STB 1083 – BIOCHEMISTRY (G04)

PROBLEM BASED-LEARNING

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FILA TABLE

Facts	Ideas	Learning Outcome	Actions
1. Stopped playing with her friends and always tired.	a. Why she feels tired all the time? b. What nutrients is she lacking?	To identify role of co-factors and vitamins in metabolism	a. A variety of illnesses can cause a child to be tired. For an example eating low-nutrient diet/ eating a diet high in unhealthy fats, added sugar, processed food which deplete energy • Consuming too many refined carbs (because a rapid rise in blood sugar. This signals pancreas to produce large amount of insulin to reduce blood sugar level. This spike in blood sugar levels and subsequent fall can make you exhausted. • Result of being underweight – poor muscle strength can make you tired more easily b. Energizing nutrients suggested by dietitian **1. Iron** Without enough iron, your body can't make enough haemoglobin to transport oxygen throughout the body, this can lead to fatigue. The most absorbable form of iron (heme) comes from meat, while the lesser bioavailable iron (non-heme) is in certain plant foods, like spinach, oats, and lentils.

			2. **B12** Vitamin B12 is one of the most important nutrients for energy, since it contributes to the health of our blood, digestive system, brain and nervous system. A lack of Vitamin B12 in the diet can cause fatigue, but luckily most people get plenty of B12 from meat and eggs. Vegans can also get it from nutritional yeast and algae, but they may have to take a supplement if their diet is lacking. 3. **Other B Vitamins** Deficiencies in other B vitamins, such as thiamine, folate and niacin, can also cause fatigue. Because B vitamins are directly involved with energy production, taking a B-complex vitamin is a good idea for those with low intake or impaired absorption of B vitamins, especially people who are fatigued. 4. **Magnesium** Magnesium plays a role in muscle function and is a component to energy production. 5. **Vitamin D** Vitamin D has various functions in the body and is necessary for bone health, calcium absorption, immune function and reduction of inflammation. This fat-

			soluble vitamin is found in few foods (egg yolks, fatty fish, beef liver) but is naturally produced by the body from sunlight. 6. **Omega-3 Fatty Acids** A deficiency in omega-3 fatty acids can lead to mood and/or cognitive deficits. "These are found in the most absorbable form in small, fatty fish like wild salmon, mackerel, anchovies, sardines, and herring. There are also some omega-3s found in flaxseed, hemp seeds, marine algae, and chia seeds, but they are not as well absorbed by the body. 7. **Potassium** A low potassium level has many causes, but it usually results from vomiting, diarrhoea, adrenal gland disorders, or use of diuretics. Drinking too much alcohol and excessive sweating are other causes. A low potassium level can make muscles feel weak and fatigued. 8. **Carbohydrates** Carbs are the main fuel source for exercise, and they feed the brain, Without the proper amount of carbs in the diet the body works harder to convert other fuel sources to carbs for energy. This can cause fatigue,

			especially during exercise. Carbs come from grains, but they are also prevalent in fruits, veggies, and dairy.
2. Swelling abdomen	a. What caused the abdomen to swell? b. How does swell ed abdomen look like? c. What is the treatment for swelling abdomen?	To identify the food that rich in vitamin and prevent the symptom malnutrition	a. The abdomen swells because of the water retention and fluid build-up in the body cause the abdomen to expand. This results in a bloated, distended stomach or abdominal area. b. They are characterized as bloated, distinctively rounded stomachs (Figure 1)  *Figure 1 shows swelling of abdomen* c. Proteins. They are responsible for the balance of osmotic pressure in the body, Proteins are generally macromolecules, which means that they are sizably large

			and not easy to transport through cells permeable membranes. The proteins can pass through the membranes only through special mechanistic procedures in the membranes and are otherwise found in the blood serum or lymph. • The presence of proteins in the lymphatic system of the body leads to a higher osmotic pressure in the lymphatic fluid, as compared to the water in the gut. This hypertonicity causes fluid to flow from the gut into the lymph fluid and eventually into the blood stream. The regulation of water maintains a healthy distribution of water throughout the body. If this regulation is compromised due to protein deficiency, the build-up of fluid leads to distention of abdomen as well as fluid retention or oedema. • Another function of the proteins is to act in reverse of the hydrostatic pressure to maintain osmotic pressure in the tissues. The presence of proteins in the bloodstream of capillaries keeps water inundation of tissues in check. Proteins being larger molecules do not seep out of capillary walls like water does. Therefore, the presence of these proteins inside the capillaries creates

			colloid osmotic pressure. This regulates the uptake of water back into the bloodstream, so the tissues are not over saturated with water. With a lack of proteins due to malnutrition, this mechanism of regulation is stunted and water builds up in tissues as well.
3. Thin arms and legs	a. What causes arms and legs to be thin? b. How to treat?	To analyse the cause of malnutrition symptoms and ways to treat.	a. Her arm and legs were thin due to stunted growth caused by inadequate protein intake. It may also due to lack of fats which acts as adipose tissue under the skin. b. Depends of diagnose complication. Suggested to consume foods which contain fats and lipids such as tuna, salmon, almonds

4. Ribs poking through her chest	a. What caused the ribs to poke through her chest? b. How to treat them?	To analyse the cause of malnutrition symptoms and ways to treat.	a. Normal for kids to have visible ribs. But, a VERY visible ribs skeleton meaning they are skinny and underweight. The ribs poking through her chest maybe due to lack of proteins which builds up the layer of skin. b. It stated to consume a enough calories from nutritious foods can help in reaching healthy weight. Most children can't get enough calories from three meals alone, since their stomachs are still relatively small. They also need to eat two or three snacks during the day. Spread out meals and snacks

			evenly throughout the day, and don't give a snack right before a meal. Children should eat at least every 3 or 4 hours. Avoid high sugars food. Instead, concentrate on nutrient-dense foods, especially those that are also energy dense, such as avocados, peanut butter, nuts and cheese. Foods that are high in protein are also good choices, since protein is necessary for building new muscle. Combine these foods with whole grains, fruits and vegetables. Serve snacks such as whole-grain crackers with peanut butter, carrots with hummus dip and yogurt parfaits with fruit and granola.
5. Yellow-reddish colour hair and fall in chunks.	a. What caused her hair to be yellow-reddish coloured and fall in chunks? b. How to treat?	To analyse the cause of malnutrition symptoms and ways to treat.	a. Childhood malnutrition is known to be associated with visible lightening of hair colour (hypochromotrichia). • A decrease in melanin content is associated with periods of malnutrition. • Reduced intake or availability of tyrosine, a key substrate in melanin synthesis, may play a role in the reduction of hair melanin content during periods of malnutrition. • Prolonged protein deficiency in the diet results in Kwashiorkor. This disease involves multiple symptoms

