# PANDUAN PRAKTIKUM GIZI DALAM DAUR KEHIDUPAN

**EDISI PERTAMA**
**TAHUN 2023**


Tim:
Prof. Dr. Sri Sumarmi, S.KM., M.Si.
Lailatul Muniroh, S.KM., M.Kes.
Dominikus Raditya Atmaka, S.Gz., M.PH.
Anisa Lailatul Fitria, S.Gz., M.Sc.
Azizah Ajeng Pratiwi, S.Gz., M.Gizi
Tiara Tivany Simangunsong, S.Gz., M.PH
Aliffah Nurria Nastiti, S.Gz
Asri Meidyah Agustin, A.Md.Gz



**Program Studi S1 Gizi**
**Fakultas Kesehatan Masyarakat Universitas Airlangga**

**PRACTICUM GUIDELINES**

**NUTRITION THROUGHOUT THE LIFE CYCLE**

**VALIDITY SHEET**

**PRACTICUM GUIDELINES**

**NUTRITION THROUGHOUT THE LIFE CYCLE**

LEMBAR PENGESAHAN

PANDUAN PRAKTIKUM

GIZI DALAM DAUR KEHIDUPAN

Surabaya, Januari 2023

Mengesahkan,

Koordinator Program Studi S1 Gizi

PJMK
Gizi Dalam Daur Kehidupan Praktikum

Emyr Reisha Isaura, S.Gz, M.PH., Ph.D.
NIP 198812032019083201

Prof. Dr. Sri Sumarmi, S.KM., M.Si.
NIP 196806251992032002

## TABLE OF CONTENTS

# HEATLY DIET FOR PREGNANT WOMEN

## FOREWORD

The mother's nutritional status before and during pregnancy can affect the growth of the unborn child. If the mother's nutritional status is normal before and during pregnancy, she will likely give birth to a healthy, full-term baby with normal weight. In other words, the quality of the baby who is born is very dependent on the nutritional state of the mother before and during pregnancy.

One way to assess the quality of the baby is to measure the weight of the baby at birth. A pregnant woman will give birth to a healthy baby if her level of health and nutrition is in good condition. However, until now there are still many pregnant women who experience nutritional problems, especially malnutrition such as chronic energy deficiency and nutritional anemia (Depkes RI, 1996). The results of the 1995 SKRT showed that 41% of pregnant women suffered from Chronic Energy Deficiency (CED) and 51% suffered from anemia, 50.9% tend to give birth to babies with low birth weight (LBW).

Pregnant women who suffer from CED and anemia have a greater risk of morbidity, especially in the third trimester of pregnancy compared to normal pregnant women. As a result, they have a greater risk of giving birth to low birth weight babies, death during labor, bleeding, and postpartum difficulty due to weakness and health problems. Babies born with LBW are generally less able to reduce the pressure of the new environment, which can result in inhibition of growth and development, and can even interfere with their survival.
In addition, it will also increase the risk of infant morbidity and mortality because they are vulnerable to lower respiratory tract infections, learning disorders, behavioral problems, and so on.

## PHYSIOLOGICAL CONDITION OF PREGNANT WOMEN

Changes in the mother's body during pregnancy are the effects of hormones, mechanical stress from the enlarged uterus and other organs. These changes fulfill the mother's metabolism and growth and development (Lowdermilk, Perry, and Bobak, 1999). Physiological changes in pregnant women include:

### a. Gastrointestinal system

In the first months of pregnancy, there is a feeling of nausea and vomiting symptoms (emesis), usually occurring in the morning, known as morning sickness. This may be due to increased estrogen and GCG hormones with side effects of nausea and vomiting, in addition, there are also peristaltic changes with symptoms of frequent bloating, constipation, more often hungry/feeling of wanting to eat continuously (cravings), also due to increased stomach acid. In certain pathological conditions, vomiting can occur more than 10 times per day (hyperemesis gravidarum).

### b. Circulatory/cardiovascular system

Physiological changes in normal pregnancy, which are mainly changes in maternal hemodynamics, include:

1. Fluid retention (increased volume load and cardiac output)
2. Relative anemia
3. Due to the influence of hormones, peripheral vascular resistance decreases
4. Arterial blood pressure lowered

5. Cardiac output increases by 30-50%, maximum at the end of the first trimester, steady until the end of pregnancy
6. Overall maternal blood volume increases up to 50%
7. Plasma volume increases faster in early pregnancy, then increases slowly until the end of pregnancy.

In the first trimester occurs:

1. Increase in cardiac output, plasma volume, and extracellular fluid volume, accompanied by an increase in renal plasma flow and glomerular filtration rate.
2. Addition/retention of water and exchangeable sodium in the body, an increase in TBW / Total Body Water.
3. As a result, there is the activation of the renin-angiotensin system and a decrease in the osmotic threshold for the release of vasopressin mediators and thirst stimulation.
4. As a result, there is also a decrease in plasma sodium concentration and a decrease in plasma osmolality, resulting in edema in 80% of pregnant women.
5. There is an increase in plasma volume up to 25-45%, with the number of erythrocytes increasing only slightly (hemoglobin levels decrease due to relative anemia).
6. Total protein increases, but the albumin-globulin ratio decreases due to a decrease in alpha-1, alpha-2, and beta albumin followed by an increase in alpha-1, alpha-2, and beta globulins.
7. Clotting factors are increased.

**c. Metabolism**

Basal metabolic rate escalating up to 15% - 20% which is generally found in the last quarter. Calories needed for it is obtained mainly from the burning of hydrate charcoal, especially after pregnancy 20 weeks and above. Alkaline-acid balance slightly changes alkali concentration. Non-pregnant women's levels of 155 mEq per liter decreased to 145-147 mEq per liter. In connection with this, serum Na drops from 142 mEq per liter to 135-137 per liter and is accompanied by a decrease in plasma bicarbonate from 25 to 22 mEq per liter (Sarwono & Hanafi, 1995).

Thyroid hypertrophy is also occurring. Carbohydrate requirements increase to 2300 cal/day. The need for protein 1 gr/ kg body weight/day to support fetal growth. Plasma cholesterol levels increase to 300 gr/100 ml. The need for calcium, phosphorus, magnesium, and copper increases. Iron is needed up to 800 mg, for the formation of additional hemoglobin. Phosphorus, magnesium, and copper are retained more during pregnancy than during non-pregnancy. Copper levels in plasma increase from 109 to 222 mcg per 100 ml, but in erythrocytes the levels remain. (Sarwono & Hanafi, 1995).

Specifically for carbohydrate metabolism, there are significantly lower maternal plasma glucose levels in normal pregnancy, because:

- Placental circulation glucose uptake increases
- Glucose production from the liver decreases
- Alanine production (one of the precursors of gluconeogenesis) decreases
- Increased renal excretory activity
- Effect of gestational hormones (human placental lactogen, other placental hormones, ovarian hormones, pituitary, pancreas, adrenal, growth factors, etc.)
- Changes in fat and amino acid metabolism
- Increase in metabolic enzymes in general

A pregnant woman will gain approximately 6.5-16.5 kg, with an average of 12.5 kg. The weight gain occurs specifically in the last 20 weeks of pregnancy due to:

- The results of conception; fetus, placenta, and liquor amnii (amniotic fluid)
- From the mother herself: enlarged uterus and breasts, increased blood volume, more fat and protein as well as water retention. (Sarwono & Hanafi, 1995)

**d. Digestive system**

The effect of estrogen on digestion starts from hyperemic gums, swollen, bleeding easily, and gingivitis often occurs called epulis signs (Loedermilk, Perry and Bobak, 1999). Hypersalivation also occurs and can change the taste sensation of food, usually appearing as a desire for unusual foods called pica. Estrogen also decreases the secretion of hydrochloric acid, which can cause peptic ulcers.

The relaxing effect of progesterone causes a decrease in smooth muscle tone and motility, gastric emptying, and peristalsis to maximize food absorption. Gastric reflux or heartburn may occur. Constipation is also often present as an effect of hypoperistalsis and increased water absorption. Relaxation also occurs in the venous wall, facilitating hemorrhoids. In early pregnancy, there will be nausea and vomiting due to increased hCG (Bennet & Brown, 1993).

**NUTRITIONAL NEEDS OF PREGNANT WOMEN**

Pregnancy causes increased energy metabolism, so the need for energy and other nutrients also increases during pregnancy. The increased energy and nutrients are required for fetal growth and development, an increase in the size of the organs of the womb, along with changes in body composition and metabolism. Therefore, the lack of certain nutrients required during pregnancy can cause the fetus to grow incompletely.

Pregnant women need more additional to all nutrients. However, the nutrients that are often lacking are energy, protein, and minerals such as Iron and Calcium.

**A. Macronutrients**

**1. Energy**

The calories needed depend on the mother's activity and the increase in BMR. For pregnant women, 300 calories/day is added to the non-pregnant requirement. The energy is given in a large number to ensure its supply so that protein will not be utilized into energy. Additional calories can be obtained from rice, bread, noodles, corn, sweet potatoes, potatoes, etc.

**2. Protein**

Protein is given high to support the formation of new cells for both mother and baby. Protein addition

10 gr/kg Body Weight/day. The consumed protein should have a high biological value, for example, meat, milk, eggs, cheese, dairy products, and fish. Additional protein is needed for fetal growth, namely to form muscles, skin, hair, and nails.

**3. Fat**
The fat accumulation in the mother's tissues is necessary for maternal energy resources. Fat also has other functions, such as a carrier of fat-soluble vitamins. Specifically regarding fat consumption, fat that contains essential fatty acids should be chosen as it is beneficial during pregnancy.

**4. Carbohydrates**
The accumulation of carbohydrates does not occur much, except in a little form of structural carbohydrate tissue in the brain, cartilage, and connective tissue. The presence of carbohydrates is necessary to prevent ketosis.

**B. Micronutrients**

**1. Calcium, phosphorus, and vitamin D**
Calcium is one of the most crucial nutrients for pregnant women, in addition to phosphorus and vitamin D.

These three nutrients are vital for the bones and teeth formation in the fetus. If consumption of these is insufficient in pregnant women, the placenta will maximally uptake these nutrients from the mother for the bones and teeth formation in the fetus.

**2. Fe (Iron)**
The need for Fe for pregnant women increases for fetal growth. The fetus stores Iron in the liver from the first to the sixth month of his/hers life. Pregnant women in the third trimester must increase iron intake for the sake of Hb levels in the blood for its transfer to the placenta, fetus, and preparation for labor. **Fe requirement during birth is 6 mg**/1000 cal. Iron requirements for each trimester are as follows:

- Trimester I: Iron requirement ± 1 mg/day (basal loss of 0.8 mg/day) plus 30-40 mg for fetal and red blood cell needs.
- Trimester II: Iron requirement ± 5 mg/day, (basal loss of 0.8 mg/day plus red blood cell (300 mg) and conceptus (115 mg) needs
- Trimester III: Iron requirement of 5 mg/day, (basal loss of 0.8 mg/day) added to the need for red blood cells 150 mg and conceptus 223 mg

Iron sources that are more recommended to consume for pregnant women are animal sources because of their high biological value. Iron is found in meat, liver, and green vegetables such as spinach, kale, cassava leaves, papaya leaves, etc.

**3. Iodine**
Iodine is one of the minerals for the thyroxin hormone formation, obligatory for fetal growth and to overcome iodine deficiency during pregnancy which loses through urine. For pregnant women, the iodine requirement is 125 micrograms/day. If there is iodine deficiency, the fetus is likely to become cretin.

**4. Zinc**
Zinc plays a role in the formation of retinol-binding protein so that **vitamin A can be transferred to the fetus.**

**5. Magnesium (Mg)**
Magnesium plays a role in bone formation.

**6. Manganese (Mn)**
In mechanism with Iron.

**7. Folic acid**
Folic acid is essential during pregnancy for cell breakdown and DNA synthesis. In addition, folic acid is needed to prevent megaloblastic anemia in pregnant women. Folic acid needs are 400-800 micrograms/day.

**8. Vitamin E**
**It is required for only the growth of the baby's mother and fetus** because vitamin E is found in essential fatty acids, namely: linoleic fatty acid.

**9. Vitamin A**
It is needed as the mother's device/reproductive organ along with the development of the fetus.

**10. Vitamin K**
It is given to avoid blood disorders in the fetus.

**11. Vitamin C**
It is needed 60 mg/day in pregnant women to form extracellular tissue substances in the fetus.

**12. Vitamin B**
In pregnant women, the need is relatively high as it acts as a coenzyme. So protein can be used as energy.

## CALCULATION OF ENERGY AND NUTRIENT REQUIREMENTS DURING PREGNANCY

During pregnancy, energy and nutrient intake are necessary not only to meet the mother's needs but also to support the growth and development of the fetus. The energy and nutrient needs of pregnant women adjust
the nutritional needs of women of her age, with additional energy that varies in each trimester of pregnancy.

**Energy Needs of Pregnant Women**
In pregnant women who are under 18 years old, their energy needs can be calculated by the following formula IOM (2002) as follows:

EER = 135,3 – 30,8 x Age (Year) + AF X (10 X BW(KG) +934 X BH (M)) + 25

AF = physical activity coefficient for 3-18 years old
AF = 1, if physical activity is very light (sedentary)
AF = 1.16 if physical activity is light (low active)
AF = 1.31, if moderate physical activity (active)
AF = 1.56, if physical activity is very high (very active)

Moreover, for adult-age pregnant women (older than 19 years old), energy calculation is by the following formula:

EER = 354 – 6,91 x Age (Year) + AF X (9,36 X BW (KG) + 726 X BH (M))

AF = physical activity coefficient for women >19 years of age
AF = 1, if physical activity is very light (sedentary)
AF = 1.12 if physical activity is light (low active)
AF = 1.27, if moderate physical activity (active)
AF = 1.45, if physical activity is very high (very active)

The result of the EER calculation adds to the energy correction factors for pregnancy, which are:

TEE of 1st trimester= Adolescent/Adult EER + 0
TEE of 2nd trimester= EER Adolescent/adult + 160 Kcal (= 8 kcal/week x 20 weeks) +180 Kcal
TEE of 3rd trimester = EER Adolescent/adult + 272 Kcal (= 8 Kcal/week x 34 weeks) + 180 Kcal

**PREGNANT MOTHER'S NUTRITION**

**A. Dietary Principles**

1. The energy needed depends on the mother's activity and an increase in BMR of 2132.1 calories, functioning to provide sufficient energy so that protein is not broken down into energy. Additional calories are obtained from rice, bread, noodles, corn, sweet potatoes, potatoes, etc.
2. Protein is given as much as 90 g. The consumed protein should have a high biological value, for example, meat, milk, eggs, cheese, dairy products, and fish. Additional protein is needed for fetal growth, namely to form muscles, skin, hair, and nails.
3. Fat is required to be sufficient at 59.2 grams to function as a carrier of fat-soluble vitamins and other functions. Specifically regarding fat consumption, the selected fats must contain lots of essential fatty acids that are necessary for the body during pregnancy.
4. Carbohydrates are required at 320 g. Carbohydrates are needed to prevent ketosis.
5. Additional vitamins and minerals, especially iron, are crucial to increase the blood supply for the mother and fetus. Iron is abundant in meat, liver, and green vegetables, such as spinach, kale, cassava leaves, papaya leaves, and so on. Additional calcium is necessary for bones, joints, and teeth formation later after the baby is born. Calcium is found in milk, dried anchovies, and green vegetables. Additional vitamins are needed to boost the mechanism of the mother's and baby's body. Some vitamins are stored for the baby's use in the first months when he/she just only drinks milk. B-complex vitamins are found in pounded rice and dried beans. Vitamin A is found in egg yolks, liver, green and yellow vegetables/fruits. Vitamin C is mostly found in vegetables and fruits.

**B. Dietary Requirements**

1. We often discover that a pregnant woman is required to abstain from various types of foods, such as fish. Some pregnant women are only allowed to eat rice with a bit of salt. Such abstinence will not help the woman either during or after childbirth, and the baby may even be in poor health. A broad explanation of the advantages of food and the dangers of such abstinence should be given to the woman beforehand, so she is convinced that such abstinence will not help her and her baby.
2. Appetite loss occurs during the first quarter of pregnancy, especially if there is frequent nausea and vomiting. During this period, food should be managed in such a way to be easily digested, as well as not in extreme portions. Orange juice, biscuits, and toast are suitable foods to be given.
3. In the second quarter of pregnancy, the basal metabolism begins to rise. The body weight also begins to increase noticeably. During this period, protein should be prioritized and blood loss should be avoided. Therefore it is good to eat leafy vegetables as it helps to provide iron salts together with vitamin A and other vitamins.
4. In the third quarter, basal metabolism continues to rise. At this time, the appetite is generally very good and the pregnant woman always feels hungry. Checking weight gain needs to be done carefully to avoid becoming too heavy so it will keep away from any difficulties during childbirth later. If the woman has signs of pregnancy poisoning, she should abstain from salt.
5. In the third quarter, the pregnancy has become so big that the stomach is slightly compressed. Food in the large portion often provokes terrible feelings. Therefore, the food portions during this period should be served small, as long as they are consumed frequently to prevent nutritional deficiencies.

