



**UNIVERSITY OF KWAZULU-NATAL**  
**SCHOOL OF AGRICULTURAL, EARTH & ENVIRONMENTAL SCIENCES**  
**DISCIPLINE OF DIETETICS & HUMAN NUTRITION**  
**EXAMINATION: NOVEMBER/DECEMBER 2012**  
**SUBJECT, COURSE & CODE: DIET THERAPY – SURGICAL DIET360 - P2**

**DURATION : 3 HOURS**

**TOTAL MARKS : 100**

**External Examiner : Mrs. A Raffner-Basson**  
**Internal Examiner : Ms C Biggs**

**NOTE: THIS PAPER CONSISTS OF 28 PAGES AND A 23 PAGE FORMULA HANDOUT. PLEASE CHECK THAT YOU HAVE ALL OF THEM**

**DO TWO (2) OUT OF THREE (3) QUESTIONS**

**STUDENT NUMBER:** \_\_\_\_\_

**QUESTION 1**

Mrs Di Alasis (50 year old black African of low socioeconomic status) has been on dialysis for a number of years and is a familiar figure in the haemodialysis unit. She came up for discussion in the renal team's weekly meeting as she has just been put on the renal transplant waiting list. Apart from renal failure and the related complications, she has been in reasonably good health this past year. Below are her results for the past week dialysis sessions.

Results	Monday 9 <sup>th</sup> Sept		Wed 11 <sup>th</sup> Sept	
	Predialysis	Postdialysis	Predialysis	Postdialysis
Urea (mmol/l)	46	28	32	25
Sodium (mmol/l)	140	138	142	139
Potassium (mmol/l)	6	5.8	6.3	5.9
Bicarbonate (mmol/l)	14	18	18	20
Creatinine (mmol/l)	987	700	800	650
Albumin (g/l)		22		24
Body weight (kg)	52	48	52.5	48.1
Height (m)		1.66		
Urine output per day (ml)	300		350	
Triceps skinfold thickness (mm)		3		
MUAC (cm)		23		

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1.1.1 Assess her nutritional status and comment on whether it is suitable for someone on the transplant waiting list. Include a good interpretation of the *nutritionally relevant* biochemical results for assessment. (7)

<b>Parameter</b>	<b>Calculations if necessary</b>	<b>Interpretation if necessary</b>
<b>BMI</b>		
<b>MUAC (23 cm)</b>		
<b>TST (3 mm)</b>		
<b>MAMC</b>		

Nutritionally relevant biochemistry:

Additional comments if necessary:

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1.1.2 Work out her fluid, energy and macronutrient prescription for haemodialysis. (8)



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Comments on her intake compared to her prescription:

1.1.4 Use the renal exchanges that you calculated that she was already eating in the previous question and add/alter these to more closely follow the renal prescription that you calculated. (3)

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1.2 A child of 4 years of age has been admitted for the first time to hospital. The child has been referred to you for treatment but you can't read the diagnosis in the file (typical doctor's handwriting). Medical treatment has not yet begun. The mother says that the child has been complaining of weakness and headaches and in spite of hardly eating anything the child is very fat. She says that it is strange as the face looks fat in the morning and then the legs look fat in the evening. The blood results are listed below.

	<b>Results</b>
Urea (mmol/l)	4
Sodium (mmol/l)	140
Potassium (mmol/l)	4
Bicarbonate (mmol/l)	20
Creatinine (mmol/l)	30
Albumin (g/l)	15
Total cholesterol (mmol/l)	10

1.2.1 From the blood results and the mother's description of the child, what is the child suffering from? Briefly explain why you arrived at this diagnosis. (3)

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1.2.2 Why does the mother describe her child as “fat” even though the child is eating very little? Explain why/how this “fatness” happens. (8 by  $\frac{1}{2}=4$ )

1.2.3 What nutritional adjustments can you make to reduce this “fatness”? (2)



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1.3 “Lipid emulsions demonstrate different biologic effects depending upon their specific fatty acid content, which may translate into beneficial effects for selected patients” (Philip C. Calder, Gordon L. Jensen, Berthold V. Koletzko, Pierre Singer, Geert J. A. Wanten. Lipid emulsions in parenteral nutrition of intensive care patients: current thinking and future directions. *Intensive Care Med* (2010) 36:735–749. DOI 10.1007/s00134-009-1744-5). **Discuss** under the following headings why the correct choice of lipid emulsions in the critically ill is very important. Include the soybean emulsions, the olive oil emulsions and SMOF giving examples where relevant.

1.3.1 Oxidation (3)

1.3.2 Immunity (4)

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1.3.3 Inflammation (4)

1.3.4 Thrombosis (2)

1.3.5 General conclusions (2)

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**QUESTION 2**

Mrs Un42nite, when driving home, was pushed off the road by a truck that had lost control. Her car caught fire and she sustained full thickness burns of 32%.

She was admitted to the ICU at the beginning of a long weekend when you were at the coast on holiday. She has been put in an enclosed heated cubicle. Her pain management is good. She has been heavily sedated and ventilated as there was some damage from smoke inhalation and the team want to prevent respiratory failure. She is a known epileptic and is on Phenobarbital (phenytoin suspension).

Although she is not conscious her gastrointestinal tract is fully functional. The anaesthetist on call over the weekend is passionate about early enteral feeding. He began feeding via the nasogastric drainage tube within 20 hours after admission as the gastric residuals were only 100 ml. Mrs UN42nite was given 2 litres of a semi elemental feed (12260 kJ, 125 g protein, 212 g CHO, 198g fat, osmolality 600) continuously per day. To the anaesthetists dismay, Mrs Un42nite aspirated and her gastric residuals increased to 600 ml per day.