			including the reduction of pigment production and incorporation into hair fibre. Normally dark brown hair becomes a rusty red. Light coloured hair becomes blonde. The flag sign sometimes seen in kwashiorkor involves alternating light and dark bands of colour along individual hair fibres. The flag sign is associated with intermittent protein malnutrition. b. Presumably normal hair colour is produced when protein intake is adequate and reduced hair colour occurs during times when there is a lack of protein intake.
6. Low appetite	a. What caused her to have low appetite? b. How to treat?	To analyse the cause of malnutrition symptoms and ways to treat.	a. Low appetite due to constipation, Intestinal worms, Anaemia, Depression, Medications, Anorexia nervosa, Illness (diarrhoea, fever etc) b. Make these meals high in calories and protein to make sure the body is getting plenty of nutrients and energy. People may also find having liquid meals, such as smoothies and protein drinks, easier to take.

7. Grades start to fall, and falling asleep in the class	a. Do the symptoms differ according to age? b. What nutrients and vitamins that are related to the brain? c. Is the brother experiencing the same case with Kanyange?	To identify the food that rich in vitamin and prevent the symptom malnutrition	a. Based on the trigger, little sister shows more symptoms compare to the big brother. This concludes that, younger age children are more prone to diseases compare to older age children due to their more develop immune system. Hence, younger children will receive more damage. b. Nutrients and vitamins that are related to the brain are: • Omega-3s: Omega-3 fatty acids are important for helping a brain function its best. In fact, research demonstrates that a special fatty acid called docosahexaenoic acid (DHA) may support normal cognitive function with age1. Thus, adults may support brain function by choosing sources of DHA more often. • Antioxidant Vitamins: Foods with antioxidant vitamins and minerals may protect against oxidative stress and its ensuing damage to the brain. • Vitamin B12 and Folate: A lack of these two vitamins may increase blood levels of homocysteine, an amino acid that's been linked with cognitive impairment, according to some research • Water: Water is an important nutrient. In fact, about 75 percent of the weight of your brain is water! When you

			don't get enough water – as in the case of dehydration – slight mental impairment can occur. And because many older adults do not meet the daily recommendations for water, emphasizing its importance in the diet is crucial. • Phytonutrients: Beyond vitamins and minerals, plant nutrients called "phytonutrients" act as antioxidants and anti-inflammatory agents in the body. Forgetting where an object is located or where a certain event occurred? That information is part of your "spatial memory" and one class of phytonutrients called polyphenols (like resveratrol) may increase spatial memory performance and activate neuroprotective pathways. • Vitamin B-complex: To produce energy, the use of glucose by nervous tissue implies the presence of **vitamin B1**; this vitamin modulates cognitive performance, especially in the elderly**. Vitamin B9** preserves brain during its development and memory during ageing. **Vitamin B6** is likely to benefit in treating premenstrual depression. Vitamins B6 and B12, among others, are directly involved in the synthesis of some neurotransmitters**. Vitamin B12** delays the onset of signs of dementia (and blood

			abnormalities), provided it is administered in a precise clinical timing window, before the onset of the first symptoms. Supplementation with cobalamin improves cerebral and cognitive functions in the elderly; it frequently improves the functioning of factors related to the frontal lobe, as well as the language function of those with cognitive disorders. • In the brain, the nerve endings contain the highest concentrations of **vitamin C** in the human body (after the suprarenal glands). **Vitamin D** (or certain of its analogues) could be of interest in the prevention of various aspects of neurodegenerative or neuroimmune diseases. Among the various **vitamin E** components (tocopherols and tocotrienols), only alpha-tocopherol is actively uptake by the brain and is directly involved in nervous membranes protection. Even **vitamin K** has been involved in nervous tissue biochemistry. • **Iron** is necessary to ensure oxygenation and to produce energy in the cerebral parenchyma (via cytochrome oxidase), and for the synthesis of neurotransmitters and myelin; iron deficiency is found in children with attention-deficit/hyperactivity disorder.

			• **Calcium**: Calcium ions are important intracellular signals that regulate several physiological processes, including neuronal gene expression, neuronal secretion of neurotransmitters into synapses, and synaptic plasticity. • **Iodine** is required for the synthesis of thyroid hormones that regulate a few physiological processes, including growth, development, metabolism, and reproduction. In addition, thyroid hormones are important for myelination of the central nervous system, which mostly occurs before and shortly after birth. Because iodine is critical for normal development of the brain, deficiency of this mineral during critical periods, such as during fatal development or during early childhood, can have deleterious effects on cognition. The most extreme cognitive effect of developmental iodine deficiency is irreversible mental retardation; milder cognitive effects include various neurodevelopmental deficits, including intellectual impairment c. Based on the symptom similarity (tired, thin & fat), there are big possibility they are.

<table>
<tr>
<td>8. May caused by the food they consumed.</td>
<td>a. Under which class of food that they normally consume?
b. Under which food class that they are lacking?
c. What is the amount of each food class that they should consume?</td>
<td>To identify the nutrient needed according to food class.</td>
<td>a. They consume foods like sweet potato, cassava (Carbohydrate) and banana (Vegetable and fruits)

b. Their food contains mostly carbohydrates and have almost no protein.

c. For kanyange (2 years old):

