EVALUATION OF APPLIED DIETARY MANAGEMENT IN PATIENTS WITH UREA CYCLE DISORDERS

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ABSTRACT

Urea cycle disorders (UCDs) represent a group of rare inherited metabolic disorders resulting from a partial or complete deficiency of one of the urea cycle components, thereby resulting in accumulation of ammonia, as well as other nitrogenous products, including glutamine and alanine. However, hyperammonemia results in cerebral edema and neurologic injury. These disorders may present at birth, childhood, or adulthood and may range from a relatively mild encephalopathy to profound developmental disability. Early diagnosis and treatment may prevent some of the adverse outcomes, which are primarily neurological.

In the present work child growth parameters were used to check efficiency of dietary that introduce to children, through four growth parameters that including length for age, weight for age, head circumference for age and body mass index (BMI) for age. The study revealed the prevalence between the onset of diagnosis and follow up based on anthropometric measurements was 50% stunted, 25% underweight and 37% wasted for BMI, compared to 87.5%, 75% and 25% respectively for the same parameters, after applied urea cycle disorders diet. This finding shows that even with adequate management of cases with urea cycle disorders also, some fractions of cases were stunted, underweight, wasted and microcephaly.

Keywords: Urea cycle disorders (UCDs), Diet management, Growth anthropometric parameters.

INTRODUCTION

Urea cycle disorders are inborn errors of metabolism that are characterized by episodic life-threatening hyperammonemia resulting from partial or complete inactivity of enzymes responsible for eliminating nitrogenous waste. Historically, mortality and morbidity have been very high, and survivors commonly have had devastating neurologic sequelae (Shih, 1976).

Inborn error of metabolism (IEM) are rare genetic disorders in which the body cannot properly turn food into energy, resulted in hereditary metabolic disease (HMD) and classically they result from the lack of activity of one or more specific enzymes or defects in the transportation of proteins (Martins, 1999).

The urea cycle is the only effective system that converts waste nitrogen from protein intake and the breakdown of endogenous protein (catabolism) into urea, which is excreted from the body. This system consists of five consecutive enzymatic reactions that convert one molecule of nitrogen from ammonia, one molecules of nitrogen from ornithine, and one molecule from aspartate to urea in each cycle, there is also a cofactor-producing enzyme (N-acetyl glutamate synthetase). There are five key enzymes in the urea cycle: Carbamoyl-phosphate synthetase 1 (CPS1), ornithine transcarbamylase (OTC), argininosuccinate synthetase (ASS), argininosuccinate lyase (ASL), and arginase (ARG). Additionally, a sixth enzyme, N-acetylglutamate synthase (NAGS) is critical for urea cycle function, providing CPS1 with its

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necessary cofactor (Mitchell *et al.*, 2009). NAGS, CPS-1 and OTC function in the mitochondria, while ASS, ASL and ARG exist in the cytosol (Summar and Tuchman, 2001).

Complete deficiency of CPS1 and OTC resulting the most sever forms of UCDs. While, ASS1and ASL deficiency maintain ability to excrete nitrogen in the form of citrulline, arginine, or argininosuccinic acid and hyperammonemia crises in these two conditions are a little bit easier to manage. However, all four of these enzyme deficiencies when sever present in the neonatal period with severe hyperammonemia and coma. ARG1 deficiency very rarely presents in the neonatal period. Citrin deficiency (citrulline type II) may present as severe neonatal cholestasis, and ORNT1 deficiency (hyperornithinemia, hyperammonemia, homocitrullinurea syndrome) does not usually cause symptoms in neonates. Patients with partial deficiency of the catalytic enzymes present at any age from early infancy to late adulthood depending on the degree of enzyme deficiency and the magnitude of the stress their bodies are exposed to. This includes males homozygous and females heterozygous for partial OTC deficiency. These were confirmed by Uta (2016).

Treatment of UCD includes restricted dietary protein, providing sufficient energy to prevent catabolism, supplementing with specific amino acids, and using nitrogen-scavenging drugs (Summar and Tuchman, 2001).