She is 36 years old, weighs 55 kg, height is 168 cm. Her temperature is normal. Her blood results on Day 2 (Saturday) follow below. So far she has not been to theatre.

Blood test	Saturday	Blood test	Saturday
Glucose (mmol/l)	10	Potassium (mmol/l)	4
Urea (mmol/l)	4	Bicarbonate (mmol/l)	23
Creatinine (umol/l)	35	Albumin (g/l)	25
Sodium (mmol/l)	138	TG (mmol/l)	3.6
		Cholesterol (mmol/l)	5

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2.1 For each disease condition there is always a range to choose from for each stress factor. From what you know about Mrs Un42nite, are there factors that you have to consider that would either decrease or even increase her energy needs within this range? Elaborate.  
(6)

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2.2 Calculate her energy and macronutrient requirements. INCLUDE HER FLUID REQUIREMENTS (1 ml per kCal) (9)

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2.3 Interpret her blood results on the Saturday – is this what you would have expected from her history/injury? Explain the reasons/mechanisms behind the changes. For example “the urea is high/low because of the decreased breakdown of ammonia into urea because the kidneys are unable to process this”. (5)

2.4 Is there a connection between her gastric residuals and aspiration? Discuss briefly. (2)

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2.5 The doctor is puzzled as she did not have a paralytic ileus which could have caused the aspiration. The doctor wants to continue enteral feeding but does not want to feed past the pyloric valve. What suggestions can you make to reduce the risk of aspiration in this patient? Elaborate considering all other possible options. (6)

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- 2.6 In general, is a paralytic ileus a risk in a burns patient? If so, list the possible causes.  
(4)



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2.7 You have the following solutions available for use – the analysis below is based on 1 litre of feed. Also available is a protein powder (Protifar) which has 4½ g protein and 76 kJ per 5g scoop and a carbohydrate powder (Fantomalt) which has 5 g CHO and 320 kJ per 5 g scoop.

Based on what you know about her, choose what feed you would use – briefly mention each feed and why you would or would not use it. Her fluid prescription is 2 litres. (5)

Name	Freedom original RTH	Freedom HP Energy RTH	Nutrfeed Standard RTH	Peptidmen RTH	Peptidmen RTH HN
Type	Isotonic polymeric fibre free enteral feed	High protein, high energy, fibre free enteral feed	Isotonic polymeric fibre free enteral feed	Peptide based diet, fibre free enteral feed	High protein, high calorie, Peptide based diet, fibre free enteral feed
Energy (kJ)	4200	6300	4200	4200	5600
Protein (g)	38	75	40	40	66
CHO (g)	138	170	123	127	156
Fat (g)	34	58	39	37	49
Omolality	300	400	315	240	450
Arginine (g)	15			20	

Freedom original RTH	
Freedom HP energy RTH	

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<b>Nutrfeed std rTH</b>	
<b>Peptidmen RTH</b>	
<b>Peptidmen RTH HN</b>	

2.8 In spite of her now tolerating her continuous nasogastric feed, her epilepsy is poorly controlled even though she is on the same oral medication as prior to the accident when she was well controlled. Would you have expected this and if so could you think of any solutions? (4)

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2.9 Dipeptivan (glutamine) has just become available for you to use. Should you prescribe this for her now she is tolerating her feeds? Elaborate taking into consideration what you have been told about her. (4)

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2.10 Her nasogastric tube has blocked! The nursing staff has tried ineffectively to unblock this for an hour and have now called you to the rescue! You need something very effective as they have tried repeated flushing and using Coke. What would you recommend and how would you attempt to clear the tube? (2)

2.11 Tubes have been blocking fairly frequently in the ICU and you are going to have to establish the cause and then educate the staff. What could be the problems? (3)

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**QUESTION 3**

After watching the Olympic mountain biking finals on TV, Olympia (8 years) decided to attempt a very steep downhill on his bicycle and, unlike his heroes, ended up in the paediatric ward with moderate to severe acute pancreatitis after a spectacular fall. His symptoms include abdominal distension, nausea, diarrhoea, steatorrhoea and severe abdominal pain. On admission a gastric decompression tube was inserted to remove gastric secretions and TPN was initiated.

There is no FH of diabetes, hyperlipidemia or cancer. Blood results are below.

<b>Laboratory test</b>	<b>Result</b>	<b>Laboratory test</b>	<b>Result</b>
Sodium (mmol/l)	140	Glucose (mmol/l)	5.8
Potassium (mmol/l)	4.2	Total cholesterol (mmol/l)	4.2
Cl (mmol/l)	106	Triglycerides (mmol/l)	1.3
Urea (mmol/l)	4.9	Bilirubin total (umol/l)	15
Creatinine (mmol/l)	78.0	Bilirubin conjugated (umol/l)	2

3.1 Being a boy, he kind of likes the idea of digesting himself (he overheard the doctor explaining the cause of the pain to his parents). What triggers this and what can it result in? (2)

3.2 The nursing staff can't believe that he can have both steatorrhoea and diarrhoea together (what a mess). Is there a relationship? Explain. (2)

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3.3 Patients suffering from pancreatitis cannot always clear lipids from the blood especially if fed via TPN. What are the potential consequences of being unable to clear fat (essentially being given too much fat) and do you anticipate this being a problem in Olympia? (5)

3.4 You have motivated for trickle feeding to be started with 48 hours of admission. The paediatrician is very sceptical about this as it does not fit in with the conventional approach of total bowel rest and the child is having his full nutritional needs met via the TPN so what is the point? Elaborate using the headings below.