Ages 2 to 3: Daily guidelines for girls and boys

Calories — 1,000-1,400, depending on growth and activity level

Protein — 2-4 ounces

Fruits — 1-1.5 cups

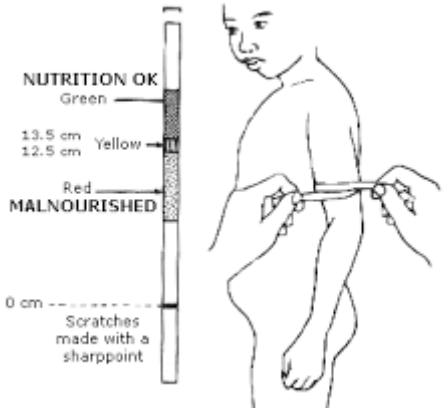
Vegetables — 1-1.5 cups

Grains — 3-5 ounces

Dairy — 2 cups</td>
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<td>For 7 years old son:
Ages 4 to 8: Daily guidelines for boys
<table><tr><td>Calories</td><td>1,200-2,000, depending on growth and activity level</td></tr><tr><td>Protein</td><td>3-5.5 ounces</td></tr><tr><td>Fruits</td><td>1-2 cups</td></tr><tr><td>Vegetables</td><td>1.5-2.5 cups</td></tr><tr><td>Grains</td><td>4-6 ounces</td></tr><tr><td>Dairy</td><td>2.5 cups</td></tr></table></td>
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<td>9. The health worker measured Kanyange arm and the health worker showed me a tape with three colours</td>
<td>a. Why they measured the arms only and not the legs?
b. What do the colours in the tape indicate?</td>
<td>To analyse the method used to identify malnutrition</td>
<td>a. Mid-upper Arm Circumference (MUAC)
MUAC (figure 2) is a quick and simple way to determine whether a child is malnourished using a simple coloured plastic strip. MUAC is suitable to use on children from the age of 12 months up to the age of 59 months. However, it</td>
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red, yellow, and green.	c. What are the advantages of this tape? d. What other methods that can be used to diagnose malnutrition?		can also be used for children over six months with length above 65 cm. Specially design for measuring arm circumference.  *Figure 2 shows the Mid-upper Arm Circumference (MUAC)* b. If using a 3-colour tape (Figure 3): • a measurement in the green zone means the child is properly nourished. • a measurement in the yellow zone means that the child is at risk of malnutrition. • a measurement in the red zone means that the child is acutely malnourished.

			If using a 4-colour tape: • a measurement in the green zone means the child is properly nourished. • a measurement in the yellow zone means that the child is at risk of malnutrition. • a measurement in the orange zone means that the child is moderately malnourished. • a measurement in the red zone means that the child is severely malnourished.  *Figure 3 shows the reading of Mid-upper Arm Circumference (MUAC) of 3 colour tape.*

			c. Advantages of Mid-Upper Arm Circumference (MUAC) screening • **It is simple and cheap**. It can be used by service providers at different contact points without greatly increasing their workload and it can be effectively used by community-based people for active case finding. • **It is more sensitive**. MUAC is a better indicator of mortality risk associated with malnutrition than Weight-for-Height. It is therefore a better measure to identify children most in need of treatment. • **It is less prone to mistakes**. Comparative studies have shown that MUAC is subject to fewer errors than Weight-for-Height (Myatt et al, 2006). • **It increases the link with the beneficiary community**. MUAC screening allows service providers from peripheral health units and from the community to refer children with acute malnutrition to therapeutic or supplementary feeding programs. The MUAC colour coding is easy to understand for the child's caretaker.

			d. The other method: Firstly, anthropometric indicators are more sensitive over the full spectrum of malnutrition than other indicators, though they lack specificity from changes in body measurement that may be the result of other biological or environmental factors. The example is BMI for age is widely used to measure malnutrition among school aged children both in internationally. The standard calculation is dividing a person's weight in kilograms by their height in meter squared. Almost all country specific and international growth refer to BMI. Next, note percentage of unplanned weight loss. Third identify mental or physical health conditions. Lastly, add all the scores obtain = overall risk of having malnutrition
10. The result came out to be red, which indicate malnutrition.	a. What is the definition of malnutrition? b. What is the negative effect of having malnutrition?	To define malnutrition and its negative effects	a. Malnutrition refers to deficiencies, excesses or imbalances in a person's intake of energy and/or nutrients. The term malnutrition covers 2 broad groups of conditions. One is 'undernutrition'—which includes stunting (low height for age), wasting (low weight for height), underweight (low weight for age) and micronutrient deficiencies or insufficiencies (a lack of important vitamins and minerals). The other is overweight,

	c. How much death that caused due to malnutrition?		obesity and diet-related noncommunicable diseases (such as heart disease, stroke, diabetes and cancer). b. The negative effect of having malnutrition are child could not grow tall and strong and it will affect how well they do in school. If the child is less than 2 years old the effect can be permanent. These kids can easily get disease like cholera, diarrhoea or malaria because body not strong enough to fight disease and take time to recover and can probably die. c. According to a fact sheet by WHO (2020), in 2016, around 45% of all deaths consist of children under the age of 5 due to undernutrition.
11. Needs medical treatment.	a. What is the treatment? b. How long does she need to recover from the disease?	To analyse the treatment for malnutrition	a. The treatment by giving fluids to replace those she had lost. Initially, she was given small amounts of milk and vitamin and mineral supplements. Zinc supplements helped stop her skin from flaking. After the oedema went away, the doctors gave her a high-calorie diet rich in protein. b. It depends on how severe the kid is malnourished. Minimum 2 weeks and could take up to 2 months.

12. If a child is as malnourish as Kanyange their stomach does not work properly anymore and giving them normal food could make them very ill.	a. Why their stomach does not work properly? b. Why does normal (usual) food make them ill? c. What are the nutrient contents in their normal food?	To evaluate important of balanced diet	a. A lack of protein in the diet or low levels of amino acids, the building blocks of proteins, can lead to symptoms like diarrhoea, inflamed intestines and other immune system disorders, which weaken the body and can be fatal. Malabsorption is a state arising from abnormality in absorption of food nutrients across the gastrointestinal (GI) tract. b. Their usual foods are sweet potatoes, banana and cassava. Those foods are rich in carbohydrate. But lack of other important nutrients such as proteins, some vitamins & minerals. Lack of protein could result in growth retardation. c. **Sweet potatoes** are mainly composed of carbs. Most of the carbs come from starch, followed by fibre. This root vegetable is also relatively low in protein but still an important protein source in many developing countries. Vitamin & mineral: vit A, vit C, vit B6, potassium, manganese **Bananas** are mainly composed of carbs. Bananas contain a number of vitamins and minerals in decent amounts. These include potassium and vitamins B6 and C. Along with potassium, bananas contain some vitamin C, folate, magnesium, and choline