Prevention of hyperammonemia and treatment of UCDs rely heavily on ammonia-lowering strategies with administration of nitrogen scavengers such

as phenylacetate or pheylebutrate as well as low protein diet. Aggressive therapy to control ammonia is necessary to affect neurodevelopmental outcome. Long-term treatment consists chiefly of low protein diet and use of oral nitrogen scavengers. While, monitoring carefully that sufficient protein and calories are supplied to provide adequate nutrients for growth and prevention of catabolism, as stated by D'Aco *et al*. (2014) and Yange *et al*. (2016).

The goals of nutrition management are to prevent the accumulation of ammonia, normalize plasma amino acids, and promote normal growth and development. The treatment of UCD differs from other metabolic disorders with respect to protein intake. In UCD total protein is limited, unlike in other many metabolic disorders where total protein is not limited, but is provided as medical food without offending amino acid(s). Sources of protein in the diet for UCD include whole protein (breast milk or standard infant formula in infancy, baby food, table foods) and medical foods containing essential amino acids (Bernstein *et al*., 2015).

The scope in the present work is an assessment of the efficiency of the management of UCD patients including diets in inborn errors metabolic clinic in Genetic Research Unit, Pediatric Hospital, Ain Shams University for eight cases of UCDs.

MATERIALS AND METHODS

This retrospective study includes eight patients with UCDs, collected from Genetic Clinic Pediatric Hospital, Faculty of Medicine, Ain Shams University through the period 2011-2019. The biochemical analyses were done after taking the informed consent from the patients. It was written in accordance with the code of ethics of the World Medical Association (Declaration of Helsinki) for experiments involving humans.

Blood analysis: Measurement of ammonia and lactate were done using spectrophotometer (Greiner Diagnostic GMbH, Model: GP100, Germany), blood samples were collected from patients on EDTA tubes placed on ice (Machado and Pinheiro, 2014). Meanwhile, determination of arterial blood gas (ABG) in arterial specimen blood was collected anaerobically from peripheral artery in a syringe contains a minimal amount of heparin (Trulock, 1990) and assayed using blood gas analyzer (Siemens, Model: RAPIDPOINT 500, UK). However, metabolic screen test was performed in dry blood spot using acylcarnitine and amino acids kits (Germany) and analyzed by Tandem Mass Spectrometry (MS/MS) (ACQUITY UPLC H-Class, Waters Corporation, MA, USA) (Chace *et al*., 2003). On the other hand organic acids and orotic acid in urine was measured using gas chromatography (GC/MS) model Schimatzu, GC/MS-TQ8040, type Excellence in Science, Japan. Therefore, patients were diagnosed and characterized as UCDs (To confirm the diagnosis of UCD, and exclude other IEM disorders).

Patients' clinical data: Patients' clinical data were extracted from files, that concerning the following items:

- Birth date, date and mode of onset of disease.
- Clinical history of consanguinity, siblings' death.

General examination of anthropometric growth parameter: Anthropometric growth parameter included: length (Length for age), Weight (weight for age), Head circumference and Body Mass Index (Body Mass Index is equal to weight in kg / height square in meters) (Khosla and Lowe, 1967) for age (BMI).

Anthropometric parameters software: Eight patients under 5years were applied WHO Anthro Software (Verssion3.2.2, 2011). Data were used to calculate z-scores of the four previous different anthropometric nutritional indicators in comparison to the published World Health Organization/National Center for Health Statistics (WHO/ NCHS) according to reference population (WHO and UNICEF, 2009). These four indicators were as follow: underweight defined as weight−for−age z−score (WAZ) less than −2 SD, stunting defined as length−for−age z−score (LAZ) less than −2 SD, small head circumference (microcephalic) defined as head circumference-for-age z-score (HCAZ) less than -2 SD, finally wasted defined as BMI-for-age z-score (BAZ) less than -2 SD.

Siblings (sib) death measurement: Sib death percentage was calculated as percentage from total siblings' death patients number divided by total patient number.

Statistical analysis: Recorded data were analyzed using the statistical package for social sciences, version 25.0 (SPSS Inc., Chicago, Illinois, USA). Quantitative data were expressed as mean ± standard deviation (SD). Qualitative data were expressed as frequency and percentage.