3.4.1 What is trickle feeding? (2)

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3.4.2 What are all the potential advantages in this case? (8 by  $\frac{1}{2}=4$ )

3.4.3 How do you suggest that the trickle feeding is given? (2)

3.5 If trickle feeding is agreed upon, what type of enteral feed would you recommend? (1)

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3.6 The doctor is keen to supplement with arginine – he has recently attended a parenteral nutrition update. Discuss the functions of arginine and whether you would supplement in this case. (7)



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3.7 Olympia's pancreatitis is improving. He has managed clear liquids and is ready to start a light diet. Using the exchanges below, plan a one day meal plan for Olympia. He likes to eat boerewors rolls, cheese and tomato sandwiches, pumpkin, ice cream, potato salad, pancakes, crisps, jelly tots and chocolate. Please use the renal exchanges as I don't think that you will remember the diabetic exchanges (I am being very very generous so this is 4 renal milk exchanges below). You do not have to take into account cultural stuff. (25)

Meat	6
Milk	4
Starch	8
Vegetables	2
Fruit	3
Sugar	6
Fat	4







# Model

**STUDENT NUMBER:** \_\_\_\_\_

## QUESTION 1

Mrs Di Alasis (45 years old, black African who loves sweet things) has been on dialysis for a number of years and is a familiar figure in the haemodialysis unit. She came up for discussion in the renal team's weekly meeting as she has just been put on the renal transplant waiting list. Apart from renal failure and the related complications she has been in reasonably good health this past year. Below are her results for the past week dialysis sessions.

- 1.1 Assess his nutritional status and comment on whether it is suitable for someone on the transplant waiting list. Give a good interpretation of the nutritional relevant biochemical results for assessment. (7)

Include MAC, TST, normagram, MAMC and blood values, BMI interpretation table

Parameter	Calculations if necessary	Interpretation if necessary
	Height = 1.66    Height <sup>2</sup> = 1.66 X 1.66 = 2.76 Weight = 48 kg	

Results	Monday 9 <sup>th</sup> Sept		Wed 11 <sup>th</sup> Sept	
	Predialysis	Postdialysis	Predialysis	Postdialysis
Urea (mmol/l)	46	28	32	25
Sodium (mmol/l)	140	138	142	139
Potassium (mmol/l)	6	5.8	6.3	5.9
Bicarbonate (mmol/l)	14	18	18	20
Creatinine (mmol/l)	987	700	800	650
Albumin (g/l)		22		24
Body weight (kg)	52	48	52.5	48.1
Height (m)		1.66		
Urine output per day (ml)	300		350	
Triceps skinfold thickness (mm)		3		
MAC (cm)		23		

<b>BMI</b>	$48/2.76 = 17.4 \text{ kgm}^2$	this is below the normal range of 20 therefore she is mildly malnourished ✓
<b>MUAC (24.0 cm)</b>	<5 <sup>th</sup> percentile	thin arms and not nutritionally compromised for the cut off for adults is $\geq 22 \text{ cm}$ which is the cut off for malnutrition ✓
<b>TST (35.0 mm)</b>	below the 5 <sup>th</sup> percentile	too little body fat ✓
<b>MAMC</b>	$22.3 \text{ cm} =$ on the 50th percentile	therefore normal muscle mass ✓

Albumin are way below the normal range which could mean that he was malnourished which seems logical in light of above anthros ✓

however alb levels are also determined by kidney function as alb is reabsorbed by the kidney and this function is lost in end stage renal failure ✓ therefore low alb could be a result of either.

So no she is not ready for transplant as her nutritional status is poor ✓

Comment for external: Most did not elaborate on the reasons for the albumin being low specific to renal failure. Most did not comment on whether her nutritional status was appropriate for a transplant. Most wasted time discussing biochemistry not related to nutritional status.

## 1.2 Work out his energy and macronutrient prescription for haemodialysis including fluid. (8)

Comment for external: A number of students tried to add an activity and stress factor – there is no excuse for that because they have an excel spread sheet on how to calculate renal equations for revision – it has also been emphasized that renal equations are based on IBW and the mg/kg/min is based on actual body weight. The ideal body weight is the lowest of the BMI range ie 18.5 multiplied by the height squared. This has also been gone over repeatedly so half marks were allocated for the rest of the question if the incorrect ideal body weight was calculated. Marks were lost if they did not interpret the NPE and/or the mg/kg/min – this was practiced and repeated endlessly in tests. If the total energy was wrong then the macronutrients were given half not full marks.