			Cassava is a significant source of carbs and also provides a small amount of fibre, vitamins and minerals. The antinutrients in cassava may interfere with the absorption of some vitamins and minerals and may cause digestive distress. This is mainly a concern for populations that rely on cassava as a staple food.
13. She was provided with special food from clinic.	a. What are the possible types of special food from the clinic? b. What is the difference between the food provided by the clinic and the food from their home? c. How long does she need to consume the special food from clinic?	To evaluate important of balanced diet	a. Oral nutritional supplements or increased amounts of fortified foods and drink are usually given as an initial measure to patients who are unwell or have poor dietary intake. It may be a specially formulated milk-based feeds or ready-to-use therapeutic food (RUTF). *RUTF* is typically made up of peanut butter, milk powder, sugar, vegetable oil, and added vitamins and minerals. b. Foods provided by the clinic are more nutrients balanced and dense. They provide more variety of food classes compare to their home food. the meals are also altered specifically to fulfil their lacking in individual's required vitamins and minerals. c. Further check-up should be performed until they reach a healthy weight. The period of recovery is varied depends on the severity. Clinic will not continuously provide foods for

			outpatients. However, nutritionist would suggest healthy food proportion and nutrients needed to be consumed at home.
14. Below 2 years old, malnutrition can be permanent.	a. What are the permanent effects of malnutrition? b. Why is it permanent for kids below 2 years old? c. Do adults get malnutrition too?	To discuss the impacts of malnutrition	a. The permanent effects of malnutrition are: • Children who do not reach their optimum height or consistently experience bouts of weight loss during childhood are affected in the long term in numerous ways. They do not reach their optimum size as adults (and so may have less physical capacity for work), their brains are affected (resulting in lower IQs) and they are at greater risk of infection (which kills many children during their early years). • Child malnutrition impacts on education attainment. The degree of cognitive impairments is directly related to the severity of stunting and Iron Deficiency Anaemia. Studies show that stunted children in the first two years of life have lower cognitive test scores, delayed enrolment, higher absenteeism, and more class repetition compared with non-stunted children. Vitamin A deficiency reduces immunity and increases the incidence and gravity of infectious diseases resulting in increased school absenteeism.

			• Child malnutrition impacts on economic productivity. The mental impairment caused by iodine deficiency is permanent and directly linked to productivity loss. The loss from stunting is calculated as 1.38% reduced productivity for every 1% decrease in height while 1% reduced productivity is estimated for every 1% drop in iron status. b. Children under two years of age are in the most critical period for growth and development. As mobility increased, children would have the tendency to experienced first exposure to soil transmitted helminth (STH) infection, which can cause malnutrition. This time of period is crucial. Children under 2 are in the process of developing and do not have a strong enough immune system to prevent the body from further deteriorated by the malnourishment. Hence, risk to have a more serious effect which can be permanent for the rest of their life are high. c. Yes. Good nutrition is very important for all older adults. It is especially important for older adults who are ill or have been diagnosed with a chronic disease or dementia.

15. After 6 months of breast feeding. And continued to breastfeed until she is 2 years old.	a. What is the benefits of breastfeeding. b. What is the nutrient content in breast milk. c. Why did she keep breastfeeding Kanyange until 2 years old?	To identify the important of breastfeeding and nutrient content in breast milk.	a. The benefits of breastfeeding are: • **Protection from illness.** Your milk will continue to enhance your toddler's immune system so that he's less prone to colds, ear infections, allergies, and other common ailments. And even if he does get sick, nursing will help to comfort him. In fact, breast milk may be the only thing he can keep down on an upset tummy. • **A healthier future.** Research has shown that breastfed babies and toddlers enjoy all sorts of health perks when they grow up, including lower blood pressure and lower cholesterol. They're also less likely to be overweight or obese, and to develop type-2 diabetes. • **A brain boosts.** Though the research isn't conclusive, some studies have found that the longer and more frequently a toddler breastfeeds, the smarter he's likely to be thanks to the omega-3 fatty acids, or DHA, that are unique to breast milk. b. Nutrient content in breast milk are: • Free water. • Proteins – Protein accounts for 75% of the nitrogen-containing compounds and the non-protein nitrogen

			substances include urea, nucleotides, peptides, free amino acids and DNA. • Fats – Essential fatty acids and long-chain polyunsaturated fatty acids. c. She had to keep feeding Kanyange as extended breastfeeding is the nutritional boost it can give. In fact, experts believe that the composition of breast milk changes to adapt to a toddler's nutritional needs. Even if the child eats like a little bird, by nursing he may make up for any deficiencies created.
16. EXTRA	a. Based on all the symptoms, what is the possible disease name?		a. Answer is Kwashiorkor Based on the trigger, imbalanced nutrients intake is a major cause of malnutrition. The symptoms of malnourished child are changing hair and skin colour (due to *hypochromotrichia*); thin arm (due to skinniness); swollen stomach (due to protein deprivation); swollen leg (due to oedema); losing energy & concentration (due to lack of nutrients); and crying with no tears (due to severe dehydration). Younger children especially those under two years old are more prone to malnutrition and will receive more serious effect compare to an older one, due to weak immune system. The diagnosis of malnutrition for children are commonly through Mid-upper Arm Circumference

			(MUAC) and presence of oedema. The treatment for this disease is by consuming a healthy and balanced diet. Although we might get confuse with Marasmus. Kwashiorkor is protein deficiency with adequate energy intake whereas marasmus is inadequate energy intake in all forms, including protein. Kanyange gets enough or maybe excessive carbohydrate but almost no protein in her diet same goes for her brother. Further differences between Kwashiorkor and Marasmus (Figure 4) below:  | Kwashiorkor	Marasmus | |---|---| | It develops in children whose diets are deficient of protein. | It is due to deficiency of proteins and calories. | | It occurs in children between 6 months and 3 years of age. | It is common in infants under 1 year of age. | | Subcutaneous fat is preserved. | Subcutaneous fat is not preserved. | | Oedema is present. | Oedema is absent | | Enlarged fatty liver. | No fatty liver. | | Ribs are not very prominent. | Ribs become very prominent. | | Lethargic | Alert and irritable. | | Muscle wasting mild or absent. | Severe muscle wasting | | Poor appetite. | Voracious feeder. | | The person suffering from Kwashiorkor needs adequate amounts of proteins. | The person suffering from Marasmus needs adequate amount of protein, fats and carbohydrates. | *Figure 4 shows the differences between Kwashiorkor and Marasmus*

Discussion on PBL

Aneshaa

Based on the Fila Table above, the first facts that we encounter is “Stopped playing with her friends and always tired”. Therefore, why she feels tired all the time?