Diet management: Depending on defending age and weight each patient gives specific and special diet as follow: infant patients from 3 months to < 6 months have received protein 1.8-2.0 g/kg and energy 120-140 kcal/kg recommended daily intakes according to the recommendation diet mentioned by Acosta and Yannicelli, (2001).

The principal of applied diet management based on three items: Protein restriction through using low available artificial natural protein intake such as (Bebelac1® or Aptamil1® or Biomil1®), nutritional supplementation amino acids (L-arginine) and pharmacological intervention or nitrogen scavenger therapy (sodium benzoate).

Data of the present study are obtained from eight of hospitalized patients aging from 1 day to 6 days and the gender was 4 males and 4 females diagnosed as urea cycle defects (UCDs) by newborn screening program in Genetics Unit, Pediatric Hospital, Ain Shams University.

Table (1) shows all patients aged from 1 day to 6 days (neonatal period), 50% male and 50% female with consanguinity between the parents present in 5 patients (62.5%) and history of sib death was 75% of patients. In this study all eight cases started their diagnosis at neonatal age with early symptoms e.g.

coma, convulsion, cyanosis, elevation of ammonia level and history of sib death.

Table(1): Demographic data of the patients:

Case	Gender	Age at onset in day	Admission symptom	Family History		
				Consanguineous marriage	Sib death	Birth order
1	Male	6	Coma	Positive	2 females & 1 male	6th
2	Female	3	Coma	Positive	1 male	2nd
3	Female	3	Convulsion	Negative	Negative	1st
4	Male	2	admitted in ▲NICU for screening for hyperammonemia as his brother died with the same condition	Positive	1 male	4th
5	Male	2	Coma	Negative	1 male	1st
6	Female	1	itemed to NICU since birth due to family history of previous sib death	Positive	2 male & 1 female	4th
7	Female	1	itemed to NICU since birth due to family history of previous sib death	Positive	2 females	4th
8	Male	3	convulsion and cyanosis	Negative	Negative	3rd

▲Neonatal Intensive Care Unit (NICU)

Regarding Table (2) shows laboratory data parameters that characterized UCD patients include blood gas, plasma ammonia level (µmol/L), metabolic screen test represented as citruilline and methionine amino acids, plasma lactate level, besides urinary both orotic acid and organic acids. Metabolic screen test was done to all eight patients and the results were classified in to three patients with high citruilline, two patients with both high citruilline and methionine and three patients were normal. Urinary orotic acid was tested in one case of high ammonia level for the diagnosis of UCD and the results was normal and seven patients could not performed. Also, blood gas test shows

six patients were respiratory alkalosis and two patients were normal. In addition, urine organic acids test was done to exclude the other metabolic diseases, and the results disclose five patients were normal and three patients could not performed. Finally, lactate level test was done and the results were at normal level in all studied eight patients.

Table(2): Diagnostic laboratory data of the studied patients:

Case No.	Blood gas	Lactate level	Metabolic screen test	Urinary orotic acid	Urine organic acids test	Diagnosis
1	aRespiratory alkalosis	cNormal	High Citruilline	Could not performed	Normal	fASS deficiency Citrullinemia Type I
2	Respiratory alkalosis	Normal	High Citruilline	Could not performed	Could not performed	ASS deficiency Citrullinemia Type I
3	Respiratory alkalosis	Normal	dNormal	Could not performed	Normal	UCD
4	bNormal	Normal	High Citruilline	Could not performed	Could not performed	ASS deficiency Citrullinemia Type I
5	Respiratory alkalosis	Normal	High Citruilline, High Methionine	Could not performed	Normal	ASS deficiency Citrullinemia Type I
6	Respiratory alkalosis	Normal	High Citruilline, High Methionine	Could not performed	Could not performed	ASS deficiency Citrullinemia Type I
7	Normal	Normal	Normal	eNormal	Normal	UCD
8	Respiratory alkalosis	Normal	Normal	Could not performed	Normal	UCD

a Respiratory alkalosis: pH>7.45,PCO_2<35mmHg.

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[b] Normal blood gas: pH(7.35-7.45), PCO_2 (35-45 mmHg).

[C] Normal level of lactate < 20 mg/dl.

[d] Normal metabolic screen test: normal level of amino acids.

[e] Normal urinary orotic acid test: 0-6 µmol/mmol creatinine.