## HEALTHY DIET FOR LACTATING WOMEN

### FOREWORD

Pregnancy, childbirth, and breastfeeding are natural conditions experienced in women. Naturally, a mother will also protect and maintain the fetus so it remains healthy and grows normally. A healthy fetus will be generated if a mother can manage her food consumption properly.

The energy and nutrients consumed by most lactating mothers in developing countries are far below the RDA standard. It is now evident that even the average woman from industrialized countries also follows a diet that is less than the minimum requirement in theoretical thought. Many investigations through food management for the whole family, and it is impossible to calculate the food that needs to be consumed per person from this information, especially for people with unique physiological needs.

Many factors cause a person can not breastfeed a baby. One of them is that the milk is unable to come out. The reasons range from mental stress to physical illness, including malnutrition. However, the behavior of not breastfeeding immediately after giving birth (provided that the mother is not under anesthesia or suffering from certain diseases that make it impossible to breastfeed, and the baby does not suffer from oral or airway abnormalities or was born not in a full-term) is mainly conditioned by the "marketing network" of baby formula, either through advertising or direct supply of the product to hospitals (or maternity centers). Once influenced and

trapped by this condition, do not expect the milk to flow optimally, if it can't be said "can't come out anymore"

Breast milk is the ideal source of nutrition and the safest food for babies during the first 4-6 months of life. Breast milk protects infants against foodborne diarrhea through the anti-infective ingredients and minimizes exposure to foodborne pathogens. Several key actions are being undertaken at national and international levels to promote breastfeeding, along with many educational materials to advise mothers about this. Health workers can also advise mothers on how to protect their breastmilk from other chemicals/hazards (e.g., by minimizing contact with pesticides and avoiding the consumption of foods that contain unsafe levels of contamination).

Breast milk is the conventional and ideal form of child nutrition. It is usually able to fulfill the nutritional needs of an infant for the first 4-6 months of life. Even if necessary supplementary foods are introduced, breastmilk can be an important secondary source for an infant's health. Breast milk can provide three-quarters of the protein needed by infants aged 6-12 months and is still a significant source for the next few months. Most infants in low-income countries require breastmilk for growth and often for survival, as it is the single most readily available and good quality source of protein, and contains all the essential amino acids.

Breastfeeding women do not need a perfect diet. Some nutrients should be consumed during breastfeeding. However, if the only "success" point is the nutrient composition of breast milk, the breast milk of women who are "underfed" is no different from the breast milk of those who are "well-fed". The difference is only the volume of the milk itself. For this reason, breastfeeding women are advised to drink more water and get enough rest.

**PHYSIOLOGICAL CONDITION**

It is stated that there is a basic thing that mothers need to know, namely that only breast milk (ASI) is the best food and beverage in the 4 to 6 months of infancy. Breastfeeding is not only beneficial for the physical growth of the baby but also affects the development of the child's psyche because it promotes an affectionate bonding experience between the mother and the baby during breastfeeding. However, there is now a strong tendency for several mothers not to breastfeed their babies for reasons such as work. If the mother works breast milk can be given in the morning and evening or at night, when the mother is at home. While at work, breast milk can be expressed, stored in a clean bottle, and put in the refrigerator. The stored breast milk can be given to the baby with a spoon while the mother is at work. The baby should not be given a pacifier with a bottle to avoid "nipple confusion".

The mammary gland is composed of two kinds of tissue, namely glandular tissue (glandular tissue, or parenchyma), and support (supporting tissue or stroma). The glandular tissue contains a large number of alveolus pockets that are surrounded by contractive epithelial muscle tissue. The inside of the alveolus is covered by a layer of epithelium. Milk is produced in this glandular epithelium. Preparation for production takes place during pregnancy so that it enlarges to 2-3 times of normal size.

Milk is produced through two phases, namely the secretion and drainage phases. In the first part, milk is secreted by the glandular cells into the lumen of the alveoli. In rats, this process is

supervised by the prolactin and ACTH hormones. Both hormones influence the development of the mammary glands. In the second phase, the milk is drained into the nipples, after previously collected in the sinuses. During pregnancy, lactogenesis is most likely locked by the influence of progesterone on the glandular cells. After parturition, this hormone diminishes drastically, allowing prolactin to react influencing lactogenesis.

**Breast Size**

Breast size, large or small, along with breast shape are not directly related to milk production. There is no guarantee that large breasts will produce more breast milk, while small breasts produce less. Milk production is mostly determined by nutritional factors, frequency of suction, and emotional factors.

Good breastfeeding should be according to the baby's needs or the baby's will because naturally, the baby will regulate its own needs. The more often the baby suckles, the more milk will be produced. The stronger the baby's suction power, will be produced. "The mother will not lack breast milk, because it will continue to be produced, as long as the baby keeps sucking. The mother eats and drinks properly, along with the belief that she can give breast milk to her child. That way, mothers can breastfeed their babies purely for about 4-6 months and continue to breastfeed until the child is two years old".

## NUTRIENT REQUIREMENTS

**Table. Nutrient Adequacy of Lactating Mothers Per Day**

| Nutrition Density (Amount/1000 calories) | | |
|---|---|---|
| **Nutrient (Units)** | **Recommended Amount** | **Addition** |
| Energy(Calories) | +500 | 0 |
| Proteins (grams) | +20 | 40 |
| Vitamin A ( gRE ) | +400 | 800 |
| Vitamin D ( g) | +5 | 10 |
| Vitamin E ( g TE) | +3 | 6 |
| Vitamin D (mg) | +40 | 80 |
| Thiamin (mg) | +0.5 | 1 |
| Riboflavin (mg) | +0.5 | 1 |
| Niacin (mg) | +5 | 10 |
| Vitamin B6 (mg) | +0.5 | 1 |
| Folacin ( g) | +100 | 200 |
| Vitamin B12 ( g) | +1.0 | 2 |
| Calcium (mg) | +400 | 800 |

| | | |
|---|---|---|
| Phosphor (mg) | +400 | 800 |
| Magnesium (mg) | +150 | 300 |
| Iron (mg) | +30-60 | 60-120 |
| Zinc (mg) | +10 | 20 |
| Iodine (□g) | +50 | 100 |

The question that is often asked by new lactating mothers is what foods should be consumed during breastfeeding. The food for lactating mothers is not much different from what mothers eat every day. The important thing is to fulfill a balanced nutritional diet. The breastfeeding period drains a lot of stamina because you have to give breast milk at night. Therefore, lactating mothers must eat adequately to maintain their stamina.

The FAO/WHO expert commission recommends taking food intake within the range of 1800-2700 calories during breastfeeding.

**Energy**

Caloric intake during the first 3 months postpartum should be 500 Kcal. This recommendation is based on the assumption that every 100 cc of breastmilk is capable of supplying 67-77 Kcal. The efficiency of energy conversion contains in food into milk energy averages 80%, with a range of 76-94%. It can be estimated the amount of energy required to produce 100 cc of milk, is around 85 Kcal. Average milk production per day is 850 cc, which means it contains 600 Kcal. Meanwhile, the calories spent to produce breast milk is 750 Kcal. If lactation lasts more than 3 months and during that time the mother's ideal body weight decreases, the amount of additional calories must be increased.

The additional calories are only 700 Kcal, while the rest (about 200 Kcal) is taken from indigenous reserves, namely fat deposits during pregnancy. Considering that the efficiency of energy conversion is only 80-90%, the recommended energy from the diet (500 Kcal) will only become 400-450 Kcal of breast milk energy. To produce 850 cc of breastmilk, 680-807 Kcal (average 750 Kcal) of energy is required. If 500 Kcal is added to the fixed diet, only 400-450 Kcal will be converted, meaning that endogenous energy reserves of 300-350 Kcal must be mobilized every day. Endogenous energy reserves of 300-350 Kcal are equivalent to 33-38 grams of fat. Thus fat storage during pregnancy, as much as 4 kg or equivalent to 36000 Kcal will be used up after 105-121 days, or about 3.5-4 months. This calculation also reinforces the opinion that with breastfeeding, the mother's weight will return to normal quickly and dismisses the issue that breastfeeding a baby will make the mother heavier.

Referring to "western literature" energy intake of less than 2700 Kcal a day implies calcium deficiency, magnesium, zinc, vitamin B6, and folate. To what extent do these deficiencies (as well as other vitamins and minerals) affect the success of breastfeeding and the impact on the health of the mother and baby is not yet known. However, vegetarian women and those who dislike milk should consume other foods enriched with vitamin D and **take** specific-breastmilk supplements (vitamin D and B12: 10 mcg and 2.6 mcg per day).

**Protein**

During breastfeeding, mothers need additional protein above the normal requirement of 20 grams per day. The basis of this provision is that every 100 cc of breast milk contains 1.2 grams of protein. Thus, 850 cc of breast milk contains 10 grams of protein. The conversion efficiency of dietary protein into milk protein is only 70% (with individual variations, of course). of course). This increased requirement is not only for the transformation into milk protein but also for the synthesis of hormones that produce (prolactin) as well as secrete milk (oxytocin).

Milk that comes out on the first day after childbirth (colostrum) contains 15% protein consisting of lactalbumin, lactoglobulin, and casein, all of which are very beneficial for the baby. If the mother is healthy, then she can breastfeed on the first day of delivery. As much as 75% of the amount of breast milk (ASI) is obtained by the baby during the first 5 minutes of breastfeeding.

The recommendation for protein is 65 g/day for the first 6 months of breastfeeding and 62 g/day for the second 6 months.

**Vitamins and Minerals**

**Vitamin A**

Mother's milk contains 50 mg retinal/100ml and it is estimated that a mother will express 850 ml, an excess of 400 mg retinal equivalent in the diet has been made by most experts. In developing countries, much of this retinal is eaten in the form of B-carotene. In reality, this can only be achieved if there is a considerable change in the dietary composition from the maternal diet in pre-pregnancy and a non-lactating state: she will require a very different diet from that eaten by other family members.

**Vitamin D**

Vitamin D, magnesium, and zinc aid calcium absorption and can be found in some natural supplements in combination with calcium. Eating enough fruits and vegetables will help to provide mom's vitamin needs. Vitamin D is specifically important for a baby's bone growth and development. Mothers can get vitamin D from foods such as fish, milk, eggs, and butter.

**Calcium**

An essential mineral for bones and various important organs of the body. It is recommended to consume 1,600 mg of calcium daily or 2-4 glasses of dairy products daily. The best sources of calcium are dairy products including yogurt, milk, cheese, broccoli, oranges, almonds, sardines, tofu, and dark leafy vegetables.

Research shows that during pregnancy and breastfeeding, calcium is siphoned from the bones. The body will replace it over a long period and the bones will become strong again. If the breastfeeding mother is allergic to or cannot consume dairy products, she should consume more calcium sources such as tofu and supplement calcium.

The RDA for calcium during breastfeeding is the same as during pregnancy, which is 1200 mg/day.

**Drink Enough Fluids**

Breast milk is made up of 87 percent water. So, the body needs additional water and juice during breastfeeding. Eight to 10 glasses daily is the recommended amount. During breastfeeding, mothers should drink when they feel thirsty. This is the best way to ensure that you are getting enough fluid while breastfeeding. In addition, the color of the urine can also be used as a sign. If the color is pale yellow, it means that the mother is drinking enough fluids. She is not drinking enough if the urine is dark yellow. Research has shown that drinking more fluids than needed will not increase milk supply. If the frequency of breastfeeding is more frequent and breast emptying is always occurring, milk production will increase. Lactating women should drink 50 ml/kg body weight/day plus 800-1000 ml to produce adequate milk.

**Factors Affecting Breast Milk**

The disruption of the breastfeeding process is principally rooted in a lack of knowledge, self-confidence, and lack of support from family and the environment.

The amount of milk produced depends on the amount of accumulated fat during pregnancy and, to some extent, the diet during breastfeeding. The average milk volume of well-nourished women is around 700-800 cc, while those who are undernourished range from 500-600 cc. The amount of milk secreted in the first 6 months is 750 cc a day. Secretion on the first day only collected 50 ccs, then increased to 500, 650, and 750 ccs on day V, the month I, and III respectively. The volume of milk in the next 6 months decreased to 600 cc. However, nutritional status has no major effect on quality (except volume). Breast milk, although the vitamins and minerals are slightly lower. This opinion can be used as an explanation to women who are reluctant to breastfeed because their nutritional status is poor.

**Foods that can Affect Breast Milk**

**Scent**: The scent and flavor of the meal will be transferred into the breast milk. Babies usually enjoy these aromas and may suckle longer. Some babies will suck longer when a new scent is introduced. This helps to introduce the aroma of family foods to the baby.

**Color**: The color of some foods is transmitted to breast milk. For example, a high intake of carrots will make breastmilk slightly orange in color, red sweet potatoes may make the breastmilk pink, and spinach or other dark leafy vegetables give the breast milk a green color.

Vegetables such as green beans, corn, beans, spinach thorns, string beans, and katok leaves provide benefits to increase breast milk production. Consume them as vegetables. For example, katuk leaves can be mixed with sliced corn and cooked as “sayur bening”.

Jombang root (Taraxacum officinale Weber et Winggers) can also increase breast milk. How to do it is by washing 30 grams of fresh jombang roots, then cut into small pieces. Boil in 2 cups of water for 15 minutes. After cooling, strain and drink 2 times a day, half of each.

**Foods to Avoid**

Women who are breastfeeding are sometimes told to avoid foods that produce gas, such as onions, cabbage, beans, chocolate, and spicy foods. There is little reason for such restrictions for such prohibitions. Very rarely a mother will remember that some of the foods she ate caused urticaria, diarrhea, or irritability in her baby for obvious reasons. Avoiding food can improve the situation.

Mothers who drink alcohol during breastfeeding seem to have a detrimental effect on the infant's motor development.

If the baby becomes fussy after breastfeeding, check if you ate anything 4-6 hours before. If the baby is still fussy for a long time, suspect the food you have consumed which may be gassy or the baby is sensitive to the food. Generally, cabbage, beans, and broccoli can produce gas. Mom can Eliminate these foods by eating them once a week or every two weeks. If the gas reappears after eating these foods, the mother needs to eliminate them by eating them only once in 2-3 months.

Mothers who suffer from allergies should avoid nuts, or foods with a high risk of causing allergies such as cow's milk, wheat, eggs, fish, and peanuts during pregnancy and breastfeeding.

**Importance of Breast Milk**

Compared to adults, infants' need for nutrients may seem very small. However, when measured as a percentage of body weight, infants' need for nutrients exceeds the adults' need for almost double size.

A baby's first and main food is of course breast milk. There is no need to debate. Breast milk is perfectly suited to meet the needs of babies in every way, the carbohydrate in breast milk is lactose, the fat contains a lot of polyunsaturated fatty acids (polyunsaturated fatty acids); the main protein is lactalbumin which is easily digested; vitamin and mineral content is high; calcium phosphate ratio is 2:1, which is an ideal condition for calcium absorption. In addition, breast milk also contains anti-infective substances.

Colostrum is breast milk that comes out for the first time, has a clear yellowish color, and is rich in antibodies such as :

a. Bifidus factor
b. SIgA, IgM, IgG
c. Antistaphylococcal factor
d. Lactoferrin
e. Lactoferoxidase
f. Complement: C3, C4
g. Interferon
h. Lysozyme
i. B12-binding protein
j. Lymphocytes
k. Macrophages
l. Lipid factors, fatty acids, and monoglycerides.

The amount of colostrum secreted varies between 10-100cc (average 30 cc) a day. Breast milk secretion increases gradually and reaches a mature composition by 30-40 hours after the baby’s delivery.

The Bifidus factor is a specific factor that promotes the growth of lactobacillus bifidus, a bacterium that is thought to interfere with the colonization of pathogenic bacteria in the gastrointestinal tract. Secretory immunoglobulin A (SIgA) is thought to be capable of binding large-molecule foreign

proteins, such as viruses, bacteria, and toxic substances. This binding aims for absorption so as not to harm the baby. Lactoferrin is a protein that binds iron so that it cannot be used by bacteria to grow and develop. Lysozyme is an enzyme that works to destroy bacteria by tearing the cell wall, which indirectly increases the effectiveness of the antibodies. Leukocytes are partly responsible for preventing necrotizing enterocolitis, a deadly disease that commonly affects low birth weight babies.

Macrophages, in addition to secreting SIgA and interferon, also function to prey on other organisms. Complement, lactoperoxidase, and antistreptococcal factors are defense factors that help lower the incidence of infection. The availability of these substances implies that problems that may arise in infants who consume colostrum will not be as severe as in formula-aspirated infants. Unfortunately, in certain cultural environments, giving colostrum is frowned upon. This story can be seen in the results of the 1992 Indonesian Health Survey: Indonesian women who gave colostrum only reached 51%. The giving of this yellowish-clear liquid increases as the mother's education level increases.