Pauline

A variety of illnesses can cause a child to be tired. For an example eating low-nutrient diet/ eating a diet high in unhealthy fats, added sugar, processed food which deplete energy. Besides that, consuming too many refined carbs (because a rapid rise in blood sugar. This signals pancreas to produce large amount of insulin to reduce blood sugar level. This spike in blood sugar levels and subsequent fall can make you exhausted. In addition, the result of being underweight – poor muscle strength can make you tired more easily.

Aneshaa

What nutrients is she lacking?

Keith

We suspected that she might be lacking several nutrients. As suggested by the dietitian energizing nutrients includes iron. Without enough iron, your body cannot make enough haemoglobin to transport oxygen throughout the body, this can lead to fatigue. The most absorbable form of iron (heme) comes from meat, while the lesser bioavailable iron (non-heme) is in certain plant foods, like spinach, oats, and lentils. Next, vitamin B12, it is one of the most important nutrients for energy, since it contributes to the health of our blood, digestive system, brain and nervous system. A lack of Vitamin B12 in the diet can cause fatigue, but luckily most people get plenty of B12 from meat and eggs. Vegans can also get it from nutritional yeast and algae, but they may have to take a supplement if their diet is lacking. Other B Vitamins too as deficiencies in other B vitamins, such as thiamine, folate, and niacin, can also cause fatigue. Because B vitamins are directly involved with energy

production, taking a B-complex vitamin is a good idea for those with low intake or impaired absorption of B vitamins, especially people who are fatigued. Magnesium might also be one of the reasons as magnesium plays a role in muscle function and is a component to energy production. Other than that, vitamin D has various functions in the body and is necessary for bone health, calcium absorption, immune function, and reduction of inflammation. This fat-soluble vitamin is found in few foods (egg yolks, fatty fish, beef liver) but is naturally produced by the body from sunlight.

Sharifah Nurazra

Not to forget, omega-3 Fatty Acids whereby a deficiency in omega-3 fatty acids can lead to mood and/or cognitive deficits. "These are found in the most absorbable form in small, fatty fish like wild salmon, mackerel, anchovies, sardines, and herring. There are also some omega-3s found in flaxseed, hemp seeds, marine algae, and chia seeds, but they are not as well absorbed by the body. A low potassium level also has many causes, but it usually results from vomiting, diarrhoea, adrenal gland disorders, or use of diuretics. Drinking too much alcohol and excessive sweating are other causes. A low potassium level can make muscles feel weak and fatigued. Finally, carbohydrates might not be one of the nutrient that she is lacking as she consume many of that but carbs are the main fuel source for exercise, and they feed the brain, Without the proper amount of carbs in the diet the body works harder to convert other fuel sources to carbs for energy. This can cause fatigue, especially during exercise. Carbs come from grains, but they are also prevalent in fruits, veggies, and dairy.

Sii Ming Ming

Therefore, the learning outcome is to identify role of co-factors and vitamins in metabolism.

Aneshaa

The second fact that we found is “Swelling abdomen”. What caused the abdomen to swell?

Whitney

The abdomen swells because of the water retention and fluid build-up in the body cause the abdomen to expand. This results in a bloated, distended stomach or abdominal area.

Aneshaa

How does swelled abdomen look like? Well here let me share you a picture of the swelling abdomen. The swelled abdomen was characterized as bloated, distinctively rounded stomachs (Figure 1)



Figure 1 shows swelling of abdomen

Aneshaa

What is the treatment for swelling abdomen?

Pauline

The treatment for swelling abdomen is by consuming proteins. They are responsible for the balance of osmotic pressure in the body, Proteins are generally macromolecules, which means that they are sizably large and not easy to transport through cells permeable membranes. The proteins can pass through the membranes only through special mechanistic procedures in the membranes and are otherwise found in the blood serum or lymph. The presence of proteins in the lymphatic system of the body leads to a higher osmotic pressure in the lymphatic fluid, as compared to the water in the gut. This hypertonicity causes fluid to flow from the gut into the lymph fluid and eventually into the blood stream. The regulation of water maintains a healthy distribution of water throughout the body. If this regulation is compromised due to protein deficiency, the build-up of fluid leads to distention of abdomen as well as fluid retention or oedema.

Keith

In addition, another function of the proteins is to act in reverse of the hydrostatic pressure to maintain osmotic pressure in the tissues. The presence of proteins in the bloodstream of capillaries keeps water inundation of tissues in check. Proteins being larger molecules do not seep out of capillary walls like water does. In addition, the presence of these proteins inside the capillaries creates colloid osmotic pressure. This regulates the uptake of water back into the bloodstream, so the tissues are not over saturated with water. With a lack of proteins due to malnutrition, this mechanism of regulation is stunted, and water builds up in tissues as well. Therefore, the learning outcome is to identify the food that rich in vitamin and prevent the symptom malnutrition.

Aneshaa

The third fact is "Thin arms and legs". What causes arms and legs to be thin?

Sharifah Nurazra

Her arms and leg were thin due to stunted growth caused by inadequate protein intake. It may also be due to lack of fats which acts as adipose tissue under the skin.

Aneshaa

How to treat?

Wong

To treat this, it depends of diagnose complication. Suggested to consume foods which contain fats and lipids such as tuna, salmon, almonds. Therefore, the learning outcome is to analyse the cause of malnutrition symptoms and ways to treat.

Aneshaa

The fourth fact based in the trigger is "Ribs poking through her chest". What caused the ribs to poke through her chest?

Sii Ming Ming

It is normal for kids to have visible ribs. But a VERY visible ribs skeleton meaning they are skinny and underweight. The ribs poking through her chest maybe due to lack of proteins which builds up the layer of skin.

Aneshaa

How to treat them?

Pauline

It is important to consume enough calories from nutritious foods can help in reaching healthy weight. Most children cannot get enough calories from three meals alone, since their stomachs are still relatively small. They also need to eat two or three snacks during the day. Spread out meals and snacks evenly throughout the day, and do not give a snack right before a meal. Children should eat at least every 3 or 4 hours. Avoid high sugars food. Instead, concentrate on nutrient-dense foods, especially those that are also energy dense, such as avocados, peanut butter, nuts, and cheese. Foods that are high in protein are also good choices, since protein is necessary for building new muscle. Combine these foods with whole grains, fruits, and vegetables. Serve snacks such as whole-grain crackers with peanut butter, carrots with hummus dip and yogurt parfaits with fruit and granola.

Keith

Therefore, the learning outcome is to analyse the cause of malnutrition symptoms and ways to treat.