[f] ASS: Argininosuccinate synthetase.

Table(3): Diet management calculated depending on age and weight of eight infants UCDs:

Case No.	Age in months	Weight kg	Na benzoate mg/kg/day	Arginine mg/kg/day	[□]Protein g/kg/day	[□□]Protein-free formulae Calories kcal/kg/day	Total Calories kcal/kg/day
1	3	6.12	267	267	1.65	58	122
2	3	5.2	300	250	1.56	31	99
3	3	3.9	250	250	1.5	72	125
4	3	6	280	280	1.6	35	98
5	3	3.9	250	250	1.29	38	128
6	3	4.3	209	209	1.15	84	137
7	3	6	250	0	1.5	50	110
8	3	5	250	0	1.9	30	125

[□]Natural protein: Biomil1[®] or Aptamil1[®] or Bebelac1[®]

[□□]Protein free formula: Duocal® (dried glucose syrup, fractionated coconut oil, hybrid safflower oil, canola oil, emulsifier (E472©)

Data in Table (3) show UCD diet introduced to UCD patients. UCD diet include Na benzoate as reported by Tuchman *et al.* (2008), arginine as stated by Leonard (2001), artificial natural protein and protein-free formula for eight patients. Diet introduced to patient was different in content and calories depending on age and weight. Also, data in Table (3) show that some patients were not have arginine because was not available in this period (case No. 7, 8).

Table (4) shows results of ammonia level in plasma for UCD patients before and after treated with UCD diet. These values were elevated with range (200-300) µmol/L in five cases at onset and was highly elevated with range (>300-525) µmol/L in three cases at onset compared to normal level in neonate <134 µmol/L. Meanwhile, these values were decreased after treatment with UCD diet. However, after treatment with UCD diet this value was markedly decrease to be ranged from 55 to 97 µmol/L in normal level.

Table(4): Ammonia level in plasma of UCD patients onset (before) and after treated with UCD diet management.

Case No.	Ammonia level (µmol/L) onset (before diet management)	Ammonia level (µmol/L) after diet management	Ammonia lowering percentage %
1	350	61	82.57
2	525	97	81.52
3	276	97	64.85
4	500	75	85.0
5	300	94	68.66
6	300	55	81.66
7	200	71	64.50
8	220	87	60.45
Mean±SD	333.88±120.07	79.63±16.54	
Range	200 – 350	55 – 97	60.45-82.57

Paired sample t-test 6.046, p-value < 0.001very highly sig.

Table (5) shows comparison of z-score for anthropometric parameters (length, weight, BMI and head circumference) by WHO 2011 for UCDs patients between baseline and after treatment. Generally, there were markedly lowering on mean z-scores of all the parameters (length, weight and head circumference) at baseline -1.45($\pm$1.12), -1.55($\pm$0.78) and -0.44($\pm$0.77); while

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after patients treatment z-score values were -2.34($\pm$2.53), -2.05($\pm$1.6) and-1.45 ($\pm$0.93) respectively. In addition, no significant differences (p>0.05) in means z-scores of these anthropometric parameters for all cases were found, except BMI parameter found significant (p<0.05) effect improvement for z-score. The results obtained show that the eight subjects between baseline and after treatment were (50%) stunted at baseline, while after treatment patients were 50% stunted and 37.5% were severely stunted. Meanwhile, Weigh-for-age was 25% underweight at baseline changed to 50% underweight and 25% sever underweight after treatment. Respecting Table (5) BMI at baseline were (25%) wasted and (12.5%) severely wasted, change after diet management to only 25% wasted. Showing head circumference for age after treatment appeared 25% microcephalic.

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Table(5): Growth parameters of patients before and after UCD diet management.