Must use IBW

### Calculating renal equations

Actual body weight (kg)	48
Height (m)	1.66
BMI	17.4
IBW range (min to max kg)	51.0 to 68.6
Ideal body weight	51 ✓

Protein in g/kg IBW	1.2	✓
Protein	61.2	
Ng	9.8	
Protein %	14	
Protein energy	1040.4	
Non protein energy	6609.6	
NPE:Ng2	675.0	✓
Energy	7650	✓
Carbohydrate %	55	✓
Carbohydrate Kj	4207.5	
Carbohydrate g	248	
mg/kg/min	3.6	✓
Fat %	31	✓
Fat g	63.2	
Total E	100	

Either 1 to 1.5 liters per day (as in renal summary sheet) or  
Urine output plus 1000 per day as in notes = 1325 ml ✓

- 1.3 His usual dietary intake is listed below. Is he eating according to his total nutritional prescription ie not just the energy and protein? Elaborate. NOTE use the actual food values of each of these foods as listed on your renal exchanges. Do not use the one page summary sheet that you would use to initially calculate the exchanges. (8)

#### INCLUDE THE RENAL EXCHANGES.

Breakfast
2 thick slices of white bread (total weight 120 g)
1 large mug tea (400 ml)
with condensed milk (2 level tablespoons)
Lunch
Dried beans cooked kidney (3/4 cups)
Maizemeal cooked crumbly porridge (4 heaped tablespoons - 200g)
1 large mug Tea (400 ml)
with condensed milk (2 level tablespoons)
Supper
Beef stew with vegetables (120g)
Samp cooked (300g)
1 large mug Tea (400 ml)
with condensed milk (2 level tablespoons)

Comment to external: I simply expected them to convert the above meal plan to the actual nutrient intake by using the renal exchanges they were actually given. For example for bread they needed to look up the value for white bread (would not accept brown bread) and then multiply it by 4 as the person ate 120 g per day and then fill in the correct values in the columns. To my surprise very few students could do this so for the additional marks at the end of this question I marked according to what they actually calculated the patient should have versus what they actually calculated the intake was to try and avoid a knock on effect. So there will be lots of variations in the answers.

Type	Type of exchange	Number of exchanges	Food code	E (kJ)	Prot (g)	CHO (g)	Fat (g)	PO <sup>4</sup> mg	Na <sup>+</sup> mg	K <sup>+</sup> mg
Bread 120g ½U	Starch low K	4	3210	1324	10.4	59.2	2	124	588	164
Condensed milk ½U	Milk high E	3	2754	2073	12	81.6	13.2	381	192	558
Dried beans ¾ cups ½U	Meat & meat subs	1	3183	453	7	12.3	0.4	100	2	457
Maizemeal cooked crumbly 200g ½U	Starch low K	4	3401	1384	7.2	67.2	2	144	4	204
Stew 120g ½U	Meat low P	2	3020	646	13.8	6.6	7.4	106	48	234
Samp 300g ½U	Starch low K	3	3280	1272	6.6	64.5	0.6	45	3	84
Tea	Low Kj Beverages	6.7		60.3	0	3.35	0	12.06	36.18	449
				7212.3	57	294.75	25.6	912.06	873.18	2150

No the protein and energy too low ✓ fat is too low and the CHO percent is too high. ✓ The K, Na and Phosphate are all in range. ✓

The fluid is Tea and condensed milk = 1200 + 36 = 1236 ml so he is drinking too much fluid. ✓

1.3 Use the renal exchanges that you calculated that she was already eating in the previous questions and add/alter these to more closely follow the renal prescription that you calculated. (3)

Comment to external: They were meant to take the differences between the prescription they actually calculated (whether it was right or wrong) and the intake and make corrections so again this was individually marked. For example if the person was taking 10 g of protein too little they needed to add the appropriate meat exchanges plus eg 30 g peanut butter in porridge etc plus a milk for example. In general they needed to increase the fat and protein which in turn would have corrected the “high” CHO intake.

Need to add 1 more protein exchange (milk or legume) to correct the protein, then add energy in the form of fat options to correct the fat. . ✓. ✓. ✓



- 2 A child of 4 years of age has been admitted for the first time to hospital. The child has been referred to you for treatment but you can't read the diagnosis in the file (typical doctor's handwriting). Medical treatment has not yet begun. The mother says that the child has been complaining of weakness and headaches and in spite of hardly eating anything the child is very fat. She says that it is strange as the face looks fat in the morning and then the legs look fat in the evening. The blood results are listed below.

	Results
Urea (mmol/l)	4
Sodium (mmol/l)	140
Potassium (mmol/l)	4
Bicarbonate (mmol/l)	20
Creatinine (mmol/l)	30
Albumin (g/l)	15
Total cholesterol (mmol/l)	10

- 2.2 From the blood results and the mother's description of the child what is the child suffering from? Briefly explain why you arrived at this diagnosis. (3)

Nephrotic syndrome ✓ as classically the blood alb are low, the blood cholesterol are high ✓ and the weakness, lack of appetite, headaches and gravity affected oedema (fatness) are all classic symptoms. ✓

- 2.2 Why do you think that the mother thinks that this child is "fat" even though the child is eating very little? Describe why/how this "fatness" happens. (4)

The oedema occurs as a result of:

- the fall in serum albumin ½
- which in turn results in a fall in colloid osmotic pressure ½
- resulting in the transudation of fluid from circulatory system to interstitial space ½
- which in turn reduces the circulatory volume ½
- resulting in a decrease in renal blood flow and BP ½
- this in turn stimulates the renin-angiotension-aldosterone system ½
- resulting in an increased retention of sodium and water by the distal tubules (secondary hyperaldosteronism) ½
- as a consequence the retained sodium and fluid also leak into the interstitial space which aggravates the oedema ½

- 2.3 What would you need to restrict to reduce this? (2)

Restriction of fluid ✓ plus no added salt diet used in beginning when child is oedematous ✓. Degree of restriction determined by the medical team

### 1.3

"Lipid emulsions demonstrate different biologic effects depending upon their specific fatty acid content, which may translate into beneficial effects for selected patients" (Philip C. Calder, Gordon L. Jensen, Berthold V. Koletzko, Pierre Singer, Geert J. A. Wanten. Lipid emulsions in parenteral nutrition of intensive care patients: current thinking and future directions. Intensive Care Med (2010) 36:735–749. DOI 10.1007/s00134-009-1744-5).