Aneshaa

The fifth fact that we found is "Yellow-reddish colour hair and fall in chunks". What caused her hair to be yellow-reddish coloured and fall in chunks?

Sharifah Nurazra

Childhood malnutrition is known to be associated with visible lightening of hair colour (hypochromotrichia). Whereby a decrease in melanin content is associated with periods of

malnutrition. Also, a reduced intake or availability of tyrosine, a key substrate in melanin synthesis, may play a role in the reduction of hair melanin content during periods of malnutrition. Prolonged protein deficiency in the diet results in Kwashiorkor. This disease involves multiple symptoms including the reduction of pigment production and incorporation into hair fibre. Normally dark brown hair becomes a rusty red. Light coloured hair becomes blonde. The flag sign sometimes seen in kwashiorkor involves alternating light and dark bands of colour along individual hair fibres. The flag sign is associated with intermittent protein malnutrition.

Aneshaa

How to treat?

Wong

Presumably, normal hair colour is produced when protein intake is adequate and reduced hair colour occurs during times when there is a lack of protein intake. Therefore, the learning outcome is to analyse the cause of malnutrition symptoms and ways to treat.

Aneshaa

The sixth facts that we encounter is “low appetite”. What caused her to have low appetite?

Whitney

Low appetite due to constipation, Intestinal worms, Anaemia, Depression, Medications, Anorexia nervosa, Illness (diarrhoea, fever etc).

Aneshaa

How to treat?

Keith

To treat low appetite, it is the best to make these meals high in calories and protein to make sure the body is getting plenty of nutrients and energy. People may also find having liquid meals, such as

smoothies and protein drinks, easier to take. Therefore, the learning outcome is to analyse the cause of malnutrition symptoms and ways to treat.

Aneshaa

The seventh facts that we found is "Grades start to fall and falling asleep in the class". Do the symptoms differ according to age?

Pauline

Based on the trigger, little sister shows more symptoms compare to the big brother. This concludes that, younger age children are more prone to diseases compare to older age children due to their more develop immune system. Hence, younger children will receive more damage.

Aneshaa

What nutrients and vitamins that are related to the brain?

Whitney

Nutrients and vitamins that are related to the brain are omega-3s. Omega-3 fatty acids are important for helping a brain function its best. In fact, research demonstrates that a special fatty acid called docosahexaenoic acid (DHA) may support normal cognitive function with age 1. Thus, adults may support brain function by choosing sources of DHA more often. Next, antioxidant vitamins is also vitamins that related to the brain. Foods with antioxidant vitamins and minerals may protect against oxidative stress and its ensuing damage to the brain. Vitamin B12 and Folate also plays a big role as a lack of these two vitamins may increase blood levels of homocysteine, an amino acid that has been linked with cognitive impairment, according to some research. Not to forget water. Water is an important nutrient. In fact, about 75 percent of the weight of your brain is water! When you do not get enough water – as in the case of dehydration – slight mental impairment can occur. And because many older adults do not meet the daily recommendations for water, emphasizing its importance in the diet is crucial. Next, Phytonutrients is a plant nutrient related to the brain. It is beyond vitamins and minerals, plant nutrients called "phytonutrients" act as antioxidants and anti-inflammatory agents

in the body. Forgetting where an object is located or where a certain event occurred? That information is part of your "spatial memory" and one class of phytonutrients called polyphenols (like resveratrol) may increase spatial memory performance and activate neuroprotective pathways. Vitamin B-complex is needed to produce energy, the use of glucose by nervous tissue implies the presence of vitamin B1; this vitamin modulates cognitive performance, especially in the elderly. Vitamin B9 preserves brain during its development and memory during ageing. Vitamin B6 is likely to benefit in treating premenstrual depression. Vitamins B6 and B12, among others, are directly involved in the synthesis of some neurotransmitters. Vitamin B12 delays the onset of signs of dementia (and blood abnormalities), provided it is administered in a precise clinical timing window before the onset of the first symptoms. Supplementation with cobalamin improves cerebral and cognitive functions in the elderly; it frequently improves the functioning of factors related to the frontal lobe, as well as the language function of those with cognitive disorders. In the brain, the nerve endings contain the highest concentrations of vitamin C in the human body (after the suprarenal glands). Vitamin D (or certain of its analogues) could be of interest in the prevention of various aspects of neurodegenerative or neuroimmune diseases. Among the various vitamin E components (tocopherols and tocotrienols), only alpha tocopherol is actively uptake by the brain and is directly involved in nervous membranes protection. Even vitamin K has been involved in nervous tissue biochemistry. Iron is necessary to ensure oxygenation and to produce energy in the cerebral parenchyma (via cytochrome oxidase), and for the synthesis of neurotransmitters and myelin; iron deficiency is found in children with attention-deficit/hyperactivity disorder. Next, calcium ions are important intracellular signals that regulate several physiological processes, including neuronal gene expression, neuronal secretion of neurotransmitters into synapses, and synaptic plasticity. In addition, iodine is required for the synthesis of thyroid hormones that regulate a few physiological processes, including growth, development, metabolism, and reproduction. In addition, thyroid hormones are important for myelination of the central nervous system, which mostly occurs before and shortly after birth. Because iodine is critical for normal development of the brain, deficiency of this mineral during critical periods, such as during fatal development or during early childhood, can have deleterious effects on cognition. The most extreme cognitive effect of developmental iodine deficiency is

irreversible mental retardation; milder cognitive effects include various neurodevelopmental deficits, including intellectual impairment.

Aneshaa

Is the brother experiencing the same case with Kanyange?

Aneshaa

Based on the symptom similarity (tired, thin & fat), there are big possibility that the brother experiencing the same case with Kanyange. Therefore, the learning outcome is to identify the food that rich in vitamin and prevent the symptom malnutrition.

Aneshaa

The eight fact is "May caused by the food they consumed". Under which class of food that they normally consume?

Sii Ming Ming

The normal food that they consume foods like sweet potato, cassava (Carbohydrate) and banana (Vegetable and fruits).

Aneshaa

Under which food class that they are lacking?

Wong

We observed that their food contains mostly carbohydrates and have almost no protein.

Aneshaa

What is the amount of each food class that they should consume?".

