age groups* was: 0-3 years - 48.9% males, and 3-18 years - 53.9% males.

The most frequently admitted pediatric

patients came from *urban* (58.9%), majorities of them living in Timisoara (50.4%). Patients who came from *rural* (38,7%) were less numerous and majorities of them came from Timis County (31%). Distribution on the statistically significant age groups of the pediatric patients considering urban/rural environment was: *0-3 years* (54.1% from urban, 48.9% living in Timisoara and 49.2% from rural environment, 38,3% living in Timis County) and *3-18 years* (64.3% from urban, 52.2% living in Timisoara and 33.9% from rural environment, 22.6% living in Timis County).

Perinatal factors

(gestational age and delivery type)

Most frequently found *gestational ages* were 40 weeks (41.9% pediatric patients) and 38 weeks (20.6% pediatric patients). There was a high rate of caesarean *delivery* (41.5% pediatric patients). Distribution of the pediatric patients on the focused age-groups was as follows: *0-3 years* (natural delivery - 48.1%, caesarian - 48.1%, gestational age 38 weeks - 27,1%, gestational age 40 weeks - 34,6% patients), *3-18 years* (natural delivery - 53.9%, caesarian - 33.9%, gestational age 38 weeks - 13.9% and gestational age 40 weeks - 48.7%).

Early nutrition (duration of natural feeding, milk formula, diversification age)

Most frequent duration of the *breast feeding* was over 1 year (21.8%), 0-2 months (20.2%) and 2-6 months (19.8% of patients). Most used *milk formulas* were Nan, Aptamil and Humana (29.9%), followed by powder milk (15.3% of patients). Most frequently *diversification age* was at the 6th month (46.4%). Distribution of the pediatric pa-

tients considering *early nutrition* on the focused age groups was: *0-3 years* (breast feeding 0-2 months at 24.1% and breast feeding over 12 months at 20.3% of patients) and *3-18 years* (breast feeding over 12 months at 23.5% and between 2-6 months at 20%) for breast feeding.

Distribution of the pediatric patients for artificial feeding with *milk formulas* was: at age groups *0-3 years* - Nan, Aptamil, Humana (42.9%), powder milk (16.5%) and at age groups *3-18 years* - Nan, Aptamil, Humana (14.8%) and powder milk (13.9%).

Distribution of the pediatric patients considering *diversification* age was: at age group *0-3 years* (at the 6th month - 46.6%, at the 5th month 33.1% of patients) and at age group *3-18 years* (at the 6th month - 46.1% and at the 5th month - 15.7% of patients).

High frequency (15% pediatric patients) of missing cases (no information) for early nutrition variables represents a limit of this study.

Prediction of gut diseases for entire sample

Residence resulted as a predictor for parasitic diseases with a decrease of these diseases in Timisoara (OR=0.11, p=0.001) and Timis County (OR=0.07, p=0.001). The model was 88.7% accurate.

A predictor for CMA was breast feeding with duration 0-2 months (OR=13.51, p=0.007, model - 84.2% accurate).

Prediction of gut diseases for age group 0-3 years

At the age group 0-3 years, binomial logistic regression indicated the breast-feeding duration 0-2 months as predictor

for: GE (OR=0.185, p=0.009, model - 71.5% accurate), Enterocolitis (OR=5.476, p=0.005, model - 66.1% accurate) and CMA (OR=7.48, p=0.002, model - 67.9% accurate).

Association GE - gender (OR=3.619, p=0.019, model - 71.5% accurate) indicate a higher frequency of this disease at female than male patients. Associations of age with gut diseases indicate for Enterocolitis (OR=0.516, p=0.005, model - 62.3% accurate) and for CMA (OR=0.54, p=0.01, model - 66.2% accurate) a decrease with age increase.

Prediction of gut diseases for age group 3-18 years

At the age group 3-18 years delivery type was found as predictor for GE (OR=3.033, p=0.014, model - 68.1% accurate), which indicates an increase of GE for patients with natural delivery.