Secretory IgA contained in colostrum can bind potential allergens, as well as prevent their absorption. That is why breastfed babies rarely experience allergies. Feeding infant formula may expose the baby to large amounts of allergens, while SIgA is not yet available. Early exposure to allergens tends to increase the risk of allergic reactions, especially in families with a history of allergies. It is recommended that exclusive breastfeeding for several weeks will reduce the risk of atopic eczema in the first year of life; together with establishing intimacy between the mother and baby.

Breast milk is the ideal food for infants, and every mother who is interested in breastfeeding should be encouraged to breastfeed. Babies who are not breastfed have 14 times the chance of dying from diarrhea, or 4 times more likely to die of acute respiratory infection (ARI) heart attack. It is expected that after a baby is born, the mother should be breastfed immediately while lying down. This not only improves the mother-child relationship, stimulates the release of breast milk, but also gets more colostrum for the baby which contains a lot of immune properties. It is also emphasized that breast milk can reduce infant mortality rates due to diarrhea, by 10% in infants aged 0-6 months. Infants need breast milk for the first 4-6 months of life, then additional food is given as they grow up. However, breast milk remains an important food in the child's diet throughout the second year. Some of the breastfeeding advantages include the convenience of breast milk delivery, breast milk having the same temperature as the baby's body, and establishing a mother-child relationship.

➢ Advantages of breastfeeding:
1. Benefits for the baby
1) Anti-infective factors: Breast milk contains various anti-infective factors and immune cells such as Ig A, Ig M, Ig G, B, and T lymphocytes, neutrophils, macrophages, and components. These are particularly important in countries where sanitation and immunization are suboptimal compared to industrialized countries.
2) Fewer food allergies.
3) Avoidance of obesity: breastfed infants are less likely to be overfed than formula-fed infants.
compared to formula-fed infants

4) Nutritional advantages: protein and fat in optimal forms for digestion, absorption, and use of zinc and iron are more easily absorbed from breast milk than formula milk.

2. Benefits to the mother
1) Comfort (if breastfeeding is already done).
2) Economic: Breast milk is generally cheaper than commercial formula).
3) Faster return to pre-pregnancy weight.
Mutual benefits increase affection between mother and child.

**CALCULATION OF NUTRITIONAL NEEDS IN BREASTFEEDING MOTHERS**
**Energy Requirements of Pregnant Women**
For breastfeeding mothers under 18 years old, their energy needs can be calculated using the following IOM (2002) formula as follows:

EER = 135,3 – 30,8 x Age (Year) + AF X (10 X BW (KG) +934 X BH (M)) + 25

AF = physical activity coefficient for 3-18 years old
AF = 1, if physical activity is very light (sedentary)
AF = 1.16 if physical activity is light (low active)
AF = 1.31, if moderate physical activity (active)
AF = 1.56, if physical activity is very high (very active).

As for breastfeeding mothers in adulthood (above 19 years old), the energy calculation based on the IOM (2002) formula can be calculated as follows

EER = 354 – 6,91 x Age (Year) + AF X (9,36 X BW (KG) + 726 X BH (M))

AF = physical activity coefficient for women >19 years old
AF = 1, if physical activity is very light (sedentary)
AF = 1.12 if physical activity is light (low active)
AF = 1.27, if moderate physical activity (active)
AF = 1.45, if physical activity is very high (very active)

The results of the EER calculation then must be added to the energy correction factor for breastfeeding:
a. Teenage Lactating Mothers
Breastfeeding TEE for the first 6 months = Adolescent EER + 500 - 170 (= energy from breast milk - weight loss)
TEE for the next 6 months = Adolescent EER + 400 - 0
b. Adult Lactating Mothers

First 6 months TEE = Adolescent EER + 500 - 70 (= energy from breastmilk - weight loss)
Next 6 months TEE = Adolescent EER + 400 - 0

## BALANCED DIET FOR LACTATING MOTHERS

### Dietary Principles

- High-calorie protein
- Adequate fat
- Adequate vitamins and minerals
- Enough liquid

### Dietary Requirements

- The daily diet should be balanced, consisting of staple foods, side dishes, vegetables, fruit, and milk.
- Use a variety of food ingredients
- Avoid stimulating foods such as foods that are too spicy (spices), too cold, too hot, and contain alcohol to maintain smooth digestion.
- Limit odorous foods such as bitter bean/stink bean/petai, dog fruit/jengkol, etc.
- Need to drink in larger quantities ± 6 glasses a day, it will be more beneficial if breastfeeding mothers drink nutritious liquid drinks such as milk, bean water, fruit juice, green leafy vegetable juice, and so on.
- Green vegetables such as katuk leaves, spinach, and kale can help stimulate milk production.
- Other restrictions other than the above are not required.
- Energy is given additionally according to the age of the child:
  - 0-6 months: + 700 cal
  - 7-12 months: + 500 cal
  - 13-21 months : + 400 cal
- Additional protein is given according to the age of the child:
  - 0-6 months: +16 grams
  - 7-12 months: + 12 grams
  - 13-21 months: + 11 grams
- Fat: 20 - 35 % of total energy
- Carbohydrates: 50-70% of total energy
- Adequate vitamins and minerals
- Adequate liquid 8- 10 glasses per day

## HEALTHY DIETS FOR INFANTS

### FOREWORD

Nutrition is a very important element for the formation of a quality human body, so it is important to learn about how to feed infants and children as this group is the generation that will fill the future. Baby's food from the womb until birth to grow and develop normally requires the fulfillment of the need for food and nutrients in addition to meeting other needs. For this reason, it is necessary to know about the stages of growth and development of infants and children, especially about food or nutritional needs. Inadequacy of the necessary nutrients will lead to physiological and metabolic disorders in the infants' and children's bodies.

The high infant and child mortality rate is a common feature in developing countries, including Indonesia. One of the prominent causes is due to poor nutrition. Poor nutrition itself is the result of various interrelated factors, especially economic, social, cultural, and political factors. Poor nutritional status in infants and children can have a profound effect on their physical, mental, and

thinking abilities which in turn will reduce work productivity. This situation indicates that in essence, poor or inadequate nutrition will have an impact on human quality.

All foods, especially for infants and young children, must meet energy and nutrient requirements and can be achieved by using various food ingredients. It should be noted that many foods have ginormous volumes to meet energy and nutrient requirements, so the composition of these food ingredients must be balanced. Because nutrition plays an important role in the health of infants and young children, several nutrients need special attention, namely protein, vitamin A, vitamin C, iron, and iodine.

**Initial Process**

Fertilization is the union of spermatozoa and ovum that come from different cells. To meet and unite the two must go through a long journey and experience the preparation process as well as the meeting place must meet the requirements of the spermatozoa. Fertility hygiene has a very important meaning for the breeding process because it produces a new cell called a zygote. The life span of the ovum is estimated to be less than 24 hours and the length of life of spermatozoa after ejaculation is less than 48 hours.

At conception, the union of the sperm with the egg, a microscopic cell is formed that can only be seen with a microscope. The product of this union is named the fetus. Over the next few days, the fetus grows and develops until its weight and length increase. Besides that, there is also a differentiation and maturation process, where cells from day to day increase in number and form organs with certain functions such as the heart, kidneys, liver, gastrointestinal tract (stomach and intestines), lungs, and so on. When a baby is born, all organs are already formed with perfect functions.

## PHYSIOLOGICAL CONDITION OF THE BABY

### Physiological Conditions of Baby Weight

Growth and development is a continuous process from conception to maturity or adulthood which is influenced by innate and environmental factors. In full-term infants, birth weight will be regained by day 10. Weight becomes twice the birth weight at the age of 5 months, becomes 3 times birth weight at one year of age, and becomes 4 times birth weight at 2 years of age. And so so on until it stops by itself when reaches the age of 18 years for girls or the age of 20 for boys.

Weight gain in the first year of life, if the child is well-nourished ranges from :

a. 700-1000 g/month in the first quarter
b. 500-600 g/month in the second quarter
c. 350-450 g/month in the third quarter
d. 250-350 g/month in the fourth quarter

The formula quoted from Behram (1992) can also be used to estimate the child's weight:

Estimate weight and kg:

a. Born: 3.25 kg
b. 3-12 months: (age in months+ 9)/2
c. 1 - 6 years: age (years) x 2 + 8
d. 6 - 12 years: (age (years) x 7 – 5)/2

**Infant Height**

In general, the growth rate decreases from the time the growth process is almost complete. From birth until the age of 4 - 5 years the growth rate rapidly decreases (deceleration) and then this deceleration slowly decreases until the age of 5-6 years. From this time until the beginning of the growth spurt, their growth is constant. However, there is often a small increase that occurs between 6 and 8 years of age, which generally causes another surge in growth rates, but this is not always present. At the age of 13-15 years, there is an acceleration of growth called the adolescent growth spurt.

The average height at birth is 50 cm. Broadly speaking, a child's height can be estimated as follows:

a. 1 year :1.5 x TB at birth
b. 4 years: 2 x birth TB
c. 6 years: 1.5 TB one year
d. 13 years old : 3 x TB at birth
e. Adults: 3.5 x TB at birth (2 x TB 2 years)

Or use the formula as quoted from Behram (1992):
Estimate height in centimeters:

a. Born: 50 cm
b. 1-year-old: 75 cm
c. 2-12 years old: age (years) x 6 + 77

The average increase in height in preschool children is 6-8 cm/year. Then in adolescence, there is an adolescent growth spurt, which differs between boys and girls as well as body weight. The average height growth rate of boys is 10.3 cm per year compared to 9 cm per year in girls. The average pace across years is 9.5 years per year in boys and 8.1 cm in girls.

Here is the formula for predicting a child's final height according to genetic potential using parental height data and assuming that all of them grow optimally according to their potential:

Girls' height = ((father's height 13 cm) ± 8.5)/2
Boys' height = ((mother's height + 13 cm) + father's height ± 8.5 cm)/2

Description:
13 cm = Average height difference between adults male and females in the UK
8.5 cm = Absolute value of height

Meanwhile, if you look at the proportions between the head, body, and limbs, there will be clear differences between fetuses, children, and adults as follows:

a. When the fetus is 2 months old, the head appears large and elongated. The length of the head is almost equal to the length of the body plus the lower limbs, members are relatively very short

b. At birth, the head is relatively large, the face is round, the anteroposterior size of the chest is large, the abdomen is distended, and the limbs are relatively short. The midpoint of his/her height is equivalent to the height of the umbiculus.
c. In adulthood, the limbs are longer and the head is proportionally smaller, so that as a midpoint is the height of the pubic symphysis.

**Head**
The head circumference at birth averages 34 cm and is larger than the chest circumference. In children aged 6 months the average head circumference is 44 cm, 1-year-old: 47 cm, 2 years: 49 cm, and adults: 54 cm. So the increase in head circumference in the first 6 months is 10 cm or about 50% of the increase in head circumference from birth to adulthood.

Skull growth follows brain growth, and vice versa. The fastest growth of the brain occurs in the third trimester of pregnancy until the first 5 to 6 months after birth. There is a rapid division of brain cells, then it slows down and becomes only brain cell enlargement. So at birth, the baby's brain weighs ¼ the weight of the adult brain.

The rapid growth period of brain tissue is vulnerable, any disturbance at that time will result in disruption in the number of brain cells and myelination that cannot be caught up in the next growth period.

**Teeth**
The first tooth erupts at the age of 5-9 months, by the age of 1 year most children have 6-8 milk teeth. During the second year, another 8 teeth grow, bringing the total number to about 14-16 teeth, and by 2.5 years of age, there are already 20 baby teeth.

**Fatty Tissue**
In addition to muscle, fat tissue increases in the third trimester of pregnancy until mid-infancy. After that, the number of fat cells does not increase much. The number and size of fat cells determine the fat or thinness of a person. The growth of fat tissue slows down until the child is 6 years old, and the child looks thin or slim. The tissue will increase again in girls aged 8 years and in boys aged 10 years until the beginning of puberty. After that, the increase in tissue in men decreases, while in women continues to increase and undergo reorganization until an adult female body shape is achieved. To measure the thickness of fat tissue, namely by measuring the thickness of the skin folds.

**Body Organs**
Organ growth follows its pattern. In general, there are 4 patterns
organ growth patterns, namely:
a. General pattern
b. Neural pattern (brain and head pattern)
c. Lymphoid pattern
d. Genital pattern (reproductive pattern
Following the general growth pattern are the bones, skeletal muscles (in neonates 20-25% of body weight, after adulthood 40% of body weight), digestive, respiratory, circulatory, and blood volume systems.

The development of the brain along with the skull bones that protect it, eyes, and ears takes place early. The brain weighs 25% of adult brain weight, at 2 years old it is 75% and at 10 years old it is already 95% of adult brain weight.
adult brain weight.

The growth of lymphoid tissue is somewhat different from other parts of the body, growth reaches a maximum before adolescence and then decreases until it reaches adult size.

Reproductive organs follow the genital pattern, where growth is slow in pre-adolescence, followed by a rapid adolescent growth spurt.

**Growth**
Growth is related to changes in size, number, size or dimensions at the cellular level, organ, or individual level, which can be measured by weight (grams, pounds, kilograms), length (cm, m), bone age, and metabolic balance (body calcium and nitrogen retention).

Physical growth, increase in the number and size of cells, hyperplasia (cells increase in number), and hypertrophy (cells increase in size, such as body height and body weight). Example:
a. The physical growth of children both weight and height is influenced by the growth of the child in the womb.

b. If the growth of the child in the womb is slow, which is marked by the increase in BW, the pregnant mother will give birth to a child with a smaller and normal BW and BH.

c. If it is normal, it will experience normal growth but if it is deficient, it takes time to catch up to become normal (at 3-4 months of age).

d. Children with normal growth or those whose weight at birth is 2.5 to 3 kg in Indonesia but 3.5 kg abroad.

e. The limit of LBW is when the birth weight is < 2.5 kg, the baby at the first birth with a weight of 3 kg, on the first day of birth the weight will drop within a few days after birth there is fluid evaporation. When in the womb the baby is immersed in amniotic water more or less will absorb water so that after birth there will be evaporation so that the baby's weight will decrease.

f. The decrease is ± 6-10 of BBL, after a few days, it will return to the actual growth.

g. Factors affecting low baby weight, the measurement should not be more than 3-4 days, and no later than 2 x 24 hours should have been measured.

h. After reaching normal growth, the first 4 months of weight gain is 20-25 gr/hr, the next 8 months the increase is 18 gr/hr, fat people have more brown cells than white cells.
i. A 4-month-old infant is generally 2 x the LBW, if the baby is born 3 kg at 4 months the LBW of the baby is 6 kg.

j. At the age of 12 months, the baby weighs 3 x the birth weight, and growth is not linear (the older the child gets, the more weight will not increase). In addition to genetic factors, environmental factors also affect growth.

k. Male babies at 4 months of age will reach normal faster than female babies.

l. LBW children will reach 2 x LBW (4 months of age) faster than normal weight (larger) babies if nutrition, genetics, and environment are good.

Early growth will always be faster than later growth:
a. Zn is one of the nutrients that affect TB growth
b. Autoregulation is the ability of the body's organs to absorb nutrients within normal limits so that if the consumption is excessive, it will not be absorbed by the body.
c. Triglycerides are sourced from only 25% of the diet while the remaining 75% is produced by the body.
d. At the age of 1 2 years, the growth acceleration is slower than in previous years.
e. Up to 10 years of age, weight gain is usually 2.3 kg/year until adulthood.

In conclusion, BB will run fast in the first year of birth and then slow down in the following years until adulthood.

**THE ROLE OF NUTRIENTS DURING INFANCY**

Nutrient requirements vary with age, growth rate, amount of physical activity, absorption efficiency, and food utilization. Healthy growth and development are highly dependent on dietary inputs. During life, children experience different growth rates. In infancy growth is very rapid, then there is a period where growth decreases until it stops.

The Recommended Average Nutrient Intake (RDA) published by the WHO, as well as the Food and Nutrition Board of the National Academy of Sciences National Research Council (1979) and the Widya Karya Pangan and Gizi Nasional(1988) list the recommended energy and nutrient adequacy for children and adults for each age group. The needs of children are very different even though they are the same age, boys are different from girls as well as the nutritional needs of taller children are different from those of shorter ones, those with large frames are different from those with small frames. The food provided must serve as energy for muscle activity, forming new tissue, but also provide a sense of pleasure and satisfaction. Normal growth for health requires food input that contains enough energy and essential nutrients.