Anthropometric measurements	Before management		After management		t-test	p-value
	No.	Mean (±SD)	No.	Mean (±SD)		
Length-for-age (cm)	8		8			
Severely stunted (≤ -3SD)	0	-1.45 (±1.12)	3 (37.5%)	-2.34 (±2.53)	0.814	0.443
Stunted (-3 to -2SD)	4 (50%)		4 (50%)			
Normal (> -2SD)	4 (50%)		1 (12.5%)			
Weight-for-age (kg)	8		8			
Severely underweight (≤ -3SD)	0	-1.55 (±0.78)	2 (25%)	-2.05 (±1.6)	1.571	0.16
Underweight (-3 to -2SD)	2 (25%)		4 (50%)			
Normal (> -2SD)	6 (75%)		2 (25%)			
BMI-for-age	8		8			
Severely wasted (< -3SD)	1 (12.5%)		0			
wasted (< -2SD)	2 (25%)	-1.36 (±1.16)	2 (25%)	-0.93 (±0.85)	2.983	0.02*
Normal (-2 to +1SD)	5 (62.5%)		6 (75%)			
Overweight (> +1SD)	0		0			
Obesity (> +2SD)	0		0			
Head circumference-for-age	8		8			
Microcephalic (≤ -2SD)	0	-0.44 (±0.77)	2 (25%)	-1.45 (±0.93)	-0.954	0.372
Normal (-2 to +2SD)	8 (100%)		6 (75%)			

Paired sample t-test, Non-Significant > 0.05, Sig. < 0.05*, high sig. < 0.01**

Urea cycle disorders (UCDs) are inherited metabolic disorders that present with hyperammonemia, and cause significant mortality and morbidity in infants and children (Bijarnia *et al.*, 2018).

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Laboratory data are useful in the diagnosis of UCDs include plasma ammonia level, pH, CO_2, quantitative plasma amino acids, urine organic acids and urine orotic acid analysis (Summar & Tuchman, 2001).

Data in Table (1) reveal that the percentage of consanguinity of patients in the present study is 62.5% (5 patients), these percentage show 75% (6 patients) sib death as shown from the history of files presented in Table (1) without diagnosis if this percentage of sib death patients have UCD or not. This result indicates a strong relationship between consanguinity and sib death, where 75% (6 cases) from UCD eight patients divided into 62.5% (5cases) positive consanguinity and 12.5% death (1case) without consanguinity. These results indicate the importance of alarming parents to make this check as soon as possible to their babes' quickly after birth if there is relationship found between parents.

Results in Table (1) reveal that the neonatal age (2-6 days) show sever symptoms between coma, cyanosis, convulsion, elevation of ammonia level, and history of sib death. These results are in agreement with Tuchman *et al*. (2008) and Häberle (2012) they found these conditions are constantly associated with a high degree of mortality (~50%) and morbidity respectively.

Regarding Table (5) the child growth parameters were used to check efficiency of dietary which introduce to children, growth parameter including height for age, weight for age, head circumference for age and body mass index (BMI) for age. The alteration between the onset of diagnosis and follow up based on anthropometric measurements criteria was 50% stunted change

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to 87.5%, 25% underweight change to 75% & head circumference-for–age 25% microcephalic at follow up. These results are confirmed by Acosta *et al*. (2005) reported that UCD children are definitely at a higher risk for poor growth, motor disorders and neurocognitive disorders and they require lifelong dietary protein restriction.

Regarding prevalence of underweight (weight-for-age) Table (5) in the present work was highly change from 25% to 75% compared to 21% and 16% reported by Mansoor and Zahara (2010) before and after treatment. As regard to head circumference-for-age, prevalence of microcephalic was null change to 25% in follow up compared to non-change number 33% reported by Pei *et al*. (2014). The values of HC of patients in follow up -1.45 ± 0.93 SD is laid in normal values (mean −2 to <0 SD) which represent about 75% was lower than 88.2% the finding from Acosta *et al*. (2005), based on the medical records.

Table(6): Z-score of anthropometric parameters (weight-for-age, length-for-age, head circumference-for-age& BMI-for-age) in males and females neonatal patients with three months:

Case No.	Case gender	Ammonia lowering percentage%	‣ WAZ	•LAZ	♦HCAZ	▪BAZ Recumbent
1	Male	82.57	-0.4	0.74	-1.73	-1.12
2	Female	81.52	-1.17	-0.92	-0.85	-0.89
3	Female	64.85	-3.58	-4.93	-2.71	-0.85
4	Male	85	-0.95	-1.30	-1.75	-0.27
5	Male	68.66	-4.49	-5.42	-1.96	-2.03
6	Female	81.66	-2.84	-5.13	-0.45	0.43
7	Female	64.50	-0.13	0.56	-0.01	-0.61
8	Male	60.45	-2.86	-2.29	-2.16	-2.13

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‣ WAZ: weight for age z-score.