- 1.3 Discuss under the following headings why the correct choice of lipid emulsions in the critically ill is very important. Include in the discussions the soybean emulsions, the olive oil emulsions and SMOF giving examples where relevant.

Comment to external: I did mention in class a number of times of the importance of the lipid emulsions...this was marked very very liberally.

### 1.3.1 Oxidation

Soybean oil (PUFA and omega 6) are very susceptible to damage from oxidation and the ICU is a highly oxidative environment. ✓ This damages the cell membranes and results in cell death. ✓ To reduce oxidative stress other LE have been developed with a reduced omega-6 content eg the addition of MCT or olive oil (only 1 double bond) eg Olimel. ✓

### 1.3.2 Immunity

The immune response is influenced by fatty acids (cell signalling, gene expression, apoptosis, activity of macrophages and neutrophils and lymphocytes, antibody dependent cell cytotoxicity) ✓✓

“The link between PUFA intake, inflammation, and immunity is related to the fact that the phospholipid profile of membranes of immune cells is affected by the composition of dietary FAs, particularly the ratio of different types of PUFA (which can change rapidly) in these cells” ✓

Olive oil may be less immune detrimental than soy bean oil or MCT/soybean oil ✓  
Addition of FO to an omega 6 (soybean) may result in a lower LOS and reduced need for antibiotics and increased survival in surgical patients ✓

### 1.3.3 Inflammation

Soybean LE is high in omega 6 which is high in AA which produces proinflammatory eicosanoids which in turn regulate further inflammatory mediators such as TNF – strangely however lipoxins which are also formed from AA have potent anti-inflammatory actions ✓  
EPA and DHA (from omega 3) stop eicosanoid formation from AA and the cytokine production as it is easily incorporated into the cell membranes ✓

EPA forms the less pro-inflammatory agents PG E3 and LTB5. “The capacity of  $\omega$ -3 PUFAs to modulate synthesis of eicosanoids, activity of nuclear receptor and nuclear transcription factors..... may also mitigate inflammatory processes already present” ✓  
“Current evidence indicates that  $\omega$ -3 polyunsaturated fatty acids (PUFAs), particularly eicosapentaenoic acid and docosahexaenoic acid found in fish oil, can prevent the development of inflammatory diseases by affecting different steps of the immune response” ✓

Not much known about how olive oil effects inflammation but does not seem to encourage the production of inflammatory mediators ✓

### 1.3.4 Thrombosis

Thrombosis formation is common and life threatening in the ICU – caused by altered concentrations of clotting factors and changes in the fibrinolytic pathway culminating in intravascular coagulation – not many studies on this – FO may have a positive role in preventing coagulation issues – MCT and soybean oil probably have the same effect - ✓  
Not much known about olive oil – may reduce clotting mediators ✓

General conclusion

“Although there are conflicting views regarding the comparative utility of different LE formulations in critically ill patients, there is growing consensus that LEs based entirely on soybean oil should be avoided ✓ in favor of emulsions in which the LA and ALA content is partially replaced by MCT, olive oil providing MUFA or fish oil providing EPA and DHA” ✓

Mrs Un42nite, when driving home, was pushed off the road by a truck that had lost control. Her car caught fire resulting in full thickness burns of 32%.

She was admitted to the ICU at the beginning of a long weekend when you were at the coast on holiday. She has been put in an enclosed heated cubicle. Her pain management is good. She has been heavily sedated and ventilated as there was some damage from smoke inhalation and the team want to prevent respiratory failure. She is a known epileptic and is on Phenobarbital (phenytoin suspension).

Although she is not conscious her gastrointestinal tract is fully functional. The anaesthetist on call over the weekend is passionate about early enteral feeding. He began feeding via the nasogastric drainage tube within 20 hours after admission as the gastric residuals were only 100 ml. Mrs UN42nite was given 2 litres of a semi elemental feed (12260 kJ, 125 g protein, 212 g CHO, 198g fat, osmolality 600) continuously per day. To the anaesthetists dismay Mrs Un42nite aspirated and her gastric residuals increased to 600 ml per day.

She is 36 years old, weight is 55 kg, height is 168 cm. Her temperature is normal. Her blood results on Day 2 (Saturday) follow below. So far she has not been to theatre.

Blood test	Saturday	Blood test	Saturday
Glucose (mmol/l)	10	Potassium (mmol/l)	4
Urea (mmol/l)	4	Bicarbonate (mmol/l)	23
Creatinine (umol/l)	35	Albumin (g/l)	25
Sodium (mmol/l)	138	TG (mmol/l)	3.6
		Cholesterol (mmol/l)	5

For each disease condition there is always a range to choose from for each stress factor. From what you know about Mrs Un42nite are there factors that you have to consider that would either decrease or even increase her energy needs within this range? Elaborate. (6)

Yes – probably lower energy needs because sedated ✓ and ventilated with immediate good support of lungs ✓ and on Phenobarbital which can lower E needs by up to 20%, ✓ does not have sepsis ✓ and good pain control ✓. However smoke inhalation can increase metabolic rate ✓ heated cubical ✓ early nutritional support ✓

1. Calculate her E and macronutrient requirements. INCLUDE HER FLUID REQUIREMENTS (1 ml per Kcal) (9)

Comments to external – very few students got this right – they were told that there would be a schofield equation and that they must know how to do these calculations. Very few got the energy correct. The patient was ventilated therefore an activity factor of -15% should have been used. If the NPE was below 420 the student should have gone back and corrected the protein intake instead of just carrying on – showed a lack of understanding. Some used notes from previous years to do the fluid calculations – this was marked wrong as procedures have changed.