**Table IV. 1 Amount of Nutrients Consumed by Infant Per Day**

| Nutrients | 0-3 month | 3-6 month | 6-12 months |
|---|---|---|---|
| Energy (Kcal) | BB(kg)x 115 | BB(kg)x | 1300 |
| Protein (grams) | 10 | 105 | 19 |
| Calcium (mg) | 225 | 15 | 600 |
| Magnesium (mg) | 30 | 440 | 50 |
| Iron (mg) | - | 40 | 9 |
| Iodine (mcg) | 30 | 7 | 50 |
| Zinc (mg) | - | 40 | 5 |
| Vitamin A (mcg RE ) | 375-420 | 3 | 375-420 |
| Selenium (mcg) | 13 | 375-420 | 13 |
| Vitamin D (mcg) | 7,5 | 13 | 10 |
| Vitamin E (mg a-TG) | 2 | 10 | 4 |
| Vitamin C (mg) | 25-35 | 3 | 25-35 |
| Folasin (mcg ) | 16 | 25-35 | 32 |
| Niacin (mg NE) | 4 | 24 | 6 |
| Riboflavin (mg) | 0.25 | 5 | 0.6 |
| Thiamin (mg ) | 0.2 | 0.4 | 0.5 |
| Pyridoxine (mg) | 0.15 | 0.4 | 0.4 |
| Vtamin B12 (mcg) | 0.3 | 0.3 | 0.5 |
| | | 0.4 | |

Source : Gutrine 1986

**Energy**

Children's energy needs are determined by basal metabolism, age, physical activity, temperature, environment, and health. Nutrients that contain energy are called macronutrients and consist of protein, fat, and carbohydrates. Each gram of protein or carbohydrate provides 4 kcal of energy, while each gram of fat provides 9 kcal. It is recommended that the required amount of energy is obtained from 50-60% carbohydrates, 25-35% fat while the remaining 10-15% is protein.

**Protein**

The protein requirement per kilogram of body weight is high in infants due to their rapid growth and then decreases with age. It is recommended to provide 2.5-3 grams per kilogram of body weight for infants and 1.5-2.0 for school children through adolescence. The amount of protein given is considered adequate if it contains sufficient amounts of all essential amino acids, and is easily digested and absorbed by the body. The protein provided should be a high-quality protein such as animal protein. Meat, fish, and eggs contain high-quality protein, additional protein is obtained from legumes such as green beans, and soybeans and its products (such as tofu and tempeh), also from cereals, namely rice, corn, bread, noodles, potatoes, etc.

**Minerals and Vitamins**

Essential minerals and vitamins are important nutrients for growth and health. Deficiencies in these nutrients can lead to nutritional diseases. Cow's milk is a good source of several vitamins and minerals such as calcium and phosphorus. Each 500-600 ml of milk contains approximately 0.7-0.8 grams of calcium and enough phosphorus for bone and tooth formation. Cow's milk also contains various vitamins such as vitamin A, and B group vitamins. Meanwhile, iron and flour are supplied by other foods rich in these substances such as meat and major vegetables. A daily menu containing milk, meat (beef, chicken, fish), eggs, vegetables, fruit, and cereals (rice, bread, potatoes, noodles) will contain enough vitamins and minerals.

**Fluids**

The amount of fluid that should enter the body is important, especially for infants who are easy to suffer from dehydration. In general, healthy children require 1000 to 1500 ml per day. In cases of illness such as infections with high body temperature, diarrhea, and vomiting, the intake should be increased to avoid deterioration.

**Table IV.2 Recommended nutrients and fluids for infants**

| Age (Month) | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| Body Weight (Kg) | 3 | 4 | 5 | 6 | 6,5 | 7 | 7,5 |
| Fluids (ml/kgBB/day) | 150 | 150 | 150 | 150 | 150 | 150 | 150 |
| (ml/day) | 450 | 600 | 750 | 900 | 975 | 1050 | 1250 |

Source: FAO/WHO 1974

**BREASTFEEDING**

Breast milk is the ideal food for infants, especially in the first months, because it meets the health requirements. Breast milk contains all the nutrients for building and providing energy in the required amounts. Breast milk does not burden the digestive tract and kidney function and produces optimum physical growth. The quality of breast milk is naturally determined by the following ingredients:

1. Nutrients

a. Major nutrients: protein, fat, and charcoal hydrates including non-protein nitrogen (NPN), cholesterol

b. Vitamins especially A, D, B, and C

c. Minerals especially Fe and Ca

2. Non-nutrients

Important substances to prevent infection and protection against allergies: lactoferrin, lysozyme, secretory IgA, complement (C3, C4) as well as macrophages or lymphocytes.

3. Side element

Chemicals excreted into breast milk can be beneficial but can also be detrimental to growth and development, such as nicotine, alcohol, tetracycline, etc. Variations in composition are influenced by factors such as the state of health or nutrition of the mother, the stage of lactation, the length of time breastfeeding, and the mother's daily diet.

**CALCULATION OF NUTRITIONAL NEEDS IN INFANTS**

**Calculation of Ideal Weight in Infants**

**2011 Formula**

Infants 0-12 months

BW = (0.5 x age in months) + 4

## A. Recommended energy and protein adequacy levels for infants and children

Calorie requirement for children:

**RDA x BBI (BW based on NCHS TB table) + (BEE x FS)**

Baby BEE Table

| Age<br>1 week-10 months | |
|---|---|
| BW (kg) | The pace Metabolic (Kcal/hr) P/W |
| 3,5 | 202 |
| 4,0 | 228 |
| 4,5 | 252 |
| 5,0 | 278 |
| 5,5 | 305 |
| 6,0 | 331 |
| 6,5 | 358 |
| 7,0 | 384 |
| 7,5 | 410 |
| 8,0 | 437 |
| 8,5 | 463 |

| Age 1 week-10 months | |
|---|---|
| BW (kg) | Metabolic Rate (Kcal/hr) P/W |
| 9,0 | 490 |
| 9,5 | 514 |
| 10,0 | 540 |
| 10,5 | 566 |
| 11,0 | 593 |

Source: RSSA (2008); Ket P = Male W = Female

Stress Factor Determination Table

| **Clinical Conditions** | **Stress Factors** |
|---|---|
| Homelessness | 1,0-1,2 |
| without stress Fever | 12% per degree > $37^0$ |
| Routine/elective surgery, major | C 1.1-1.3 |
| sepsis Heart Failure | 1,25-1,5 |
| Major | 1,2-1,4 |
| Surgical | 1,4-1,5 |
| Sepsis | 1,5-2,0 |
| Growing | 1,5-1,7 |
| chase | |
| Trauma or head injury | |

RDA table for infants and children

| Age Group | Energy Requirements (kcal/kb BBI) | | Protein Sufficiency (gram/kg BBI) |
|---|---|---|---|
| | Men | Women | |
| 0-1 | 110-120 | 110-120 | 2,5 |
| 1-3 | 100 | 100 | 2 |
| 4-6 | 90 | 90 | 1,8 |
| 6-9 | 80-90 | 60-80 | 1,5 |
| 10-14 | 50-70 | 40-55 | 1-1,5 |
| 14-18 | 40-50 | 40 | 1-1,5 |

**Infant Energy and Protein Requirements Based on the IOM Formula**

| Age | Energy Requirement (Kcal) | Protein Requirement (g) |
|---|---|---|
| 0-3 months | ((89 x BBI)-100) + 175 | 9,1 |
| 4-6 months | ((89 x BBI)-100) + 56 | 9,1 |
| 7-12 months | ((89 x BBI)-100) + 22 | 11 |
| 13-36 | ((89 x BBI)-100) + 20 | 13 |

Fluid Needs:
- As per energy intake = 1 ml/kcal
- By Age Group:
→ Baby
First quarter : 175-200 ml/kg BW/day
Quarter II : 150-175 ml/kg BW/day
Quarter II I: 120-140 ml/kg BW/day

**MAKING A BALANCED MENU FOR BABIES**
**How to Breastfeed**

**1. Amount of breast milk**
The lactation ability of mothers varies. In addition, there are variations in the amount of milk a mother produces, due to the following:
a. Age of lactation

b. At the beginning of lactation, milk production (colostrum) is 20-100 ml/day in the first 3 days, and then increases. It usually matches the needs of the growing baby until approximately 4-6 years.

c. Influence on the quality and quantity of the mother's diet

d. The efficiency of conversion of nutrients in the mother to breast milk is 80-90%, derived from the mother's daily diet or the mother's body tissue reserves. Pregnant women store 4 kg of spare tissue as a reserve for breast milk production. If supplementary food is inadequate, the quantity of breast milk will be reduced.

e. Emotional disturbance

f. The mother's peace of mind and willpower are important factors for the smooth production of breast milk. If the mother experiences unrest, tension, and other difficulties that disturb her peace of mind, milk production tends to decrease. The effect of emotions is found to be more striking when compared to the effect of maternal food deficiency (Laurence, 1980 in Samsudin and Arjadmo, 1985).

g. Disruptions in lactation coaching and maintenance

h. The stimulus that occurs during breastfeeding has a major effect on milk production through the pathway of increased prolactin production. If the continuity of breastfeeding is interrupted for a long period, for example, due to illness or because the mother is working outside the home, breast milk production tends to quickly decrease and then stop altogether.

i. Effect of feeding other foods to the baby

j. Giving other foods including solids can indirectly reduce the stimulus to produce breast milk, therefore it is only given if necessary. According to Thomson and Black (1976), in Samsudin and Arjadmo (1985), breast milk production in well-nourished mothers during the first 6 months of lactation is approximately 600-700 ml/day. Whereas in mothers who are poorly nourished and in a poor living environment, breast milk production is more variable, approximately 500-700 ml/day in the first 6 months, and 400-600 ml/day in the next half year, then 300-500 ml/day in the second year, and in the third year 230-488 ml/day. From these variations, we can conclude that the adequacy of breast milk for infant growth and development needs to be considered in every infant-mother-breastfeeding case.

k.However, in general, according to Jelliffe and Jelliffe (1978) in Samsudin and Arjadmo, (1985), if the infant-mother-breastfeeding couple has good health conditions, with good lactation coaching and lactation maintenance, the quality and quantity of breast milk are usually good and sufficient for optimal growth until the age of 6 months, at least until 4 months.

**2. Breast milk frequency**

Since ancient times until now there have been two kinds of breastfeeding methods that are closely related to the frequency of breastfeeding, namely:

a. Frequency of breastfeeding with restriction

Restrictions are placed on the frequency, spacing of feedings, a strict schedule, and a feeding time of approximately 10-15 minutes. This method can educate the baby to get used to discipline and also provides convenience for health workers in hospitals or maternity homes in the management of infant-mother-breastfeeding pairs. However, it is now considered that this method may reduce the lactation ability of the mother, and is therefore no longer recommended.

b. Freestyle breastfeeding frequency, un-restricted

Babies are breastfed whenever they cry because they are hungry or thirsty. For smart mothers, it is not so difficult to distinguish whether the baby is crying for other reasons, for example, because of feelings of pain, or itching. Shock, overheating, and so on. Nowadays, breastfeeding without restrictions is encouraged and is called on-demand breastfeeding. In practice, some breastfeeding may be done at the mother's convenience.

**3. Duration and method of breastfeeding**

Each breast acts as a producer, storage, and device to provide breast milk. To achieve balance, both breasts should be given alternately. Lam breastfeeding depends on the nature of the baby. For

a quick-feeder baby, the breasts are generally almost emptied within five minutes, while for a slow-feeder baby, it takes 20 minutes or more, with short breaks. It is best not to breastfeed for too long to avoid the possibility of breastfeeding, which is breastfeeding without obtaining significant amounts of milk.

**Infant Formula Feeding**

**Infant Formula**

Baby milk is also known as infant formula because it comes from cow's milk formulated in such a way that its composition is close to breast milk. In Indonesia, there are various kinds of formula milk with various trademarks, but can be divided into three groups, as follows:

1. Adapted Milk Formula

Adapted means adapted to the physiological state of the baby. The composition of this formula is very close to breast milk, making it suitable for use for newborns up to 4 months old. Adapted formulas circulating in Indonesia include Vitalac, Nutrilon, Nan, Bebelac, Dumux sb, and Enfamil.

2. Complete Starting Formula

This formula has a complete nutritional composition and can be given as a starter formula. Unlike the adapted formula, the protein and mineral content of this formula is higher and the price is cheaper than the adapted formula. To save money, babies are usually given adapted formula until three months of age, then continued with this formula. Complete starting formula milk circulating in Indonesia include SGM 1, Lactogen 1, and New Camelpo.

3. Follow-Up Formula

The definition of follow-up in this formula is a continuation, which is replacing the current formula with this formula. This formula is intended for babies aged 6 months and above. It generally contains higher protein and minerals than the previous formula. Examples of follow-up formulas are Lactogen-2, SGM-2, Chilmil, Promil and Nutrima, Enfapro.

In addition, there are special formulas to be given to infants with certain metabolic disorders, so that they can continue to grow normally. Some examples of special formulas (diet formulas) include:

1. Premature Formula: Nenatal and Enfalac.
2. Low Lactose and No Lactose Formulas: LLM (Low Lactose Milk), Almiron, and Bebelac FL.
3. Formulas with High MCT Fatty Acids: Portagen.
4. Protein Hydrolysate Formula: Nutramigen.
5. Soy Bean Formula: Nutri-soya and Prosobee.
6. Semi-Elementary Formula: Pregestimil and Pepti-Junior.

**Delivery technique.**

**1. Quantity**

Newborns up to 3 or 4 months of age should be fed an adapted formula, (see adapted formula) but if the parent's income does not permit, a complete starting formula may be fed. It is recommended to give 100 110 kcal of energy per kilogram of body weight per day. Since infant milk contains approximately 67 kcal per 100 cc, infants can be fed 150 to 160 cc of milk per kilogram of body weight. These recommendations should be used as flexible guidelines. Not all infants need this amount of energy, some need more, and some need less.

If the amount of milk given to the baby elevates the baby’s weight rapidly, the amount of milk should be reduced. If with the recommended amount of milk, the baby's weight does not increase as expected, the food should be increased The schedule for formula feeding in infants according to age for 24 hours is as follows:

a. 1-2 weeks old is given the adaptation formula 6-7 times with 90 ml.
b. Age 3 weeks 3 months given 6 times adaptation formula of 100-150 ml
c. 3 months of age given 5 times adaptation formula of 180 ml
d. 4-5 months of age given 4 times adaptation formula of 180 ml
e. 6 months of age given 3 times adaptation formula of 180-200 ml
f. Age 7-12 months is given 2 times advanced formula of 200-250 ml

**2. Frequency**

The amount of milk to be given to the baby can be divided into 5-6 bottles and given every 3 or 4 hours. The drinking schedule should not be rigid. Although it takes 3-4 hours for the stomach to empty, sometimes the baby cries before that time so that the milk can be given earlier. It should not be forgotten that a crying baby is not always hungry but may be colicky, or thirsty because the formula contains too much salt.

Soft foods can be started at 4-6 months to meet the increasing demand for energy, protein, and other nutrients. It is generally not necessary to give soft foods before 4 months of age to avoid excessive inputs that may be detrimental to the infant's growth and health. Soft/solid foods gradually replace infant milk. By 6 to 7 months of age, the infant's diet consists of 2 times milk and 3 times soft food plus 1-2 times fruit. Follow-up milk such as SGM 2, Lactogen 2, Nutrima, Enfapro, etc. can replace starter formulas such as Vitalac, Nutrilon Primer, Nan, and so on if the baby is already 6 months old, but the latter formula can be continued until 12 months of age if the soft/solid food meets WHO recommendations (such as protein content of not less than 15% per 100 grams of powder, with a quality of at least 70% casein, and so on).

**Conditions for Feeding or Preparation for Feeding Formula.**

During the preparation of the formula, there is a danger of contamination by bacteria and dilution of the milk. It is generally difficult to feed formula to infants in a hygienic manner, given that mothers' household conditions vary. Bottles can be easily contaminated. Bottles should be glass (not plastic), upright and wide-mouthed (for easy cleaning), and marked with milliliters (fluid ounces).

Bottle nipples can be easily contaminated. Must be made of high-quality material and resistant to boiling. The hole in the teat should be able to release milk at a constant rate when the bottle is turned upside down.

Wash all baby feeding or drinking utensils immediately after use, using cold water and soap or detergent with a bottle brush. Bottle nipples are coated with salt to remove milk clots. Then everything is washed well. After that, sterilize with boiling water. Put the equipment including the bottle teat in a container one-third full of water, then fill it with water. Boil for 5-10 minutes, drain, dry, and store covered until ready to use.

Important things to note in giving formula milk are as follows: It is better if the mother or guardian gives the formula herself, by holding the baby to accelerate the close relationship between the two. Every time milk is prepared, it should be given to the baby immediately. Leftover milk can only last for 1-2 hours in a closed container at room temperature unless it is stored in the refrigerator. When giving formula in a bottle, note that the milk water, and not air are sucked by the baby. A few spoons of cooled boiled water are needed by the baby to dilute the cow's milk he drinks. This water is given with a spoon, after each feeding.

**Complementary Feeding**

1. Quantity

Complementary feeding should begin at 6 months of age, with the amount increasing with the age of the infant. The energy from complementary foods required by a child with average feeding frequency in developing countries is 200 Kcal/day at 6-8 months, 300 Kcal/day at 9-11 months, and 550 Kcal/day at 12-23 months.