•LAZ: height for age z-score.

♦HCAZ: head circumference for age z-score.

▪BAZ: BMI for age z-score.

Tables (3, 4 & 6) show that cases 1,2,4& 6 ammonia was lowered to approximately to the same percentage with range 81.5-85.0%, these four patients at age 3 months, two males and two females three of them case 1,2&4 received sodium benzoate ranged 267-280 mg/kg/day, arginine ranged 267-280 mg/kg/day, natural protein ranged 1.56-1.6 g/kg/day and total calories ranged 98-122 kcal/kg/day. While, z-score of the weight, length, HC and BMI of this three patients were normal. However, the fourth patient received 209 mg/kg/day sodium benzoate, arginine 209 mg/kg/day lower than the three of others, but give natural protein 1.15 g/kg/day and total calories was 137 kcal/kg/day more than others. While, z-score of weight and height were lower than the median (z-score <-2), z-score of HC and BMI were normal. These results indicate that lower arginine in case 6 may be attributed to lowering in weight and length, but this lower may be likelihood may be due to inherited effect because BMI of this patient (6) is normal that mean the weight and length is behave the same change that resulted in normal value.

This result in fourth patient reveal that despite she has taken total calories 137 kcal/kg/day which laid in the adequate ranged of calories (120-140 kcal/kg/day) but the weight and length were not in normal values of anthropometric. This finding may be attributed to inherited effects that her

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parents may be shorter in both weight and length, or this patient was not applied the program diet or may be suffer from illness during the follow up period.

Tables (3,4&6) show two patients at age 3 months received 250mg/kg/day from both sodium benzoate and arginine, while natural protein 1.5 and 1.32 g/kg/day, with total calories 125 and 128kcal/kg/day in case 3 and 5 respectively. While, z-score of weight was lower than median (z-score <-3 severely wasted), and length z-score was lower than median (<-3 severely stunted), while z-score of HC was <-2 (macrocephaly) in case 3 and was normal in case 5, but z-scores of BMI was normal in case 3 (-2 to+1) and wasted in case 5 (<-2). In case 3 BMI was normal despite weight and height was abnormal, this finding may be due to that BMI parameter is a ratio between weight and height and this value in this case was laid in normal ratio of z-score which reflect that this change may be due to inherited effect. However, case 5 all anthropometric parameters were abnormal, while HC was normal from onset and is not affected with UCDs.

Tables (3,4&6) show two patients 7 and 8 at age 3 months have received 250 mg/kg/day of sodium benzoate, have not received arginine and have natural protein 1.5 and 1.9 g/kg/day with total calories 110 and 125 kcal/kg/day in case 7 and 8 respectively. On one hand, z-score of weight, length, HC and BMI were normal in case 7. On the other hand, case 8 was abnormal in all anthropometric parameters, weight was underweight (z-score <-2), HC was microcephaly (z-score<-2), BMI was wasted (z-score <-2) and

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length was stunted (z-score <-2). These results reveal that case 7 has received lower natural protein 1.5 g/kg/day and higher calories protein-free formula 50 kcal/kg/day compared to case 8 that have received natural protein 1.9 g/kg/day and calories protein-free formula 30 kcal/kg/day, despite both cases have received the same dose of sodium benzoate 250 mg/kg/day and have not taken arginine as essential amino acids which reflect in normal anthropometric parameters in case 7 and abnormality in case 8. This observation may be due to the differences between natural protein calories and protein-free formula was led to this finding or may be consequences of inherited effect.

There are summarization data of Tables (3, 4&6) present in Table (7).

Table(7): Summarization of the before data.