Stress factors is 1.5 to 1.8

Protein 1.5 to 2 g

CHO 60 to 70%

Fat <20%

Fluid (1ml per kCal)	✓ 1759	ml
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Energy Requirements				
30 - 59 yrs	✓ 55	5452	5452	
Basal Metabolic Rate:			5452	kJ
Stress factor	✓ 50	%	2726	kJ
Activity factor	✓ -15	%	-818	kJ
Total Energy			7361	kJ

<b>Protein</b>	g/kg BW	Protein (g)
	✓ 1.5	83
	% TE	NPE:gN
	19	✓ 451

<b>CHO</b>	% of Tot E	Total CHO (g)
	62	✓ 268
	mg/kg/min	
	✓ 3.4	

<b>Fat</b>
------------

<b>% of Tot E</b>	<b>Total Fat (g)</b>
<b>19</b>	<b>✓ 37</b>

**Total % of protein, CHO, fat**                      **100 %**

Interpret her blood results on the Saturday – is this what you would have expected from her history/injury? Explain the reasons/mechanism behind the changes. For example “the urea is high/low because of the decreased breakdown of ammonia into urea because the kidneys are unable to process this”. (5)

Comment to external – under albumin wanted the term mild depletion as this is the correct interpretation (otherwise for low got a half mark).

Low albumin – mild depletion ✓ – result of stress– def also expected in burns because of increased needs of protein because of an increased breakdown of skeletal muscles wound exudates. ✓ No surgery as yet. Not reflective of nutritional status.

High TG because of an increased fat breakdown which increases FFA and TG concentrations ✓ (driven by the catecholamines) – FA are usually bound to albumin – albumin levels are low and low carnitine levels results in less fat being moved into the mitochondria to be burnt and the accumulation of TG ✓

High blood sugar levels because of insulin resistance which is a common occurrence in burns patients ✓ There is insulin resistance often resulting in hyperglycaemia which has all the complications as with trauma

4 Is there a connection between the gastric residuals and the aspiration? Discuss briefly. (2)

Comment to external: Here I wanted a clear understanding of what a gastric residual was and how this could lead to aspiration especially in a sedated patient on a ventilator ie lying flat

Yes as high gastric residuals means that the stomach is not draining and there is a large volume of fluid in the stomach which cant go down and therefore has to come up (vomit) ✓ which increases the risk especially if unconscious of the vomit running back down into the lungs ie aspiration. ✓

5 The doctor is puzzled as she did not have a paralytic ileus which could have caused the aspiration. The doctor wants to continue enteral feeding but does not want to feed past the pyloric valve. What suggestions can you make to reduce the risk of

aspiration in this patient? Elaborate considering all other possible options.

(6)

Nurse at 45 degrees as there is no information given as to the angle of nursing and as told in class this is a leading cause of aspiration. ✓

Could have checked that the tube was still in place - no mark as this would not have increased the gastric residuals which was the problem and also the ng drain is a huge thick tube which is very unlikely to have moved.

Change the rate of administration ie started on 80 ml per hour instead of 20 ml per hour ✓ and therefore reduce the volume. ✓

Feed has a high osmolality as is semi elemental and high in energy ie change feed ✓

Can give feed with a lower fat content ✓

Change to a fine bore tube ie not the ng drain as this reduces reflux ✓

6 Is a paralytic ileus a risk in a burns patient? If so, list the possible causes.

(4)

Common complication Occurs within hours of being burnt as part of the shock response ✓

May be caused by:

- electrolyte disturbances (such as low blood potassium levels) ✓
- gastric ischaemia (lack of blood flow) ✓
- increased catecholamine levels which results in vasoconstriction in the splanchnic bed (vessels of the liver, spleen and intestine) resulting in slower peristalsis ✓

7 You have the following solutions available for use – the analysis below is based on 1 litre of feed. Also available is a protein powder – Protifar which has 4 ½ g protein and 76 kJ per 5g scoop and a carbohydrate powder – Polycose which has 5 g CHO and 320 kJ per 5 g scoop. (5)

Based on what you know about her choose what you would use – briefly mention each feed and why you would or would not use it. You need to decide how much fluid you need to give and then take it to the nearest ½ litre. If you want to give 1100 ml then give 1 litre for example.

Name	Freedom original RTH	Freedom HP Energy RTH	Nutrfeed Standard RTH	Peptidmen RTH	Peptidmen RTH HN
Type	Isotonic polymeric fibre free enteral feed	High protein, high energy, fibre free enteral feed	Isotonic polymeric fibre free enteral feed	Peptide based diet, fibre free enteral feed	High protein, high calorie, Peptide based diet, fibre free enteral feed
Energy (kJ)	4200	6300	4200	4200	5600
Protein (g)	38	75	40	40	66
CHO (g)	138	170	123	127	156
Fat (g)	34	58	39	37	49
Omolality	300	400	315	240	450
Arginine (g)	15			25	

Comment to external: The students should have started off first by eliminating the arginine rich foods as this is an unstable burn in the ICU and they have been taught to be very very careful before using an arginine enriched feed. They then should have taken their original prescription and figured out the volume that they need to give and then looked for the closest match mainly for energy and protein. The answer to this would vary depending on the original fluid and prescriptions as calculated by the individual student. They needed to give some idea of the amounts of fantomalt and protiphar to add.