2. Consistency

Gradually increase the consistency and variety of food as the baby gets older. Babies can consume puree and semi-solid foods at the beginning of breastfeeding or 6 months of age. When the baby reaches 8 months of age, the baby can consume "finger food" (snacks that can be eaten by the child without being fed). At 12 years of age, the baby can start to be introduced to family meals. Avoid foods that may cause the child to choke (e.g. shape and/or consistency that may cause food to easily enter the trachea, e.g. nuts, grapes, raw carrots).

3. Meal Frequency

Increase the frequency of feeding as the child gets older. The recommended feeding frequency depends on the energy density of the breastmilk complement fed to the child. For healthy infants, feeding can start at 2-3 times/day at 6-8 months of age, and 3-4 times/day at 9-11 months of age, with an additional 1-2 snacks per day. In children who consume foods with low energy density, it may be necessary to increase the frequency of feeding.

Minimum number of complementary food frequency by energy density

| Energy Density (Kcal/g) | 6 - 8 months | | 9 - 11 months | | 12 - 23 months | |
|---|---|---|---|---|---|---|
| | Low BME | Avg BME | Low BME | Avg BME | Low BME | Avg BME |
| 0,6 | 3,7 | 2,4 | 4,1 | 2,8 | 5,0 | 3,7 |
| 0,8 | 2,8 | 1,8 | 3,1 | 2,1 | 3,7 | 2,8 |
| 1,0 | 2,2 | 1,4 | 2,5 | 1,7 | 3,0 | 2,2 |

Description:
- Assuming the stomach capacity is 30 g x Reference Body Weight, the maximum food weight is 249 g/meal at 6-8 months; 285 g/meal at 9-11 months; and 345 g at 12-23 months.
- Low BME (infrequent breastfeeding), assumed energy from breastmilk of 217 kcal/day at 6-8 months; 157 kcal/day at 9-11 months; and 90 kcal/day at 12-23 months.
- Avg BME (adequate breastfeeding), assumed energy from breastmilk 413 Kcal/day at 6-8 months; 379 Kcal/day at 9-11 months; and 346 Kcal/day at 12-23 months.

4. Nutritional Content of Breast Milk complementary food
Provide a variety of foods to ensure the baby gets adequate nutrient intake. Meat, poultry, fish, eggs, and other protein sources should be consumed daily or as often as possible. A strict diet is not suitable for infants, as it cannot meet the high nutrient requirements of infants, except with the addition of special supplements. Fruits and vegetables rich in vitamin A also need to be consumed daily. Adequate fat intake should also be ensured in the baby's breast milk. Avoid giving drinks that contain fewer nutrients such as tea, coffee, and sweet and fizzy drinks. Limit juices to prevent the child from skipping other foods that are richer in nutrients.

Feeding potentially allergenic foods such as high-protein foods has been debated by several experts. In some industrialized countries such as the US, children with parents who have a history of allergies are restricted to feeding protein sources such as cow's milk until 1 year of age, eggs until 2 years of age, and nuts and fish until 3 years of age. However, to date, there are no published studies showing evidence that this restriction can prevent or slow down the incidence of allergy or atopic dermatitis in infants, despite a family history of allergy. For this reason, the International Group of Experts (WHO/IAACI, 2000) does not recommend this restriction.

## HEALTHY DIET FOR TODDLERS

### FOREWORD
The quality of human resources (HR) is an absolute requirement for development in all fields. Nutritional status is one of the factors that greatly affect human quality, especially those related to intelligence, productivity, and creativity.

An important period in child development is the toddler period. This is the period of basic growth that will influence and determine the child's further development. During this period, the development of language skills, creativity, social awareness, emotions, and intelligence runs very fast and is the foundation for subsequent development. Moral development and the basics of personality are also formed during this period. There is even a scholar who says that the child is the father of the man. So that every slightest abnormality if not detected let alone not handled properly will reduce the quality of human resources in the future.

Age 1 - 5 years in toddlers is an age in the life cycle where growth is not as fast as in infancy, but there are many activities. Play, play, and play. This is a typical activity characteristic of toddlers. Almost all of their activities involve elements of play. But playing in this age period is not meaningless, because it is through playing activities that they learn. Learning about many things. Learning to utilize their own physical devices, learning to recognize the meaning of friends,

learning to communicate with the same verbal language, with the language of the people in their environment, and learning to behave in a controlled manner following the applicable rules.

Playing while learning, learning while playing, is indeed the right phrase to describe the characteristics of physical and mental activity of children of this age. The results are obvious. So it is no exaggeration if one of the child psychologists from the United States Elizabeth B. Hurlock, says that this age period is a golden period (Golden Age) in the process of developing a human child. At this age, children experience amazing leaps of progress. Not only physical progress, such as running, jumping, and flexible use of fingers, but also social and emotional. At this age they often become rebellious, arguing, which should be sufficiently controlled and directed, not turned off. Effective communication between parents and children can guide and direct children to a path that is acceptable to their environment.
Seeing that the physical activity of children under five has begun to be dense, tends to forget time when playing, and is vulnerable to infectious diseases, or nutritional diseases (Lack of Protein Energy, Anemia, and Lack of Vitamin A), nutritional factors play a very important role in the growth and development of the next child. To prevent these toddlers from experiencing nutritional problems, it is necessary to study the importance of the role of nutrition and the factors that can influence their growth and development.

## PHYSIOLOGICAL CONDITION OF THE BABY

### Toddler Growth

Growth and development assessment includes physical growth evaluation (curves or graphs of weight, height, head circumference, chest circumference, and abdominal circumference), dental growth evaluation, neurological and social development evaluation, and youth evaluation.
1. Height and Weight Growth.
During the second year, the weight gain rate is 0.25 kg/month. Then, it becomes about 2 kg/year until 10 years old. The average length at the end of the first year increases by 50% (75 cm) and doubles by the end of the fourth year (100 cm). The standardized values often used are the charts (growth charts) compiled by the NCHS for weight and height.

2. Sensory Development.
At this age, the child's five senses - sight, hearing, taste, smell, and touch - are expected to function optimally. In line with the development of intelligence and the number of words they hear, preschool children can already speak using simple complete sentences.

3. Teetth Growth
The formation of a healthy and perfect teeth structure is possible with adequate nutrition of protein, calcium, phosphate, and vitamins (especially vitamin C and vitamin D). Tooth classification begins at 5 months of fetal age and includes all milk teeth. Delayed tooth eruption can be found in hypothyroidism, nutritional disorders, and growth disorders.

At 16-18 months of age, canine teeth begin to appear. Up to 2 years old, the age of an infant can be roughly measured by counting the number of nutrients plus 6, to determine the age in months. Milk teeth begin to fall out at 6 years of age and end at 10-12 years of age.

4. Head Size (head circumference)
Head size increases by 10 cm in the first year of life. The standard value used for head size (head circumference) is the Nellhaus chart.

5. Muscle Growth
In children, muscle growth is very rapid. In infants, the circumference of the upper arm increases by ± 10 cm at birth, to about 16 cm at 12 months of age, but only blooms by 1 cm in the following 4 years.

6. Bones
For a few months from birth, only the front head is still open, but it usually closes by 18 months of age.

7. Heart Rate
Infants' heart rate is faster than adults'. The average heart rate is as follows, birth 140/min, first month 130/min, 2-4 years 100/min and 10-14 years 80/min.

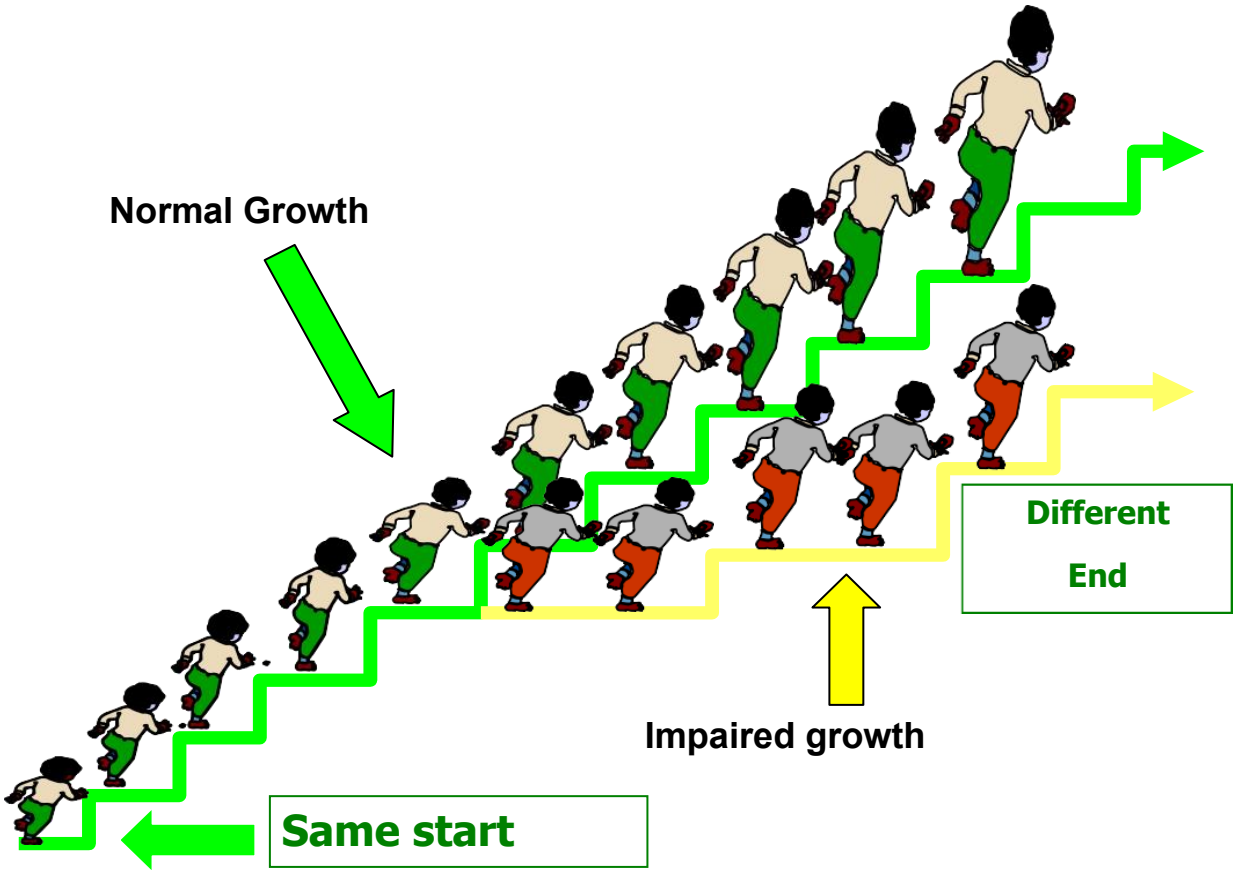



Figure 2.3 Growth of Normal and Abnormal Toddlers

There are differences in growth in toddlers who experience growth disorders with toddlers whose growth is normal. Normal toddlers and toddlers with impaired growth initially experience the same level of growth, usually, this occurs in infancy. But in toddler age, the difference in growth will be

seen. Toddlers who get good nutrition during infancy and fetal age will grow normally according to their age.

**THE ROLE OF NUTRIENTS IN TODDLERHOOD**

The role of nutrition in the development of human resource quality has been proven by various studies. Nutritional disorders in early life affect the quality of subsequent life. Undernutrition in toddlers not only affects physical growth disorders but also affects the quality of intelligence and future development. Therefore the role of foods with high nutritional value is very important as in foods that contain energy, protein (especially animal protein), vitamins (vitamin B complex, vitamin C, vitamin A), and minerals (Ca, Fe, Iodine, Fluorine, Zn). Parents' attention to the food given to children should be able to increase children's appetite. In general, children prefer various foods that have cute shapes and are colorful. Also, they prefer to eat with their peers.

Toddlerhood is a very important period of life and needs serious attention. During this period, a very rapid growth and development process takes place, namely physical growth and psychomotor, mental, and social development. Psychosocial stimulation must begin early and on time to achieve optimal psychosocial development. To support the physical growth of toddlers, we need practical guidance on food with balanced nutrition as follows:

1. Eat a variety of foods
2. Eat food to meet energy needs
3. Eat half of your energy needs from carbohydrate sources
4. Limit consumption of fats and oils to a quarter of energy intake
5. Use iodized salt
6. Eat iron-source foods
7. Breastfeed your baby only until 6 months of age
8. Get into the habit of eating breakfast
9. Drink enough clean, safe water
10. Engage in regular physical activity and exercise
11. Avoid drinking alcoholic beverages
12. Eat foods that are safe for your health
13. Read labels on packaged foods

During this period, toddlers need to obtain nutrients from daily food in the right amount and good quality. Therefore, "delays in health, nutrition, and psycho-social interventions result in a loss that cannot be repaired or replaced in the future". Balanced nutrition for toddlers is compiled based on 13 basic PUGS messages, aiming to guide Puskesmas nutrition officers in improving family nutrition.

Nutritional needs in toddlers include energy, protein, fat, water, carbohydrates, vitamin, and minerals.

**Energy**

Daily energy requirements in the first year are 100-200 kcal/kg BW. For every 3 years of age, energy needs decreased by 10 kcal/kg BW. The use of energy in the body is 50% or 55 kcal/kg BW/day for basal metabolism, 5-10% for Specific Dynamic Action, 12% for growth, 25% or 15-25 kcal/kg BW/day for physical activity and 10% is wasted through feces.

Energy-containing nutrients consist of protein, fat, and carbohydrates. It is recommended that the required amount of energy is obtained from 50-60% carbohydrates, and 25-35% fat, while the rest (10-15%) comes from protein.

Energy Adequacy in Children per Kg of Body Weight

| Age Group (year) | Body Weight (kg) | Energy (Kcal) |
|---|---|---|
| 0,5-1 | 8,0 | 870 |
| 1-3 | 11,5 | 1210 |
| 4-6 | 16,5 | 1600 |

Source: Karyadi and Muhilal. 1985. Recommended Nutritional Adequacy. Page 10.

**Protein**

Protein is a source of essential amino acids that are needed as building blocks, namely for growth and the formation of proteins in serum, hemoglobin, enzymes, hormones, and antibodies; replacing damaged body cells; maintaining the acid-base balance of body fluids and energy sources.

It is recommended to provide 2.5-3 gr/kg BW for infants and 1.5-2 gr/kg BW for school children to adolescents. The amount of protein given is considered adequate if it contains all essential amino acids in sufficient quantities, and is easily digested and absorbed by the body, then the protein given should be partly high-quality protein such as animal protein.

Estimated Amino Acid Adequacy (mg/kg BW/day)

| Amino Acids | BW | 2-year-old child |
|---|---|---|
| Histidine | 28 | ? |
| Isoleucine | 70 | 31 |
| Leucine | 161 | 73 |
| Lisin | 103 | 64 |
| Methionine & Cystine | 58 | 27 |
| Penylalanine & Tyrosine | 125 | 69 |
| Threonin | 87 | 37 |
| Tryptophan | 17 | 12,5 |
| Valin | 93 | 38 |

Source: FAO/WHO/UNU.1983 in Recommended Nutritional Adequacy. 1985. Page 12. Jakarta

**Water**

Water is a very important nutrient for infants and children because the largest part of the body consists of water. Water loss through the skin and kidneys in infants and children is greater than in adults and infants and children will be more susceptible to diseases that cause large amounts of water loss.

Daily Water Requirements in Children

| Age | Daily Needs (ml/ kg/ BW/ day) |
|---|---|
| 12 months | 120-135 |
| 2-3 years | 115-125 |
| 4-5 years | 100-110 |

Source: Nelson. 1983. Textbook of Pediatrics. New York in Kapita Selekta Kedokteran. 2000. Page 566. Jakarta.

**Fat**

Fat requirements are not expressed in absolute numbers, it is recommended that 15-20% of total energy comes from fat. In Indonesia, the energy derived from fat is generally around 10-20%. This low proportion of fat content is thought to be better for health, as the risk of developing atherosclerosis is lower. It can thus be concluded that fat should be present in the diet and the amount of fat present in Indonesian dishes is generally adequate.

Fat intake after 6 months of age of 30-35% of total energy is considered normal, but should not be lower. Very low-fat diets can cause fatigue and eliminate satiety. On the other hand, excessive fat intake can lead to obesity.

**Carbohydrates**

It is recommended that 60-70% of total basal energy comes from charcoal hydrates. In breast milk and most infant formulas, 40-50% of the calorie content comes from hydrates, especially lactose. Carbohydrates are required by growing children as a source of energy, and there is no minimum carbohydrate requirement, as glucose in circulation can be formed from protein and glycerol. The optimal intake ranges from 40-60% of total energy. Preferably the carbohydrates eaten should consist of polysaccharides such as those found in rice, wheat, potatoes, and vegetables. Sugars found in sugary drinks, seltzer, cakes, confectionery, and chocolate should be limited and not exceed 10% of total energy.