DISCUSSION

In the performed case-study a population of pediatric patients was investigated for gut diseases and factors that could impact them. First results indicated localization and etiology as being used in the diagnoses of this pathology. Therefore, enterocolitis, GE, CMA, microbial, viral and parasitic diseases were determined to be gut diseases. The highest frequencies of enterocolitis and CMA were found in pediatric patients aged between 0-3 years, and of GE in patients aged between 3-18 years. Previous studies have shown that Enterocolitis could be determined by sepsis or food allergies in infancy (4) and that the burden of acute gastroenteritis on children continues to be enormous (5). CMA is the most common food allergy,

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especially in infancy (6). A generalized effect was ADS and predominated in patients aged between 3-18 years. In another study, most cases of ADS were clinically diagnosed (similar with our study) (7).

In the performed study, distribution of age-groups of the pediatric patients diagnosed with gut diseases was non-uniform when the information was collected from primary sources of evidence. More than half of the pediatric patients age was between 0 - 3 years. The necessity to adjust the investigation of GE to the age resulted in an empirical examination study of the 'pediatric gastroenteritis admission rate' indicator in Italy (8). In our study we considered age-groups (according to developmental stages criterion) when analyzed association with gut diseases for both samples.

The study involved a predominance of patients from an urban area for these two age groups. The loss of environmental biodiversity could be a public health threat as was concluded in another study (9). Caesarean delivery was more frequently (14%) at the age group 0-3years than at 3-18 years. Caesarean section is medically indicated. The concept of option arises from the fact that the regulations are more permissive in certain countries. The reasons why women opt for caesarean section were analyzed in another study and consisted of the fact that it is a pain-free method of birth and it is safe for both mother and baby (10). Early nutrition investigation of the pediatric patients in the performed study indicated natural (breast) and artificial feeding. Natural feeding duration was frequently found between 0-2 months for pediatric patients aged between 0-3 years, and over 1 year

for pediatric patients aged between 3-18 years, suggesting a tendency to decrease the duration of breast feeding at 0-2 months. Human milk has potential effects on the infant, effects that will never be possible with the milk formula: it contains specific oligosaccharides that drive the growth of microbes within the gut (human microbiome), antimicrobial proteins/peptides that assure the immune protection (11). In the performed study, main milk formulas used for artificial nutrition were NAN, Aptamil, Humana and powder milk. These milk formulas predominated at the age groups 0-3 years and were used in the same measure with powder milk at the age group 3-18 years. Milk formulas proved to be useful against infections and to stimulate growth when they were symbiotic enriched (12).

In this study associations were found between gut diseases and certain personal (residence, age and gender), perinatal (delivery type) and early nutrition (breast feeding 0-2 months) factors. The most significant results of this study were obtained for association of gut diseases (GE, enterocolitis, CMA) with natural feeding duration (0-2 months) at the age group 0-3 years. Frequency of patients with GE decreases when frequency of patients with natural feeding duration (0-2 months) increases. On contrary, frequency of patients with Enterocolitis and CMA increase with frequency of patients with natural feeding duration (0-2 months) increase. Another study demonstrated that there are risks associated with all forms of infant feeding, including the breast feeding or use of manufactured milk formulas (13). CMA was proved to develop even when the child is breast feeding when the mother's diet con-

tains cow milk (14).

Other important predictors for gut diseases were age and residence. At the age group 0-3 years, Enterocolitis and CMA decrease with age increase. Residence was associated with parasitic diseases for entire sample, with a decrease of parasitic diseases in urban environment (9). Age proved to be an important factor in the study of digestive diseases in children (8). Delivery type was associated with GE, at the age group, 3-18 years, with an increase of GE for patients with natural delivery. Another study found that the mode of birth affects oral microbiota in infants, vaginally delivered infants having a higher number of taxa detected than infants delivered through caesarean section (15).

The discovered results were supported by research literature presented. A limit of this study is that it is an observational one.

CONCLUSIONS

The most frequently identified gut diseases in hospitalized pediatric patients are: enterocolitis, gastroenteritis and cow milk allergy. ADS is frequently found as a generalized effect of gut diseases. The most affected age group is 0-3 years. Personal

factors (age and residence) are associated with gut diseases: age relates to enterocolitis and CMA. at the age group 0-3 years and residence relates to parasitic diseases for the entire sample. There is a weak association between delivery type and GE for age group 3-18 years. At the age group 0-3 years, there is a strong association between early nutrition factors (duration of breast feeding 0-2 months) and gut diseases: CMA, Enterocolitis and GE. As a general conclusion, there is an association between specific gut diseases and personal (age, residence), perinatal (delivery type) factors and early nutrition (natural feeding duration - 0-2 months).

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CONFLICT OF INTEREST AND FUNDING

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