<b>Freedom original RTH</b>	Although a burns patient she is not stable so I would not give arginine ✓
<b>Freedom HP energy RTH</b>	Too high in energy ✓
<b>Nutrfeed std rTH</b>	Could use this ✓ depending on what they calculated they can add fantomalt and protifar
<b>Peptidmen RTH</b>	Although a burns patient she is not stable so I would not give arginine ✓
<b>Peptidmen RTH HN</b>	Protein too high ✓

8 In spite of her now tolerating her continuous nasogastric feed her epilepsy is poorly controlled even though she is on the same oral medication as prior to the accident when she was well controlled. Would you have expected this and if so could you think of any solutions?

(4)

Yes as she is getting a phenytoin suspension it will be given down the tube ✓ – it interacts with the enteral feed and decreases concentrations of drug substantially ✓ and the drug has a narrow therapeutic range ✓ so better to inject it ✓ as the other option is to stop the feed before and after each for 2 hours and this is too much feeding time lost. ✓

9 Dipeptivan (glutamine solution) has just become available for you to use. Are you keen to use it on her now she is tolerating her feeds? Elaborate.

(4)

Her blood albumin levels are low – evidence shows that supplementation with glutamine can sig raise albumin levels. ✓

Yes as it is a conditionally essential AA in hypermetabolic conditions including burns.

Although a burns patient she is not stable so I would not give arginine ✓

Plasma and muscle glutamine is significantly lower in the initial burns injury – this may enhance susceptibility to wasting, weight loss and infections ✓

Nb energy source for the immune system and the GIT ✓

Burns patients continuously enterally fed on 0.57 g/kg/day glutamine had fewer gram –ve infections and a significant increase in pre-alb and transferrin and a reduced C-reactive protein after 2 weeks post burn when compared to the controls

101 Her nasogastric tube has blocked! The staff has tried to unblock this for an hour and have now called you to the rescue! You need something very effective as they have tried flushing and using Coke. What would you recommend?

(2)

Most effective method of unblocking tubes is using a solution of pancreatic enzymes

Mix 1 tablet of pancreatic enzymes in 15 to 30 ml of water

Add sodium bicarbonate (324 mg) to increase pH of the solution ✓

Use a 6 to 12 ml syringe to put this solution into the tube

Massage the tube while doing this

Let solution stand for 30 minutes in the tube before flushing with water ✓

Repeat if necessary

12 Tubes have been blocking fairly frequently in the ICU and you are going to have to establish the cause and then educate the staff. What could be the problems?

(3)

Laboratory test	Result	Laboratory test	Result
Sodium (mmol/l)	140	Glucose (mmol/l)	5.8

3 marks for any 3 of these

Tube inner diameter is too small (Fr 6 or smaller) ✓

Tube is not flushed regularly with 3water ✓

Adhesion of feed residue to interior of tube lumen ✓

Powdered or crushed drugs ✓

Gastric acid precipitation of feed ✓

Sour feeds

Kinked/knotted tubes. ✓

**DISCIPLINE OF DIETETICS & HUMAN NUTRITION  
EXAMINATION: NOVEMBER/DECEMBER 2012  
SUBJECT, COURSE AND CODE: DIET 360 P2**

**STUDENT NUMBER:** \_\_\_\_\_

**QUESTION 3**

After watching the Olympic mountain biking finals on TV, Olympia (8 years) decided to attempt a very steep downhill on his bicycle and, unlike his heroes, ended up in the paediatric ward with moderate to severe acute pancreatitis after a spectacular fall. His symptoms include abdominal distension, nausea, diarrhoea and steatorrhoea and severe abdominal pain. On admission a gastric decompression tube was inserted to remove gastric secretions and TPN was initiated.

There is no FH of diabetes, hyperlipidemia or cancer. Blood results are below.



Potassium (mmol/l)	4.2	Total cholesterol (mmol/l)	4.2
Cl (mmol/l)	106	Triglycerides (mmol/l)	1.3
Urea (mmol/l)	4.9	Bilirubin total (umol/l)	15
Creatinine (mmol/l)	78.0	Bilirubin conjugated (umol/l)	2

3.1 Being a boy, he kind of likes the idea of digesting himself (he overheard the doctor explaining the cause of the pain to his parents). What triggers this and what can it result in? (2)

Auto digestion of pancreas and nearby tissue (peritoneal and plural space) by premature activation of the pancreatic enzymes ✓  
Results in Systemic Inflammatory Response Syndrome (SIRS) ✓

3.2 The nursing staff cant believe that he can have both steatorrhoea and diarrhoea together. Is there a relationship? Explain. (2)

Yes fat is hydroxylated by bacteria in colon ✓  
Hydroxylated fat acts on mucosa of colon:increasing motility and decreasing water and electrolyte absorption therefore producing ✓diarrhoea

3.3 Patients suffering from pancreatitis cannot always clear lipids from the blood especially if fed via TPN. What are the potential consequences of being unable to clear fat (essentially being given too much fat) and do you anticipate this being a problem in Olympia? (5)

Comment to external: 2 marks were allocated to whether he was at risk, then need to get the hypertriglyceridemia making the pancreatitis worse and then 2 marks for anything else

Should tolerate the fat because the TG are below 4.4 mmol/l ✓ and there is no history of hyperlipidemia ✓

Hypertriglyceridemia which exacerbates the pancreatitis ✓ **and then ✓✓ for any of the below**

fatty infiltration of the liver (though usually from excessive CHO)

pulmonary disease eg may impair lung function possibly by altering intrapulmonary PG production

blood coagulation disorders

anaemia (haemolytic)

lipid induced toxicity (rare) - fever, chills, N, V after the initiation of therapy as well as abnormal platelet function

3.4 You have motivated for trickle feeding to be started with 48 hours of admission. The paediatrician is very sceptical about this as it does not fit in with the conventional approach of total bowel rest and the child is having his full nutritional needs met via the TPN so what is the point? Elaborate using the headings below.