Other monosaccharides and disaccharides are found in fruits and milk and dairy products. Fruit, milk, and dairy products are sources of vitamins and trace elements for growing children. Foods that are too sweet can lead to tooth decay in children.

**Vitamins and Minerals**

Essential vitamins and minerals are nutrients that are important for growth and health. Some of the B vitamins required for brain development are vitamin B1, vitamin B6, and folic acid (vitamin B9). If their needs are not met, there will be disturbances in the growth and function of the brain and nervous system.

Vitamin needs for toddlers are used for:
1) Vitamin A functions for the growth of epithelial cells and as a regulator of light sensitivity in the nerves and eyes.

2) Vitamin B1 functions for carbohydrate metabolism, and water balance in the body and helps the absorption of fatty substances in the intestines.

3) Vitamin B2 functions in the transfer of light stimuli to the eye nerves and enzymes, and functions in the oxidation process in cells.

4) Vitamin B6 functions in the manufacture of red blood cells and the process of growth and the work of nerve fibers.

5) Vitamin C functions as an activator of various ferments that break down proteins and fats, in oxidation and dehydration in cells, and is important in platelet formation.

6) Vitamin D regulates lime and phosphorus levels, and together with adenoids increases the absorption of lime and phosphorus from the intestines and affects the work of endocrine glands.

7) Vitamin E prevents bleeding in pregnant women and prevents miscarriage and is needed when cells are dividing.

8) Vitamin K functions in the formation of prothrombin which is important in the blood clotting process. Vitamins are classified as fat-soluble vitamins (ADEK) and water-soluble vitamins namely Vitamin B complex (B1, B2, Niacin, B6, pantothenic acid, biotin, folic acid, and B12 ) and vitamin C.

Children under the age of 1-5 years are often deficient in vitamins A, B, and C. Therefore, children need to get 1-1½ bowls or 100-150 grams of vegetables a day. Choose yellowish or orange fruits and sour fruits such as papaya, banana, mango, pineapple, orange, and so on. Give 1-2 pieces of papaya a day (100-200 g) or 1-2 oranges or other fruits. The recommended vitamin adequacy can be seen in the table below:

Vitamin Needs of Toddlers

| Age (th) | BW (Kg) | Vit A re | Vit D µg | Vit E µg | Vit K µg | Vit $B_1$ µg | Vit $B_2$ µg | Niacin µg | Vit B12 µg | Folate µg | Pyridoxine µg | Vit C µg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1-3 | 12 | 350 | 10 | 6 | 15 | 0,5 | 0,6 | 5,4 | 0,5 | 40 | 1,0 | 40 |
| 4-6 | 18 | 460 | 10 | 7 | 20 | 0,8 | 1,0 | 8 | 0,7 | 60 | 1,1 | 45 |

Source: Widya Karya Nasional Pangan dan Gizi, LIPI, Jakarta, 1998

The nutritional needs of micro minerals that are more needed during toddler age are:
1. Iron (Fe).
According to Sumarmi (2003), iron has a large role in the body because iron is involved in various oxidation-reduction reactions. Aerobic metabolism also requires iron. In this process, iron acts as a functional group of various enzymes in the Krebs cycle and as an electron carrier in cytochrome. Iron work as oxygen transportation in the blood. Iron is also involved in cell proliferation, production and disposal of oxygen-free radicals, systemic hormone activity, and some aspects of immunity. The iron sufficiency recommended by Widya Karya Pangan dan gizi (1998) in Almatsier (2001) for toddlers is 8-9 mg/day. Dallman et al (1980) in Sumarmi (2003) reported that toddlers aged 1 year with a weight of 10 kg should provide 30% of iron from food, while adults only need 5%. The difference in iron consumption between toddlers and adults occurs due to:
a. Infants and children consume iron with low availability
b. Born with decreased iron stores
c. Growing too fast
d. Increased iron excretion

Normal infants can maintain hemoglobin levels only by consuming breast milk for 3 months, so the iron sufficiency rate for children aged 6 months to 3 years is 10 mg/day. Infants born with low body weight require an iron input of 2 mg/kg BW/day from 2 months of age (Sumarmi, 2003).

2. Iodine
Almatsier (2001), says that iodine is an integral part of both thyroxine hormones triiodothyronine and tetraiodothyronine. The main function of these hormones is to regulate growth and development. Thyroid hormones control the rate at which each cell uses oxygen. Thyroid hormones thus control the rate at which energy is released from energy-producing nutrients. Thyroxine can stimulate metabolism by up to 30%. In addition, these two hormones regulate body temperature, reproduction, red blood cell formation, and muscle and nerve function. Iodine also plays a role in the conversion of carotene into the active form of vitamin A, protein synthesis, and absorption of carbohydrates from the gastrointestinal tract. Iodine also plays a role in blood cholesterol synthesis.

Iodine sufficiency recommended by Widya Karya Pangan dan Gizi (1998) in Almatsier (2001) for toddlers is 70-120 µg/kg BW.
3. Zinc
Zinc has very important biochemical roles in metabolic processes, namely:
a. As a component of zinc-containing metalloenzymes.
3 criteria must be met for a compound to be classified as a metalloenzyme:
1) Structure consists of metal elements and proteins
2) Metal ions must bind tightly to proteins
3) The catalytic function of the enzyme will be reduced if the metal element is absent.

b. In polysome formation
c. Membrane stability
d. As free ions in cells

Zinc also plays a role in nucleic acid metabolism and protein synthesis. In addition, zinc also functions for cell growth, cell replication, maturation of reproductive organs, vision, immunity, taste, and appetite. For cell growth, zinc function is associated with the process of protein synthesis involving the enzyme RNA polymerase, while in cell replication zinc function is associated with the role of enzymes DNA polymerase, deoxynucleotidyl transferase, and thymidine kinase.

Sumarmi (2003) also mentioned that full-term newborns can meet their zinc requirements by getting breastfed and zinc storage in the liver. During the first 1 month of infants who only consume breast milk, on average get zinc at 2 mg of zinc per day. Around 6 months of age, babies consume only 0.6 mg/day of zinc. Many consume formula because the availability of zinc in the formula is lower than the number set for infants who consume formula 5 mg/day. While for children it is recommended to consume 10 mg/day of zinc.

The food composition will be enhanced by the presence of milk as a source of energy that also contains various important components, such as DHA, AA, Sialic Acid, Sphingomyelin, protein, vitamins, and minerals.

1) Docosahexaenoic acids (DHA) and arachidonic acid (AA), the largest components of long-chain polyunsaturated fatty acids (LC-PUFA), are very important ingredients for the central nervous system organs. As an essential form of fatty acid LC-PUFA must be added to the diet (Hidajat, 2003). DHA is an essential Omega-3 fatty acid. Chemically, DHA is a carbo silicic acid with a 22-carbon chain and six cis double bonds; the first double bond is on the third carbon of the omega end. DHA and AA are the main components that form the brain and retina of the eye. DHA and AA also play an important role in optimizing the function of brain cell membranes, eye retina, and the metabolic processes of nerve cells in the brain. DHA itself is very important in brain development. Research has shown the following:
a) Infants and toddlers who have low levels of DHA in their diets have lower brain development and reduced visual acuity.

b) Infants and toddlers who drink milk with good DHA have higher intelligence and academic performance.
c) Cultures whose diets are high in Omega-3 fatty acids (such as the Japanese and Eskimos) have a lower incidence of hereditary diseases, especially central nervous system diseases such as multiple sclerosis.

d) In animal studies, those whose diets were low in DHA were found to have smaller brains and delayed development of the central nervous system.

e) Some children who perform very poorly in school due to ADD (Attention Deficit Disorder: concentration disorder), are found to lack essential fatty acids in their diet.
Alle (2007) argues that the human body naturally produces DHA, but the amount is too small and not routinely produced, so it needs to be supplemented from outside. DHA is found in many marine fish such as salmon, tuna (especially bluefin tuna, which has five times more DHA than other tuna), sardines, herring, mackerel, and shellfish. Although not as much as marine products, food sources such as eggs, meat, and beef liver and brain also contain DHA. Alle (2007) also says that AA stimulates platelet production, which thickens the blood and narrows the blood vessels. Due to the

oversupply of DHA, enzymes reduce their DHA production. Automatically, the production of AA is also reduced. The ideal DHA level for normal babies is a maximum of 20 mg per kilogram of baby weight per day. For premature babies, the WHO recommends 40 mg per kilogram of baby weight.

2) Sialic acid (SA), part of the brain's ganglion, has been found to play an important role in children's learning and memory formation.
3) Sphingomyelin is a sphingolipid that was first characterized by J.L.W. Thudicum in 1884. Chemically and structurally, Sphingomyelin can still be categorized in the phospholipid fat group, but Sphingomyelin is categorized as a sphingolipid because of its chemical skeleton called sphingosine. Sphingomyelin is a fat content in the brain, acting as a framework for cell membranes as well as many other functions. Sphingomyelin also plays a role in the formation of the protective layer of myelin, where myelin functions to accelerate stimulation from one nerve cell to another nerve cell including muscles and other target cells to optimize the brain's ability to send messages. Myelin is a lipid-rich sheet where the main components are sphingomyelin and other sphingolipid metabolites. It has recently been learned that sphingomyelin, a type of phospholipid contained in food and breast milk, plays an important role in the myelination process of the central nervous system. Myelination of the human central nervous system begins at 12-14 weeks of gestation in the spinal cord and continues until 30 years of age in the spinal cord. However, the most rapid and dramatic changes occur between the middle of pregnancy and the end of the second year after birth. Unlike the other types of phospholipids, sphingomyelin does not contain glycerol, but ceramide. Since all sphingolipids are made from ceramide, sphingomyelin can also be classified as a sphingolipid (Jumpsen & Clandinin, 1995 in Handajani, 2006). This ceramide will then form the cerebroside, which is a universal marker of myelination (myelin formation) in the brain, with the help of the enzyme UDP galactosyltransferase.
In the body, Sphingomyelin is hydrolyzed through the gastrointestinal tract into a category of metabolites (ceramide- and sphingoid-based) that are used by cells to regulate growth, differentiation, apoptosis, and other cell functions. Past studies have shown that sphingolipids prevent intestinal carcinogenesis, reduce serum LDL cholesterol and raise HDL. Sphingolipid metabolism can also be modified with fatty acids and mycotoxins (fumonisins) which can help cell regulation and reduce disease.

## CALCULATION OF ENERGY AND NUTRIENT REQUIREMENTS FOR TODDLERS

Child BEE Table

| Age 11-36 months | | | Metabolic Rate (Kcal/hr) | | |
|---|---|---|---|---|---|
| BW (kg) | Metabolic Rate (Kcal/hr) | | BW (kg) | Metabolic Rate (Kcal/hr) | |
| | P | W | | P | W |
| 9,0 | 528 | 509 | 15 | 859 | 799 |
| 9,5 | 547 | 528 | 20 | 953 | 898 |
| 10,0 | 566 | 547 | 25 | 1046 | 996 |
| 10,5 | 586 | 566 | 30 | 1139 | 1092 |
| 11,0 | 605 | 586 | 35 | 1231 | 1190 |
| 11,5 | 624 | 605 | 40 | 1352 | 1289 |
| 12,0 | 643 | 624 | 45 | 1418 | 1387 |
| 12,5 | 662 | 646 | 50 | 1512 | 1486 |
| 13,0 | 682 | 665 | 55 | 1606 | 1584 |
| 13,5 | 701 | 684 | 60 | 1699 | 1680 |
| 14,0 | 720 | 703 | 65 | 1793 | 1776 |
| 14,5 | 739 | 722 | 70 | 1886 | 1874 |
| 15,0 | 758 | 741 | 75 | 1980 | 1973 |
| 15,5 | 778 | 760 | | | |
| 16,0 | 797 | 782 | | | |
| 16,5 | 816 | 802 | | | |

Source: RSSA (2008); Ket P = Male W = Female

MAKING A BALANCED MENU FOR BABIES

Daily Food Consumption Intake

| Age | Food Forms | Meal Frequency |
|---|---|---|
| 0-4 months | Exclusive breastfeeding | As often as possible |
| 4-6 months | Soft strained/pureed food | 2 x a day<br>2 tablespoons at a time |
| 6-12 months | Soft mashed/finely chopped food | 3 x a day<br>Plus 2 x snacks |
| 1-3 years | Family meals<br>1-1½ plates of rice/substitute 2-3 pieces of animal side dishes<br>1-2 cut vegetable side dish<br>½ vegetable bowl<br>2-3 pieces of fruits<br>1 glass of milk | 3 x a day |
| 4-6 years | 1-3 plates of rice/substitute 2-3 pieces of animal side dishes<br>1-2 pieces of vegetable side dish 1-1½ bowls of vegetables<br>2-3 pieces of fruits<br>1-2 glasses of milk | 3 x a day |

Source: Indonesian Ministry of Health. 2000. Balanced Nutrition Toward a Healthy Life for Toddlers. Page 4. Jakarta.

The growth of toddlers is strongly influenced by several factors, both internal and external factors. Internal factors are influenced by the amount and quality of food, and toddler health (presence or absence of disease). External factors are influenced by economic level, education, behavior (parents/caregivers), socio-culture or habits, and availability of food in the household (Depkes RI, 2000).

**Healthy Eating Key Message (Pesan Gizi Seimbang)**

Food imbalances in the toddler period will result in physical and mental abnormalities that can hinder the development and growth of the toddler. To support this, based on nutritional problems and nutritional needs in children under five, balanced nutrition messages need to be understood and delivered to the target.

The messages of balanced nutrition are (Ministry of Health, 2000):

1. Message 1: Eat a variety of foods for toddlers
   A variety of food is when each dish consists of at least four food ingredients: varied staples, side dishes, vegetables, and fruits.
   It is better if a variety of foods are consumed at every meal. A person's dislike for certain foods will inhibit the action of achieving nutritional balance. Therefore, to prevent this, introduce and provide a variety of foods from an early age. Various types of foods should also be introduced from an early age. Consumption of various foods for toddlers can ensure the completeness of nutrients needed by the body because each food contains different nutrients, both in type and amount.
   Other foods can supplement the lack of nutrients in certain foods. However, it is necessary to consider other unfavorable foods such as ice cream, sweet cakes, sweets/candies, and snacks that use many food additives.

2. Message 2: Eat enough food to meet toddlers' energy needs
   Every toddler is encouraged to eat dishes that contain enough sources of energy so that they can carry out their daily activities such as playing, learning, recreation, and other activities. Energy needs can be met by consuming carbohydrates, protein, and fat food sources. Energy adequacy for toddlers is critical to obtain optimal growth and development of children.
   Energy adequacy for toddlers is characterized by normal body weight. The normal weight of toddlers can be known by using the Kartu Menuju Sehat (KMS). Too much energy consumption causes children to become overweight/obese, on the other hand, less energy consumption causes children to become undernutrition.
   In addition to being breastfed until two years of age, toddlers should also be given complementary foods from 6 months, including strained/pureed, mashed/finely chopped, and family food (ages 1-5 years). Soft strained/pureed food is given twice daily, two tablespoons at a time (fruit water, flour porridge, or crushed banana). Soft mashed/finely chopped food is given three times daily, with 1-2 snacks daily (fruits, mung bean porridge, cakes, etc.). Family meals are given three times a day, each giving ½ portion of adult food, and also snacking at least two times a day. The family diet consists of staple foods, proteins, vegetables, and fruit.

3. Message 5: Use iodized salt for toddler food
   Iodized salt is fortified salt with 30-80 ppm of potassium iodate (KI03). Iodine is one of the minerals that is crucial for the human body.
   Iodine deficiency in toddlers can cause various diseases such as goiter, physical and mental

growth disorders, also decreased concentration and intelligence levels. Therefore, to avoid the occurrence of diseases due to iodine deficiency, convince parents of toddlers to use iodized salt in food by putting iodized salt on food immediately after cooking and no longer consuming food using salt briquettes/bricks.
Choose iodized salt that is written "contains 40 ppm KI03 " on the label or package.

4. Message 6: Eat iron-rich foods for children under five
   Iron is one of the essential elements in the process of red blood cell formation, which is naturally obtained from daily food.
   A sustained lack of iron in the daily diet can lead to nutritional anemia, also known as blood loss.
   Examples of iron sources are animal products such as liver, meat, eggs, chicken, etc. In addition, iron sources are found in legumes and their processed products, such as green beans, kidney beans, peanuts, tempeh, tofu, and dark green vegetables, such as cassava leaves, kangkong, spinach, etc. These foods should be consumed together with sources of vitamin C, such as fresh fruits. Since it facilitates iron absorption in the body.