Sharifah Nurazra

According to dietician, Kanyange which is 2 years old should consume calories between 1,000-1,400, depending on growth and activity level, protein 2-4 ounces, fruits 1-1.5 cups, vegetables 1-1.5 cups,

grains 3-5 ounces and dairy 2 cups. Next for Kanyange's brother which is 7 years old should consume calories 1,200-2,000, depending on growth and activity level, protein 3-5.5 ounces, fruits 1-2 cups, vegetables 1.5-2.5 cups, grains 4-6 ounces and dairy 2.5 cups. Therefore, the learning outcome is to identify the nutrient needed according to food class.

Aneshaa

Next, the nine fact that we found is "The health worker measured Kanyange arm and the health worker showed me a tape with three colours red, yellow and green". Why they measured the arms only and not the legs?

Pauline

Mid-upper Arm Circumference (MUAC) (figure 2) is a quick and simple way to determine whether a child is malnourished using a simple coloured plastic strip. MUAC is suitable to use on children from the age of 12 months up to the age of 59 months. However, it can also be used for children over six months with length above 65 cm. Specially design for measuring arm circumference.



Figure 2 shows the Mid-upper Arm Circumference (MUAC)

Aneshaa

What do the colours in the tape indicate?

Sharifah Nurazra

In MUAC there are two types of colour tape. If using a 3-colour tape (Figure 3), a measurement in the green zone means the child is properly nourished. When a measurement in the yellow zone means that the child is at risk of malnutrition. Lastly, if a measurement in the red zone means that the child is

acutely malnourished. If using a 4-colour tape, a measurement in the green zone means the child is properly nourished meanwhile a measurement in the yellow zone means that the child is at risk of malnutrition. When a measurement in the orange zone means that the child is moderately malnourished. Lastly, a measurement in the red zone means that the child is severely malnourished.

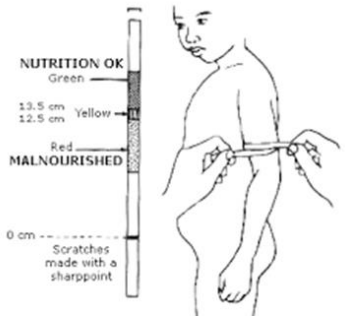


Figure 3 shows the reading of Mid-upper Arm Circumference (MUAC) of 3 colour tape.

Aneshaa

What are the advantages of this tape?

Sii Ming Ming

There are several advantages of Mid-Upper Arm Circumference (MUAC) screening. Firstly, it is simple and cheap. It can be used by service providers at different contact points without greatly increasing their workload and it can be effectively used by community-based people for active case finding. It is more sensitive. MUAC is a better indicator of mortality risk associated with malnutrition than Weight-for-Height. It is therefore a better measure to identify children most in need of treatment. Next, it is less prone to mistakes. Comparative studies have shown that MUAC is subject to fewer errors than Weight-for-Height. Lastly, it increases the link with the beneficiary community. MUAC screening allows service providers from peripheral health units and from the community to refer children with acute malnutrition to therapeutic or supplementary feeding programs. The MUAC colour coding is easy to understand for the child's caretaker.

Aneshaa

What other methods that can be used to diagnose malnutrition?

Wong

The other method to measure malnourish is anthropometric indicators. These are more sensitive over the full spectrum of malnutrition than other indicators, though they lack specificity from changes in body measurement that may be the result of other biological or environmental factors. The example is BMI for age is widely used to measure malnutrition among school aged children both in internationally. The standard calculation is dividing a person's weight in kilograms by their height in meter squared. Almost all country specific and international growth refer to BMI. Next, note percentage of unplanned weight loss. Third identify mental or physical health conditions. Lastly, add all the scores obtain = overall risk of having malnutrition.

Pauline

Therefore, the learning outcome is to analyse the method used to identify malnutrition

Aneshaa

The tenth fact is "The result came out to be red, which indicate malnutrition.". What is the definition of malnutrition?

Keith

Malnutrition refers to deficiencies, excesses, or imbalances in a person's intake of energy and/or nutrients. The term malnutrition covers 2 broad groups of conditions. One is 'undernutrition'—which includes stunting (low height for age), wasting (low weight for height), underweight (low weight for age) and micronutrient deficiencies or insufficiencies (a lack of important vitamins and minerals). The other is overweight, obesity and diet-related noncommunicable diseases (such as heart disease, stroke, diabetic and cancer).

Aneshaa

What is the negative effect of having malnutrition?

Wong

The negative effect of having malnutrition are child could not grow tall and strong and it will affect how well they do in school. If the child is less than 2 years old the effect can be permanent. These kids can easily get disease like cholera, diarrhoea, or malaria because body not strong enough to fight disease and take time to recover and can probably die.

Aneshaa

How much death that caused due to malnutrition?

Whitney

According to a fact sheet by WHO (2020), in 2016, around 45% of all deaths consist of children under the age of 5 due to undernutrition. Therefore, the learning outcome is to define malnutrition and its negative effects.

Aneshaa

The eleventh fact is "Needs medical treatment.". What is the treatment?

Sharifah Nurazra

The treatment by giving fluids to replace those she had lost. Initially, she was given small amounts of milk and vitamin and mineral supplements. Zinc supplements helped stop her skin from flaking. After the oedema went away, the doctors gave her a high-calorie diet rich in protein.

Aneshaa

How long does she need to recover from the disease?

Pauline

To make sure Kanyange recover from the disease it depends on how severe the kid is malnourished. Minimum 2 weeks and could take up to 2 months. Therefore, the learning outcome is to analyse the treatment for malnutrition.

Aneshaa

The twelfth fact is “If a child is as malnourish as Kanyange their stomach does not work properly anymore and giving them normal food could make them very ill.”. Why their stomach does not work properly?

Sii Ming Ming

Their stomach down not work properly due to lack of protein in the diet or low levels of amino acids, the building blocks of proteins, can lead to symptoms like diarrhoea, inflamed intestines and other immune system disorders, which weaken the body and can be fatal. Malabsorption is a state arising from abnormality in absorption of food nutrients across the gastrointestinal (GI) tract.

Aneshaa

Why does normal (usual) food make them ill?

Wong

Their usual foods are sweet potatoes, banana and cassava. Those foods are rich in carbohydrate. But lack of other important nutrients such as proteins, some vitamins & minerals. Lack of protein could result in growth retardation.

Aneshaa

What are the nutrient contents in their normal food?

Keith

Their normal food consists of sweet potatoes are mainly composed of carbs. Most of the carbs come from starch, followed by fibre. This root vegetable is also relatively low in protein but still an important protein source in many developing countries. Next, another food they normally consume are bananas. They are mainly composed of carbs. Bananas contain a number of vitamins and minerals in decent amounts. These include potassium and vitamins B6 and C. Along with potassium, bananas

contain some vitamin C, folate, magnesium, and choline. Lastly, Cassava is a significant source of carbs and also provides a small amount of fibre, vitamins and minerals. The antinutrients in cassava may interfere with the absorption of some vitamins and minerals and may cause digestive distress. This is mainly a concern for populations that rely on cassava as a staple food. Therefore, the learning outcome is to evaluate important of balanced diet.

Aneshaa

The thirteenth fact is "She was provided with special food from clinic.". What are the possible types of special food from the clinic?"

Aneshaa

The possible type of special food from the clinic called Oral nutritional supplements. Another way is to increase amounts of fortified foods and drink are usually given as an initial measure to patients who are unwell or have poor dietary intake. It may be a specially formulated milk-based feeds or ready-to-use therapeutic food (RUTF). RUTF is typically made up of peanut butter, milk powder, sugar, vegetable oil, and added vitamins and minerals.

Aneshaa

What is the difference between the food provided by the clinic and the food from their home?

Whitney

Foods provided by the clinic are more nutrients balanced and dense. The difference between the food provided by the clinic is that they provide more variety of food classes compare to their home food. The meals are also altered specifically to fulfil their lacking in individual's required vitamins and minerals.

Aneshaa

How long does she need to consume the special food from clinic?

Wong

The duration needed we are not really sure yet, but further check-up should be performed until they reach a healthy weight. The period of recovery is varied depends on the severity. Clinic will not continuously provide foods for outpatients. However, nutritionist would suggest healthy food proportion and nutrients needed to be consumed at home. Therefore, the learning outcome is to evaluate important of balanced diet

Aneshaa

The fourteenth fact is "Below 2 years old, malnutrition can be permanent.". What are the permanent effects of malnutrition?

Keith

The permanent effects of malnutrition are children who do not reach their optimum height or consistently experience bouts of weight loss during childhood are affected in the long term in numerous ways. They do not reach their optimum size as adults (and so may have less physical capacity for work), their brains are affected (resulting in lower IQs) and they are at greater risk of infection (which kills many children during their early years).

Aneshaa

Why is it permanent for kids below 2years old?

Whitney

Child malnutrition impacts on education attainment. The degree of cognitive impairments is directly related to the severity of stunting and Iron Deficiency Anaemia. Studies show that stunted children in the first two years of life have lower cognitive test scores, delayed enrolment, higher absenteeism and more class repetition compared with non-stunted children. Vitamin A deficiency reduces immunity and increases the incidence and gravity of infectious diseases resulting in increased school absenteeism. Other than that, child malnutrition impacts on economic productivity. The mental impairment caused by iodine deficiency is permanent and directly linked to productivity loss. The loss

from stunting is calculated as 1.38% reduced productivity for every 1% decrease in height while 1% reduced productivity is estimated for every 1% drop in iron status. Children under two years of age are in the most critical period for growth and development. As mobility increased, children would have the tendency to experienced first exposure to soil transmitted helminth (STH) infection, which can cause malnutrition. This time of period is crucial. Children under 2 are in the process of developing and do not have a strong enough immune system to prevent the body from further deteriorated by the malnourishment. Hence, risk to have a more serious effect which can be permanent for the rest of their life are high.

Aneshaa

Do adults get malnutrition too?

Pauline

Adults can get malnutrition too. Good nutrition is very important for all older adults. It is especially important for older adults who are ill or have been diagnosed with a chronic disease or dementia. Therefore, the learning outcome is to discuss the impacts of malnutrition.

Aneshaa

The fifteenth fact is "After 6 months of breast feeding. And continued to breastfeed until she is 2 years old". What is the benefits of breastfeeding?"

Wong

The benefits of breastfeeding are it gives protection from illness. Your milk will continue to enhance your toddler's immune system so that he's less prone to colds, ear infections, allergies, and other common ailments. And even if he does get sick, nursing will help to comfort him. In fact, breast milk may be the only thing he can keep down on an upset tummy. Next, the benefits of breastfeeding are a healthier future. Research has shown that breastfed babies and toddlers enjoy all sorts of health perks when they grow up, including lower blood pressure and lower cholesterol. They're also less likely to be overweight or obese, and to develop type-2 diabetes. Other than that, the benefits of breastfeeding

are as brain boosts. Though the research isn't conclusive, some studies have found that the longer and more frequently a toddler breastfeeds, the smarter he's likely to be thanks to the omega-3 fatty acids, or DHA, that are unique to breast milk.

Aneshaa

What is the nutrient content in breast milk?

Sharifah Nurazra

Nutrient content in breast milk are free water, proteins which accounts for 75% of the nitrogen-containing compounds and the non-protein nitrogen substances include urea, nucleotides, peptides, free amino acids and DNA and lastly fats. Whereby, essential fatty acids and long-chain polyunsaturated fatty acids.

Aneshaa

Why did she keep breastfeeding Kanyange until 2 years old?

Whitney

She had to keep feeding Kanyange as extended breastfeeding is the nutritional boost it can give. In fact, experts believe that the composition of breast milk changes to adapt to a toddler's nutritional needs. Even if the child eats like a little bird, by nursing he may make up for any deficiencies created. Therefore, the learning outcome is to identify the important of breastfeeding and nutrient content in breast milk.

Aneshaa

As a conclusion, based on all the symptoms, the possible disease is Kwashiorkor. Based on the trigger, imbalanced nutrients intake is a major cause of malnutrition. The symptoms of malnourished child are changing hair and skin colour (due to hypochromotrichia); thin arm (due to skinniness); swollen stomach (due to protein deprivation); swollen leg (due to oedema); losing energy & concentration (due to lack of nutrients); and crying with no tears (due to severe dehydration). Younger

children especially those under two years old are more prone to malnutrition and will receive more serious effect compare to an older one, due to weak immune system. The diagnosis of malnutrition for children are commonly through Mid-upper Arm Circumference (MUAC) and presence of oedema. The treatment for this disease is by consuming a healthy and balanced diet. Although we might get confuse with Marasmus. Kwashiorkor is protein deficiency with adequate energy intake whereas marasmus is inadequate energy intake in all forms, including protein. Kanyange gets enough or maybe excessive carbohydrate but almost no protein in her diet same goes for her brother.