Case No.	Age	Case gender	Ammonia lowering percentage%	Na benzoate mg/kg/day	Arginine mg/kg/day	Natural Protein g/kg/day	Protein-free formulae kcal/kg/day	Total Calories kcal/kg/day	WAZ	LAZ	HCAZ	BAZ Recumbent
1	3m	Male	82.57	267	267	1.65	58	122	-0.4	0.74	-1.73	-1.12
2	3m	Female	81.52	300	250	1.56	31	99	-1.17	-0.92	-0.85	-0.89
3	3m	Female	64.85	250	250	1.5	72	125	-3.58	-4.93	-2.71	-0.85
4	3m	Male	85	280	280	1.6	35	98	-0.95	-1.30	-1.75	-0.27
5	3m	Male	68.66	250	250	1.32	38	128	-4.49	-5.42	-1.96	-2.03
6	3m	Female	81.66	209	209	1.15	84	137	-2.84	-5.13	-0.45	0.43
7	3m	Female	64.50	250	0	1.5	50	110	-0.13	0.56	-0.01	-0.61
8	3m	Male	60.45	250	0	1.9	30	125	-2.86	-2.29	-2.16	-2.13

CONCLUSION

This study confirms previous studies that although a great deal of research and clinical experience has contributed to the understanding of the

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impact of disease on nutritional status of children with UCDs as well as the formation of suggested guidelines and treatment protocols, much more longitudinal nutrition surveys in future are needed in order to have a clearer understanding on the effect of disease or treatment upon metabolism, growth and development among children with UCDs.

This study shows that even with adequate management of cases with hyperammonemia, there is some fractions of cases have stunted, underweight and microcephaly. This stresses indicate to the neediness for improvement and training dietitian specialized in IEM clinic, continuous monitoring of the patients parameters (weight for age height/length for age and BMI for age) to reach optimized diet. Also molecular study and enzyme assay techniques should be available and performed in advanced study to facilitate UCD diagnosis precise and accurate than classical techniques.

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تقييم النظام الغذائي المطبق للمرضى في حالات اختلال دورة اليوريا

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المستخلص العربي

تمثل اضطرابات دورة اليوريا مجموعة من الإضطرابات الأيضية النادرة الموروثة الناتجة عن نقص جزئي أو نقص كامل لأحد مكونات دورة اليوريا، مما يؤدي إلى تراكم الأمونيا، وكذلك المنتجات النيتروجينية الأخرى، بما في ذلك الجلوتامين والألانين، ويؤدي زيادة مستوي الأمونيا في الدم إلى حدوث ارتشاح على المخ وإصابة عصبية. وقد تحدث هذه الاضطرابات عند مرحلة الولادة أو الطفولة أو البلوغ وقد تتراوح من اعتلال دماغي متوسط نسبيًا إلى إعاقة نموعميقة. وربما يؤدى التشخيص المبكر والعلاج إلى منع بعض النتائج السلبية التى تكون أساسا عصبية.

وتهدف هذه الدراسة إلى تقييم كفاءة إدارة مرضى اضطرابات دورة اليوريا بما في ذلك النظام الغذائي في عيادة التمثيل الغذائي لحديثى الولادة في وحدة الأبحاث الوراثية بمستشفى طب الأطفال جامعة عين شمس لعدد ثمانية حالات من حالات اختلال دورة اليوريا بعمر ثلاثة شهور. وقد تناولت الدراسة استخدام معايير نمو الطفل للتحقق من كفاءة النظام الغذائى الذى يقدم للأطفال، فقد شملت الدراسة معاييرالنمو مثل الطول بالنسبة للعمر، الوزن بالنسبة للعمر، وكذلك مؤشر كتلة الجسم للعمر وأيضا محيط الرأس بالنسبة للعمر.

وقد أظهرت النتائج بين بداية التشخيص والمتابعة بناءً على قياسات الجسم البشري أن نسبة ٥٠٪ يعانون من التقزم ٢٥٪ يعانون من نقص الوزن، ٣٧,٥٪ يعانون من انخفاض في مؤشر كتلة الجسم بالنسبة للعمر. مقارنة بنسب ٨٧,٥٪ ، ٧٥٪ و ٢٥٪ لنفس المقايس السابقه علي الترتيب بعد اتباع النظام الغذائي المخصص لحالات إختلال دورة اليوريا. مما يشير إلى أهمية إعادة النظر في النظام الغذائي لمرضى حالات اختلال دورة اليوريا.

الكلمات الدالة: اضطربات دورة اليوريا، إدارة النظام الغذائي، معايير النمو.