What is trickle feeding? (2)

Trickle (trophic) feeding is the giving of small amounts ✓ (10 to 30 ml per hour of EN (adult) and 1 to 2 ml per hour (infant)) of enteral feed to maintain gut integrity and the other advantages of EEN so the point is small amount given enterally to maintain gut ie not to meet nutritional needs. ✓

What are all the potential advantages in this case? (8 by ½ )

Comment to external: [this question was asking the benefits of early enteral nutrition as the trickle feeding was started within 48 hours of admission](#)

Important to **feed early** with enteral nutrition to:

- T maintain gut integrity ½ (McClave *et al* 2009 Guidelines for the provision and Assessment of Nutrition Support Therapy in the Adult Critically Ill Patient. SCCM and ASPEN)
- T control the stress and immune system response ½ (McClave *et al* 2009 Guidelines for the provision and Assessment of Nutrition Support Therapy in the Adult Critically Ill Patient. SCCM and ASPEN)
- T diminish disease severity ½ (McClave *et al* 2009 Guidelines for the provision and Assessment of Nutrition Support Therapy in the Adult Critically Ill Patient. SCCM and ASPEN)
- T prevent stress ulcers particularly in burns (curlings ulcer) ½ (McClave *et al* 2009 Guidelines for the provision and Assessment of Nutrition Support Therapy in the Adult Critically Ill Patient. SCCM and ASPEN)
- T decrease incidence of infections and sepsis ½ (American Burns Association citing Moore *et al* 1992)
- T lower incidence of abdominal abscess in trauma and perhaps “earlier return of cognitive function in head injury patients” ½
- T improved wound healing ½
- T decrease protein catabolism and improve N balance ½ (American Burns Association citing Moore *et al* 1992)
- T reduced hospital stay ½ (McClave *et al* 2009 Guidelines for the provision and Assessment of Nutrition Support Therapy in the Adult Critically Ill Patient. SCCM and ASPEN)

How would you give this? (2)

Nasal jejunostomy tube ie below ligament of Treitz ✓ to reduce pancreatic secretion as much as possible ✓

3.5 If trickle feeding is agreed what type of enteral feed would you recommend? (1)

Small peptide based MCT formula ✓

3.6 The doctor is keen to supplement with arginine – he has recently attended a parenteral nutrition update. Discuss the functions of arginine and whether you would supplement in this case.

Would not supplement as this is a child and very little research done on immune enhancing stuff in children let alone for pancreatitis. ✓

Being essential for the transport, storage and excretion of nitrogen ✓  
supplying E ✓ ie production of creatine phosphate and part of the TCA energy producing cycle

being a strong endocrine secretagogue ie enhances secretion of insulin, glucagon, GH, prolactin and adrenal catecholamines ie anabolic hormones ✓

seems to play an important role in wound healing ✓ Successful wound healing is the key to recovery following surgical procedure

Seems to enhance wound collagen deposition ie increasing wound breaking strength ✓  
 plays an important role in the immune response ✓

Specialised immune cells (myeloid suppressor) “regulate the availability of arginine, necessary for normal T lymphocyte function.” Severe deficiency states can be caused by these cells - this reduces the production of NO (a vaso dilator) which “negatively impacts microcirculation”

Usually synthesised in sufficient quantities if non-stressed but thought to be conditionally essential under conditions of stress/hypermetabolism as N metabolism and E needs increase.

3.7 Olympia pancreatitis is improving. He has managed clear liquids and is ready to start a light diet. Using the exchanges below plan a one day meal plan for Olympia. He likes to eat boerewors rolls, cheese and tomato sandwiches, pumpkin, icecream, potato salad, pancakes, crisp, jelly tots and chocolate. Please use the renal exchanges as I don't think that you will remember the diabetic exchanges (I am being very very generous so this is 4 renal milk exchanges)

Meat	6	
Milk	4	
Starch	8	
Vegetables	2	
Fruit	3	
Sugar	6	
Fat	4	

Marking sheet for Pancreatic Olympia question

Student number: \_\_\_\_\_

Have they planned all the exchanges?

Meat	6	
Milk	4	
Starch	8	
Vegetables	2	
Fruit	3	
Sugar	6	
Fat	4	

Is the food allocated to each exchange correct?

Have they made low fat choices from the groups?

Are the meals suitable for a light diet?

Have they planned 6 small meals?

Have they included?

boerewors rolls	Not allowed
cheese and tomato sandwiches	They could give cheese sandwiches if you think the fat content of cheese is low enough
pumpkin	Include but cooked light
icecream	Include
Potato salad	Include if no onion or other stuff added
pancakes	Not allowed
Crips eg Simba	Not allowed
jelly tots	Allowed

chocolate	Not allowed
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Comments on meals:

Breakfast:

Snacks:

Lunch:

Snacks:

Supper:

Snacks:

General comment: