

Minortrack “Child Healthcare”

CAT “Food & health”, date 24-11-2017, 8.45-10.45 hrs

This examination contains **12** open questions. Each question contains information about how many points can be earned. The maximum number of points to earn for the test is 90.

Only write down answers in logical sentences, no loose information with lack of structure. Your grade is not influenced by the number of words you use in your answers, unless this is specified otherwise at the question.

It is not permitted to give more answers than specified in the question (e.g. three criteria, four aspects). So don't write down six answers in hoping three of them are correct.

This examination takes two hours (+ 30 minutes for the students with extra time). The end of the exam is marked by instructions how to submit your exam.

Practical matters

- Mobile phones have to be switched off and be put in your bag under your chair.
- Only necessities for this examination are allowed on the table.
- Questions about the content of the examination will not be answered.
- You can send your comments to the course representation (CVW) afterwards.
- Visiting the toilet is not permitted.
- Fraud will be punished.
- You are obliged to follow the instructions of the invigilator at all times.
- In the event of a technical malfunction, raise your hand so that your name can be written down by the invigilator. If your name is not written down, you have no right to complain afterwards.
- If you have not signed up for this examination, you will not receive a result.
 - You can object to the fact that you can no longer sign up for the examination after the subscription deadline.
 - Send in your appeal within one week after the examination. More information you will find on www.vu.nl/intekenen.

Good luck!

***Fill in your details and save your document regularly(Ctrl+s).
When you have answered all questions, please close the document and upload your file. See the instructions on the last page.***

Student number	
First name	
Prefix	
Surname	

**Question 1: Role of micronutrients in feeding and dieting
(3x 4 points)**

Inborn errors of metabolism can be diagnosed by at least three different tools/methods.

Which type of materials/tests can be used for identifying inborn errors of metabolism in general?

Structure your answer as follows:

	Material type:	Test this material for:
1.		
2.		
3.		

1a. urine 1b. metabolite testing (eg creatine, guanidinoacetate)

2a. source of DNA (eg blood, tissue, cells) 2b. genetic testing/ DNA sequencing (eg AGAT, GAMT, CTR genes)

3a. cells (eg lymphoblasts, fibroblasts) 3b functional assay (eg AGAT/GAMT enzyme, transport assay: creatine uptake)

**Question 2: Role of micronutrients in feeding and dieting
(2x 4 points)**

Quasiorkor is caused by extreme overrepresentation of carbohydrates in the diet (staple foods) with a concurrent lack of proteins and micronutrients. Thus, although these children are overweight and have fatty livers (steatohepatosis), they are clinically malnourished.

Describe in maximally 5 lines what is causing the (A) **fatty liver disease** and (B) **oedema** in these children, from a biochemical (molecular) perspective?

(A) The excess of carbohydrates is converted through glycolysis, acetyl-CoA and fatty acid synthesis into triglycerides. For TG to leave the liver lipoproteins (ApoB100) are needed, but these cannot be produced by lack of amino acids. As TG cannot leave the liver, they are stored in the liver leading to liver dysfunction (non alcoholic fatty liver disease).
(B) Oedema is caused by insufficient production of plasma albumin due to amino acid deficit, leading to osmosis: water is retracted from blood into the tissues (oncotic pressure).

**Question 3: Heelprick screening for newborns for metabolic diseases
(3 points)**

Newborn screening on phenylketonuria in The Netherlands started in 1974.

Name 3 reasons why screening for phenylketonuria was introduced.

1. Severe damage/developmental delay when untreated
2. Treatable/treatment with diet/treatment with phenylalanine restricted diet
3. Limitation of damage when treatment starts early/the earlier treatment the better

**Question 4: Development of the mammalian immune system
(2x 3 points)**

Diet affects the immune system at many levels. Vitamin A is a dietary component which is required for an optimal functioning immune system.

Provide **2 examples** by which vitamin A influences the immune system.

2 of the following answers:

1. Induction of L_{Ti} cell differentiation
2. Induction of CXCL13 expression, which attracts L_{Ti} cells during LN formation
3. It promotes isotype switching to the IgA isotype
4. It induces gut homing molecules on T cells
5. It promotes Treg cell formation

**Question 5: Immune responses in young children: the Generation R study
(5 points)**

From an immunological perspective an unborn fetus expresses many antigens which are foreign to the mother and therefore may induce an immune reaction in the mother directed against her baby. Yet, in a healthy pregnancy this does not occur. The mother is tolerant towards her baby. This tolerance involves dampening of immune cells that potentially may attack the fetus.

Explain the mechanism that prevents natural killer cell (NK cell) activation in the placenta.

There is high expression of HLA-G in the placenta, which upon binding to inhibitory receptors on the NK cells induces apoptosis and inhibits NK proliferation and cytotoxicity.

**Question 6: Malnutrition and the immune system
(10 points)**

Most undernourished children in developing countries die from infectious diseases. Especially protein malnutrition can lead to immunological problems.

Describe the relation between dietary protein intake, nucleotide synthesis and T- and B-lymphocyte function.

Proteins are digested to amino acids. Amino acids are the building block precursors of nucleotides especially in the liver but also in T and B cells. During T and B cell expansion in response to infection, clonal proliferation is so fast that the novo nucleotide synthesis cannot keep up with DNA multiplication. Purines and pyrimidines have to be taken up from blood (salvage pathway), but levels will be low due to insufficient production by the liver due to amino acid deficit. This hampers clonal expansion. Furthermore antibody production by B cells (protein!) requires sufficient amino acid availability in blood.

**Question 7: Outcome measurement: the case of preterm birth
(5x 2 points)**

Very preterm birth (gestational age \leq 32 weeks) is associated with a range of adverse neurodevelopmental outcomes.

Indicate **five adverse outcomes** reported in the reviews and meta-analyses provided as obligatory reading material.

5 answers out of:

1. Cerebral palsy.
2. Neurosensory impairments (visual, hearing).
3. Impaired intelligence.
4. Impaired motor development including developmental coordination disorder.
5. Behavioural and emotional problems and psychiatric disorders including (symptoms of) ADHD, internalizing disorders, externalizing disorders.

6. Impaired academic outcomes including impairments in mathematics, reading, and spelling.

**Question 8: Failure to thrive
(6x 3 points)**

Failure to thrive most often has a non-organic origin, however it is very important to exclude an underlying chronic disease.

Name **6 chronic diseases** and for each briefly describe at least one main factor responsible for growth impairment (10 words max per disease)

6 answers out of:

1. Cystic Fibrosis Increase energy expenditure, increased nutrient loss, decreased intake
2. Chronic kidney disease dietary restrictions, nutrient loss by dialysis
3. Chronic liver disease Increased energy expenditure, decreased nutrient intake, malabsorption, impaired protein synthesis
4. Congenital heart disease increased energy expenditure, decreased nutritional intake
5. Cancer Decreased nutrient intake, chronic inflammation, increased energy expenditure
6. Inflammatory bowel disease Decreased food intake, increased nutritional needs, steroids
7. Short bowel syndrome decreased nutrient absorption, increased nutrient loss
8. Chronic infection/immunodeficiency (HIV) Increased resting energy expenditure, increased nutrient loss, decreased nutrient intake

Disease=1 point, reason=2 points

From; [Kyle et al. Nutrition in Clinical Practice 2015 \(Links to an external site.\)Links to an external site.](#)

**Question 9: Problems of prematurity
(7 points)**

Which are the most common long term complications of extremely preterm infants? Name 7.

1. Increased incidence of cerebral palsy

2. Mental retardation
3. Sensory impairments
4. Minor neuromotor dysfunction
5. Language delays
6. Visual-perceptual disorders
7. Learning disability
8. Behavior problems
9. Metabolic syndrome

**Question 10: The severely ill child
(3 points)**

In critically ill patients, both failure to provide adequate calories as well as overfeeding may lead to detrimental effects. Application of standardized schedules or formulae may be too simplistic and inaccurate.

What diagnostic measurement is considered to be true guide for energy intake in critically ill children?

measurement of resting Energy Expenditure (alternative: indirect calorimetry, RQ =3).

**Question 11: Adrenocortical function in early life
(4 points)**

A 5 month old girl comes in to the emergency room with fever, rhinorrhoea and overall malaise. You suspect a viral upper respiratory tract infection. Because you find the child apathetic, you run blood tests. You find a glucose level of 2.2 mmol / l, a sodium level of 115 mmol / l and a potassium level of 6.9 mmol / l.

What type of deficiency is expected? A primary or a secondary adrenal insufficiency? Explain your answer

Primaire bijnierschorsinsufficiëntie (1 pt); vanwege de hyperkaliëmie (3 pt)

Question 12: Adrenocortical function in early life (repeat)
(4 points)

A 5 month old girl comes in to the emergency room with fever, rhinorrhoea and overall malaise. You suspect a viral upper respiratory tract infection. Because you find the child apathetic, you run blood tests. You find a glucose level of 2.2 mmol / l, a sodium level of 115 mmol / l and a potassium level of 6.9 mmol / l.

Which medication or medications should be given to the patient?

Hydrocortison
Fludrocortison
Both are needed, only one correct =1 point.