5. Message 7: Breastfeed infants until six months old
   Breast milk is the best food for babies. There is no other food that can replace breast milk because breast milk has advantages covering four aspects, namely nutritional aspects, immune aspects, economic aspects, and psychological aspects, in the form of affection that is important for children's mental development and intelligence. Colostrum (thick and yellowish in color) is breast milk that comes out on the first day that contains high immune substances and vitamin A, which should be given to babies.
   Breast milk can fulfill the baby's nutritional needs for growth and development until the baby is six months old, so in this period, there is no need to give any additional food. Considering the great benefits of breast milk in a child's growth and development, every mother is expected to provide sufficient breast milk for the child both in quantity and quality. Therefore, each mother needs to pay special attention to the amount and quality of food nutrition during pregnancy and breastfeeding. In an economic crisis, exclusive breastfeeding for infants will reduce the mortality number of children under-five years old.
   After a baby is six months old, breast milk alone can no longer fulfill the baby's nutritional needs. Therefore, after the baby is over six months old, it is necessary to get complementary foods for breast milk (MP-ASI).
   Breastfeeding is continued until the child is two years old.

6. Message 8: Get toddlers used to eating breakfast
   Breakfast is food given at 6:30 am in the form of staple foods and side dishes (proteins) or snacks.
   The habit of eating breakfast helps toddlers to fulfill their daily nutrient intake. The amount of food given is approximately 1/3 of the daily diet. The type of dish for breakfast can be selected and prepared according to local conditions.
   Eating breakfast regularly every day in sufficient quantities is very important for

maintaining physical endurance, maintaining immune health, and improving children's intelligence. If children are not accustomed to eating breakfast, they will experience a lack of energy, become lethargic, cold sweat, drowsiness, lack of concentration, and decreased consciousness.
Parents should set a good example by making a habit of eating breakfast. When eating breakfast, children should always be accompanied by parents or family members.
It needs to be done gradually to accustom children who are not used to eating breakfast. At first, give a small or small portion, gradually increasing the portion of food as recommended. Morning meals include chicken porridge, mung bean porridge, Manado porridge, omelet sandwiches, and snacks (e.g., fried bananas, stuffed rice cake, etc.).

7. Message 9: Drink enough clean and safe water for toddlers. Clean water is defined when the water is odorless, colorless, and tasteless.
   Drinking water is clean water that is boiled and stored in a clean and closed container. Toddlers also need drinking water to balance the fluids and mineral salts in the body as well as to replace body fluids that come out in the form of sweat, urine, etc.
   To facilitate metabolic processes in the body, toddlers are recommended to consume at least 4-6 glasses of water daily; 200 ccs per glass.

8. Message 13: Read labels on packaged foods for toddlers
   Food labels are information or statements about food in pictures, writing, or other forms carried out in various ways for marketing and trading food.
   The purpose of labeling packaged foods is to assist potential consumers in making choices before use.
   Such information includes the product's name, list of ingredients, net weight or net contents, manufacturing /importing company, production date, and expiration date.
   Parents should check the label before consuming them to see if they contain restricted/ prohibited ingredients.

   The advantage of reading labels for families with children under five is :

   1. Able to choose food that has not expired and packaging that is still good
   2. Able to know the rules of feeding
   3. Able to obtain food with the same quantity and quality as needed but at a lower price
   4. Able to choose salt that contains Iodine

   If using packaged food is the only option, parents should :

   1. Read the label carefully before using it
   2. Do not buy the food if the label is missing or damaged
   3. Do not buy things that have expired even if the price is cheap

## HEALTHY DIET FOR SCHOOL-AGE CHILDREN

## PHYSIOLOGICAL CONDITION OF SCHOOL-AGE CHILDREN

### Growth of School-Age Children

After children reach the age of 2 years, nutritional status is no longer measured using the parameters BW/A, BH/A, or BW/BH. The nutritional status of children above the age of 2 years, including at school age, is more appropriately measured using BMI/A (Body Mass Index per Age) because it is known that there is a correlation between height and adipose before the age of 12 years (Freedman *et al.,* 2004).

The growth rate of each child varies greatly depending on the individual conditions of each child. Factors that affect children's growth rate include environmental conditions such as physical activity and food intake. It is also influenced by internal factors such as the history and growth patterns of parents and close relatives. The average growth rate in school-age children can be seen in the following table

| Indicator | Age | Average Daily Growth (g/day) |
|---|---|---|
| Weight gain | 7-10 | 5-12 |
| Height growth | 7-10 | 0,4-0,6 |

## THE ROLE OF NUTRITION IN SCHOOL-AGE CHILDREN

### Energy

As the growth rate of children including school-age children increases, so does the energy requirement. Energy requirements in toddlers and school children vary depending on bone growth rate and level of physical activity. Energy determination can use the actual body weight and height of school-age children.

### Protein

Protein is the main constituent of body tissues. Protein plays a role in the formation, maintenance, and replacement of body tissues, such as muscles and organs. In the growth and development of children, protein is one of the key nutrients that determine the growth rate of children. The recommendation for protein intake is 10-20% of children's total daily energy intake. This recommendation is designed to ensure adequate fulfillment of protein needs that increase due to tissue growth and development.

### Water

Water is needed by the body to maintain homeostasis and distribute nutrients into cells, and remove metabolic waste. Therefore, water is one of the most important nutrients that must be

fulfilled. Water can come from drinking water, soupy foods, fruits, and vegetables, ice cream, etc. Children need to consume sufficient amounts of water, but it should be considered that the consumption of water or other beverages does not decrease the consumption of calcium-source fluids such as milk, etc.

**Fat**

Up to 3 years of age, fat plays an important role in brain development. Fat makes up about 60% of the central and peripheral nervous system that essentially regulates, controls, and integrates every body system. Therefore, children need adequate fat from their diet. Fat content in the diet is known to be an important element in providing satiety. Snacks or foods that contain low levels of fat will cause children to feel hungry easily and end up consuming snacks that are high in calories but lack essential nutrients. Most children require 30% fat from their total energy intake per day. However, in the case of overweight children, special dietary modifications are required to keep the fat intake at 30% or below to support optimal growth. Keep in mind that not all fats have the same benefits. Recommended fat sources should mostly come from mono and polyunsaturated fats such as fish, nuts, and vegetable oils.

**Carbohydrates**

**Vitamins and Minerals**

1. Calcium

   Calcium is the main mineral involved in bone mineralization. School-aged children have increased calcium requirements to support bone and skeletal growth rates. Several studies have shown that calcium intake of around 800 mg/day is associated with adequate bone mineralization in school-aged children. Other studies also show adequate calcium intake during childhood can prevent osteoporosis in older age.

2. Iron

   Iron can be classified into two types, heme and non-heme. Heme iron comes from

   animal products such as meat, chicken, milk, beef liver, fish, eggs, etc. Non-home iron comes from plants such as fruits, vegetables, nuts, and processed products.

   Iron deficiency anemia is the most common micronutrient deficiency in school-aged children. Risk factors for anemia in school children include low income, lack of access to health care, poor diet quality, and low nutrition education and knowledge. The impact of anemia during the school years is the disruption of neuronal development which leads to decreased concentration and learning achievement.

   In addition to the direct cause of low iron intake, excess calcium intake can also cause iron deficiency anemia. This occurs because calcium and iron absorption are competitive.

## CALCULATION OF ENERGY AND NUTRIENT REQUIREMENTS FOR SCHOOL-AGE CHILDREN

**EER for Boys 3 to 8 Years (Within the 5th to 85th Percentile for BMI)[§]**

EER = TEE[†] Energy deposition

EER = 88.5 − 61.9 × Age (yr) + PA × (26.7 × Weight [kg] + 903 × Height [m]) + 20 (kcal for energy deposition)

**EER for Boys 9 to 18 Years (Within the 5th to 85th Percentile for BMI)**

EER = TEE Energy deposition

EER = 88.5 − 61.9 × Age (yr) + PA × (26.7 × Weight [kg] + 903 × Height [m]) + 25 (kcal for energy deposition)

in which

PA = Physical activity coefficient for boys 3-18 years:

PA = 1 if PAL is estimated to be ≥ 1 < 1.4 (Sedentary)

PA = 1.13 if PAL is estimated to be ≥ 1.4 < 1.6 (Low active)

PA = 1.26 if PAL is estimated to be ≥ 1.6 < 1.9 (Active)

PA = 1.42 if PAL is estimated to be ≥ 1.9 < 2.5 (Very active)

**EER for Girls 3 to 8 Years (Within the 5th to 85th Percentile for BMI)**

EER = TEE Energy deposition

EER = 135.3 − 30.8 × Age (yr) + PA × (10 × Weight [kg] + 934 × Height [m]) + 20 (kcal for energy deposition)

**EER for Girls 9 to 18 Years (Within the 5th to 85th Percentile for BMI)**

EER = TEE + Energy deposition

EER = 135.3 − 30.8 × Age (yr) + PA × (10 × Weight [kg] + 934 × Height [m]) + 25 (kcal for energy deposition)

in which

PA = Physical activity coefficient for girls 3-18 years:

PA = 1 (Sedentary)

PA = 1.16 (Low active)

PA = 1.31 (Active)

PA = 1.56 (Very active)

## NUTRITION PROBLEMS IN SCHOOL-AGE CHILDREN

1. **Snacking**

   Snacking is an important source of energy for children. Toddlers and children generally have a smaller stomach size than adults so children cannot consume as much food as adults. Snacks consumed by children tend to be high in energy from fat and sugar. The high consumption of snacks causes children to skip main meals, so the quality of nutrients that enter also tends to be low.

   It is important to choose snacks that are rich in nutrients, both macro and micro, to ensure that children consume adequate amounts of nutrients. Nutritious snacks can be made with fruit or vegetables. In addition, the time of snacking also needs to be considered. Giving snacks while children are watching TV can reduce children's

concentration on food so that satiety will come more slowly. If left unchecked, this can lead to obesity in children.

2. **Breakfast**

   The early morning school start time, as well as the long and time-consuming distance from home to school, are often reasons for school-age children to skip breakfast. Breakfast is an important and beneficial habit that needs to be practiced, especially for school-age children. Several studies have shown that children who regularly consume breakfast have good concentration and learning achievement. Children who do not consume breakfast have the potential to increase BMI and the risk of obesity (Cho *et al.*, 2003).

   A good breakfast contains nutritionally complete foods, such as fruits, vegetables, cereals, animal-source proteins, and plant-source proteins.

3. **Influence of Television and Media**

   Most children spend more time a day watching television than interacting with their parents. Many food advertisements on television target children as consumers. Therefore, television advertisements are likely to influence the food choices of school-age children.

   Restriction of television viewing time, especially at mealtimes, is necessary, as studies have shown a positive correlation between television viewing time and obesity in school-age children.

## PREPARING A BALANCED MENU FOR SCHOOL-AGE CHILDREN

In planning meals for school-age children, in addition to nutrient content, the taste and appearance of the dishes need to be considered. Children tend to dislike vegetables and fruits, even though a lack of vegetables and fruits can cause micronutrient deficiencies such as vitamins A and C, and fiber. In addition, low fruit and vegetable consumption is also associated with high fat intake.

### Healthy Eating Key Message for School Children

The Ministry of Health in 2014 has published Eight (8) Healthy Eating Key Message for School Children, which consists of the following messages:

1. Get used to eating a variety of foods
2. Get used to eating 3x a day (morning, noon, night) with family
3. Get used to eating fish and other protein sources
4. Eat plenty of green vegetables and colorful fruits
5. Make it a habit to bring food and water from home
6. Limit consumption of fast food and sweet, salty, and fatty snacks

7. Get into the habit of brushing your teeth 2x a day after breakfast and before bedtime activities
8. Avoid smoking

## HEALTHY DIET FOR ADULT

### Definition and *Stages*

Adulthood is a period of life defined as a person older than 19 years unless national laws define a person as an adult at an earlier age (WHO). Other sources define adulthood as someone between the ages of 20 and 64 (Brown, 2011). Hurlock (1990) defines early adulthood as beginning at age 18 until approximately age 40 when physical and psychological changes accompany the reduction of reproductive abilities. The adult period is divided into 3 (three) periods, namely:

a. *Early* adulthood/Young *adulthood* : 18 - 25 years; 26 - 40 years
b. Midlife/Middle *adulthood* : 40 - 60 years
c. *Old age* / Late adulthood : >60 years old

### Adult lifestyle changes

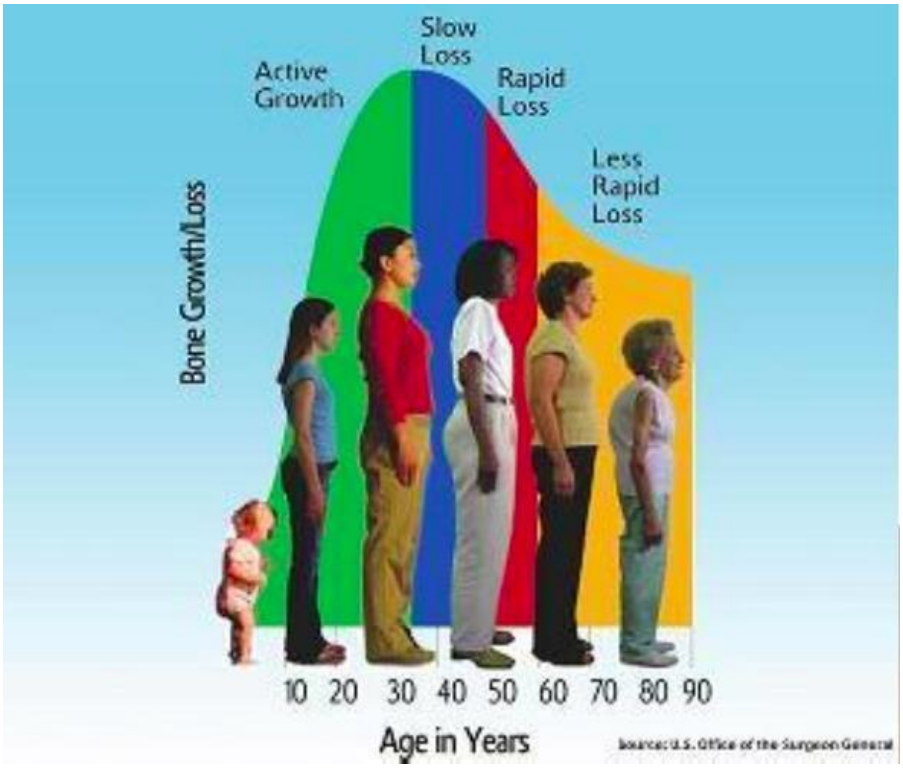
With the onset of adulthood, some lifestyle changes will occur and also have a direct effect on your food intake. Lifestyle changes can also be noticed at each stage of adulthood. The following is a description of the lifestyle changes that occur in adulthood:

- 20s: In their 20s, adults start to plan, buy and prepare their meals. This means that during this period, people start to independently choose the food they consume. For example, in the 20s, a person starts to enter the world of college/work which requires them to live separately from their parents. Therefore, this period of your 20s is very important to establish a healthy diet.
- 30s: At this age, a person will have increased responsibilities to and for others; for example, starting a household makes it possible to change diet. In the 30s, it is also common to have a renewed interest in nutrition and more *awareness* about nutrition and health.
- 40s: In the 40s, adults focus on their career and starts to schedule meals around work. Some adults have the habit of *skipping meals* which can disrupt one's diet.
- 50s: In the 50s, several diseases start to appear, so the *awareness of* maintaining a diet and limiting certain foods also arise.
- 60s: A period of transition into retirement, one will have more free time, and be able to pay greater attention to physical activity and nutrition.

### Physiological Changes in Adulthood

Some of the physiological changes that occur in adulthood include:

- ✓ Body composition → Decreased *lean body mass* and increased body fat mass
- ✓ Metabolic rate and Energy expenditure →Decline in early adulthood by 2% every decade; energy requirements also decline
- ✓ Physical activity capacity →Declines gradually from the age of 25 - 65 years characterized by a decrease in VO2 max of 5 - 10% per decade
- ✓ Decreased function of the five senses (sensory, hearing, vision) →Decreased appetite and intake
- ✓ Hormonal changes →Menopause in late adulthood, decreased levels of estrogen in female adults and testosterone in male adults
- ✓ Bone mass →After the age of 30, the body will slowly begin to experience a decline in bone mass. In female adults, the decline in bone mass will become more rapid after menopause.




**Estimated Energy Needs of Adults**

The implementation of a healthy diet in the adult group is very important to maintain normal nutritional status, especially when physiological changes have occurred. An energy balance (when the energy intake from food is equal to the energy used) is achieved by implementing a healthy diet. If there is a negative energy balance, a person will become *underweight*; conversely, if there is a positive energy balance, a person will become overweight/obese. To

avoid a negative/positive energy balance, adult energy needs can be estimated using several calculations by considering the following:

1. Basal Metabolic Rate (BMR)

   Energy is needed for organ work (brain, liver, digestive tract, heart, kidneys) and active metabolism and to maintain normal body temperature
2. Thermic Effect of Food (TEF)

   The energy required for digestion and absorption of nutrients
3. Physical Activity

In addition to the 3 main factors in estimating energy demand above, several other factors affect energy demand, namely:

- Age : As the age of adulthood increases, the *trend of* energy requirements will decrease
- Gender : Males have greater requirements related to high muscle mass and physical activity; except during pregnancy when adult females require additional energy.
- Nutritional status : In conditions of underweight and obese nutritional status, energy requirements must be adjusted accordingly. Energy additions and subtractions are required to match the nutritional status.
- Comorbidities: The presence of comorbidities causes differences in energy requirements in the adult group, so it is necessary to consider the accompanying disease factors.

<u>Formula 1: Harris-Benedict</u>

Men: BMR = 66 + (13.7 x wt in kg) + (5 x ht in cm) - (6.8 x age in years)

Women: BMR = 655 + (9.6 x wt in kg) + (1.8 x ht in cm) - (4.7 x age in years)

Energy Requirement = BMR x Physical Activity Factor (x Stress Factor, if comorbidities are present)

Activity Factor:

- Sedentary = BMR x 1.2 (little or no exercise, desk job)
- Lightly active = BMR x 1.375 (light exercise/sports 1-3 days/week)
- Moderately active = BMR x 1.55 (moderate exercise/sports 6-7 days/week)
- Very active = BMR x 1.725 (hard exercise every day, or exercising 2 xs/day)

- Extra active = BMR x 1.9 (hard exercise 2 or more times per day, or training for a marathon, or triathlon, etc.)

Formula 2: Mifflin-St. Jeor Energy Estimation Formula

REE for females: $10\,W + 6.25\,H - 5\,A - 161$

REE for males: $10\,W + 6.25\,H - 5\,A + 5$

[W, weight in kg; H, height in cm; A, age in years]

Energy Requirement = REE x Physical Activity Level (PAL) Physical activity level:

- 1.2 sedentary
- 1.55 moderately active
- 1.725 very active

Formula 3: FAO/WHO Basal Energy Estimation Equation

| | Age | Equation (height in m, weight in kg) |
|---|---|---|
| Men | 18–30 years | kcal/day = (15.3 × weight) + 679 |
| | 30–60 years | kcal/day = (11.6 × weight) + 879 |
| | >60 years | kcal/day = (8.8 × weight) + (1128 × height) − 1071 |
| Women | 18–30 years | kcal/day = (14.7 × weight) + 496 |
| | 30–60 years | kcal/day = (8.7 × weight) + 829 |
| | >60 years | kcal/day = (9.2 × weight) + (637 × height) − 302 |

The FAO/WHO formula divides the calculation of estimated energy requirements by age group and without multiplying by the physical activity factor.

Formula 4: Schofield Equation (1985)

| Age | Men | Women |
|---|---|---|
| 18–29 years | 15.1 × weight (kg) + 692 | 14.8 × weight (kg) + 487 |
| 30–59 years | 11.5 × weight (kg) + 873 | 8.3 × weight (kg) + 846 |
| 60+ years | 11.9 × weight (kg) + 700 | 9.2 × weight (kg) + 687 |

Similar to the FAO/WHO formula, the Schofield formula also differentiates by age and gender without multiplying by the physical activity factor.

Formula 5: IOM (2005)

| Model persamaan | Kecukupan Energi (Kal) |
|---|---|
| **Laki laki 19-55 dengan status gizi normal**<br>TEE = 662 – (9.53xU) + PA x (15.91xBB+ 539.6xTB)<br>Keterangan :<br>PA = 1.0 (sangat ringan) PA = 1.25 (aktif)<br>PA = 1.11 (ringan) PA = 1.48 (sangat aktif) | TEE + 0.1TEE |
| **Perempuan 19-55 tahun dengan status gizi normal**<br>TEE = 354 – (6.91xU) + PA x (9.36xBB+726xTB)<br>Keterangan :<br>PA = 1.0 (sangat ringan) PA = 1.27 (aktif)<br>PA = 1.12 (ringan) PA = 1.45 (sangat aktif) | TEE + 0.1TEE |

Keterangan :
U = Umur (tahun), BB = Berat badan (kg), TB = Tinggi badan (m)
TEE = *Total Energy Expenditure* - total pengeluaran energi, (Kal)
PA = koefisien aktivitas fisik

Formula 6: Henry/Oxford Equation (2005)

**Henry Oxford Equations**
**Basal metabolic rate BMR**

**W = Dry weight always used**

| Gender | Age | Kcal /day |
|---|---|---|
| Males | 18-30 | 16.0W + 545 |
| | 30-60 | 14.2W +593 |
| | 60-70 | 13.0W +567 |
| | 70+ | 13.7W +481 |
| Females | 18-30 | 13.1W +558 |
| | 30-60 | 9.74W +694 |
| | 60-70 | 10.2W +572 |
| | 70+ | 10.0W +57 |

The Henry/Oxford energy requirement calculation uses dry body weight and multiplies BMR by physical activity. The table below shows the activity factor multiplier for the Henry/Oxford formula

| Activity level | Description | Men | Women |
|---|---|---|---|
| **Inactive** | Assume sitting most of the day with less than 2 hours on their feet. | **1.4** | **1.4** |
| **Light** | Assume some daily exercise – at work or tasks about the house or garden – with at least 2 hours on their feet. | **1.5** | **1.5** |
| **Moderate** | Assume 6 hours on their feet or regular strenuous exercise. | **1.78** | **1.64** |
| **Heavy** | Those in heavy labouring jobs or serious athletes in training. | **2.1** | **1.82** |

In calculating energy requirements for overweight/obese individuals, ideal body weight (IBW) or *adjusted* body weight (ABW) can be used to estimate intake. IBW and ABW can be calculated using the following formula:

**The Brocca Index:**

**Men**: Ideal Body Weight (kg) = [Height (cm) - 100] - ([Height (cm) - 100] x 10%)

**Women**: Ideal Body Weight (kg) = [Height (cm) - 100] + ([Height (cm) - 100] x 15%)

ABW = IBW + [(actual weight - IBW) x 25%]

The calculation of estimated energy needs can use any of the six formulas above; especially when considering needs at the individual level. At the population level, energy requirements can be determined by looking at the 2013 nutrient adequacy guidelines (AKG: Angka Kecukupan Gizi). The following is a table of AKG (or RDAs) for the adult age group:

| Kelompok umur | BB* (kg) | TB* (cm) | Energi (kkal) | Protein (g) | Lemak (g) | | | Karbohidrat (g) | Serat (g) | Air (mL) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Total | n-6 | n-3 | | | |
| 19-29 tahun | 60 | 168 | 2725 | 62 | 91 | 17,0 | 1,6 | 375 | 38 | 2500 |
| 30-49 tahun | 62 | 168 | 2625 | 65 | 73 | 17.0 | 1.6 | 394 | 38 | 2600 |
| 50-64 tahun | 62 | 168 | 2325 | 65 | 65 | 14,0 | 1,6 | 349 | 33 | 2600 |
| Perempuan | | | | | | | | | | |
| 19-29 tahun | 54 | 159 | 2250 | 56 | 75 | 12,0 | 1,1 | 309 | 32 | 2300 |
| 30-49 tahun | 55 | 159 | 2150 | 57 | 60 | 12,0 | 1,1 | 323 | 30 | 2300 |
| 50-64 tahun | 55 | 159 | 1900 | 57 | 53 | 11,0 | 1,1 | 285 | 28 | 2300 |

**Recommended range of macronutrient energy distribution (AMDR)**

After calculating the energy needs, the energy must be distributed in the form of macronutrients, namely carbohydrates, proteins, and fats. The table below is the recommended Pamdr for the adult age group:

| Macronutrients | Percent of total Energy |
|---|---|
| Protein | 15 (10 - 30)* |
| Fat | 25 (20 - 30) |
| Carbohydrates | 60 (45 - 65) |

*) in parentheses is the recommended range in the United States (IOM, 2005 in Hardinsyah, 2012).

**Other Nutrition Recommendations**

Other nutrients that need attention because their intake is still low or too high, some of these nutrients include:

- ✓ Fiber: Fiber plays an important role in the digestive process so its consumption must be fulfilled by + 38 gr for men and 25 gr for female adults or can also be calculated as 14 gr / 1000 kcal. Fiber intake in Indonesian adults is still very low, so it must be met by consuming at least 5 servings of vegetables per day.
- ✓ Vitamin A: Important for the growth and development of epithelial cells and the activity of immune cells. Sources: vit. Enriched milk and cheddar cheese; sweet potato, carrot, pumpkin, melon, broccoli, apricot, spinach, etc.
- ✓ Vitamin D: To increase calcium absorption to maintain bone density. Adequate intake of 5 micrograms/day
- ✓ Calcium: Maintains bone density and delays osteoporosis/bone fractures. Adults can meet calcium needs by adding a 240 ml glass of calcium-fortified milk/yogurt, or orange juice daily. Other good sources are calcium-fortified soy drinks, tofu, and salmon.
- ✓ Choline: Choline plays a role in lipid transportation, and along with folate and vitamin B12 is involved in converting homocysteine to methionine to prevent degenerative diseases. The requirement is 425 mg for adult females and 550 mg for adult males. Food sources of choline include liver, eggs, beef, brussels sprouts and broccoli, shrimp and salmon, milk, and peanuts.

- ✓ Potassium: Functions in electrolyte balance and muscle contraction. The requirement is 4700 mg/day; potassium-rich diets tend to reduce blood pressure. Good plant-based sources of potassium include dried apricots and raisins, wheat bran and wheat germ, potatoes, bananas, and orange juice.
- ✓ Sodium: High sodium intake may increase the risk of developing hypertension in early adulthood. Therefore, daily intake is limited to 2300 mg of sodium/day. A recommendation of 1500 mg/day is also suggested as a preventive measure. One gram of salt contains ± 400 mg of sodium
- ✓ Water: Water needs in adults are recommended at 3.7 liters for male adults and 2.7 liters for female adults; with a note that consumption of sweet drinks is limited to a maximum of 15% of total energy a day.
- ✓ Caffeine: Consumption of food/beverage sources of caffeine is limited to a maximum of 400 mg/day.

**Daily Diet**

In one day, food intake can be divided into 3x meals and 3x snacks to keep blood sugar normal and not fluctuating. For example, for an adult with a requirement of 2100 calories, the meal division is as follows:


**Physical Activity Recommendations for Adults**

The latest data from Basic health research (2013) shows that sedentary behavior (3-5.9 hours) of the Indonesian population >10 years old is 42% and 26.1% are inactive. Low physical

activity is associated with overweight/obesity and increases the risk of early onset of degenerative diseases. Therefore, physical activity for adults is recommended as follows:

- ✓ Basic recommendations: 2 hours and 30 minutes a week (150 minutes) of moderate intensity, or 1 hour and 15 minutes a week (75 minutes) of high-intensity aerobic physical activity, or an equivalent combination. Aerobic activity should be done in episodes of at least 10 minutes, preferably spread throughout the week.
- ✓ For additional health benefits: increase to 5 hours (300 minutes) a week of moderate-intensity aerobic physical activity or 2 hours and 30 minutes (150 minutes) of high-intensity physical activity.
- ✓ Adults should also engage in muscle-strengthening activities that involve all major muscle groups, performed on 2 or more days per week.

# HEALTHY DIET FOR THE ELDERLY

## Definition of Elderly

- Elderly = aging, becoming old
- Elderly is the process of gradual loss of the ability of tissues to repair themselves and maintain their normal structure and function so that they cannot defend against injury (including infection) and repair damage sustained.
- In general: if you are over 65 years old
- Epidemiologically: 65-74 years old, 75-84 years old, >85 years old (85 years old is usually called *Octogenaria*)
- According to WHO:
  - Elderly (elderly) 60-75 years
  - Old > 75-95 years
  - Very old > 90 years

## General Condition of the Elderly

- The elderly are included in the nutritionally vulnerable group, even though it has nothing to do with body growth, on the contrary, evolution and degeneration of tissues and cells have occurred.
- Although there is a natural decline in the function of various organs, it does not have to cause disease, therefore the elderly must be healthy. Healthy in this case means:
  1. Free from physical, mental, and social illness
  2. Able to perform activities to fulfill daily needs
  3. Receive social support from family and community (Rahardjo, 1996)

<u>Physical Changes</u>

Includes changes from the cellular level to all organ systems, including the system:

- Cell structure
- Breathing
- Hearing
- Vision
- Cardiovascular
- Respiration System
- Gastrointestinal
- Reproduction

- The urinary system
- Endocrine
- Musculoskeletal

Mental Changes

- Factors affecting mental change.
  a. Physical changes, especially in the sensory organs.
  b. General health
  c. Education level
  d. Heredity
  e. Environment
- *Memory.*
  a. Long-term memories: Hours to days ago.
  b. Short-term or immediate memories: 0-10 minutes, bad memories.
- IQ *(Intelligence Quotient).*
  a. It does not change with mathematical information and verbal words.
  b. Decreased performance, perception, and psychomotor skills, changes in imagery due to time pressure.

Psychological Changes

In dealing with these changes, adjustment is needed. Characteristics of poor adjustment of the elderly (Hurlock, 1979) cited by Munandar (1994) are:

1) Narrow interest in events in the neighborhood
2) Withdrawal into a fantasy world
3) Always remembering the past
4) Always worried because of unemployment
5) Lack of motivation
6) A sense of loneliness due to poor family relationships
7) Unwanted residence

Psychosocial Changes

a. Retirement: a person's value is often measured by their productivity and identity is linked to their role at work. When a person retires, he or she will experience losses, such as:
   - Financial loss (reduced income).

- Loss of status (used to have a fairly high position, complete with all the facilities).
  - Losing friends/acquaintances or relationships.
  - Loss of employment/activity.

b. *Sense of awareness of mortality*

c. Changes in the way of life, i.e. entering a care home, moving more narrowly.

d. *Economic deprivation* due to dismissal from office.

e. Increased cost of living on a hard income, increased medical expenses.

f. Chronic illness and disability.

g. Sensory nerve disorders, resulting in blindness and deafness.

h. Nutritional disorders due to loss of position.

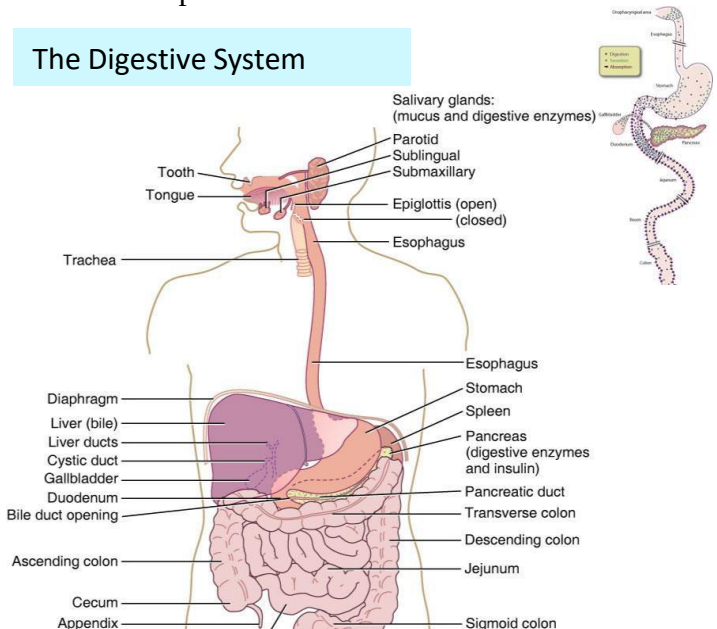
<u>Spiritual Change</u>

- Religion or belief is increasingly integrated into his life (Maslow, 1970)
- The elderly are more mature in their religious life, this can be seen in their thinking and actions in everyday life (Murray and Zentner, 1970).
- Spiritual development at the age of 70 according to Folwer (1978), is achieved at this level by thinking and acting in a way that sets an example of how to love justice.

**Nutrition-Related Gastrointestinal Changes**

- Tooth loss due to Periodontal disease, poor dental health, and poor nutrition.
- Decreased sense of taste, loss of sensitivity of the taste buds on the tongue to sweet, salty, sour, and bitter flavors.
- Dilated esophagus.
- Decreased hunger and stomach acid production.
- Peristalsis is weak and constipation is usually present.
- Absorption function is weakened.

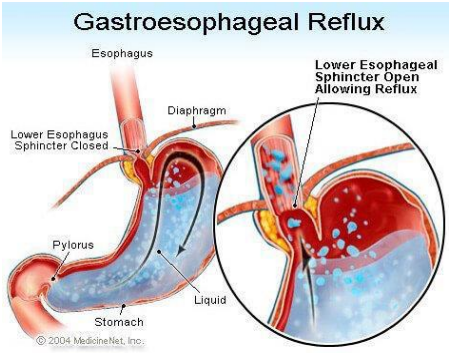
The Digestive System




**Secretions from gall bladder and pancreas aid in**

- Mechanism for nourishing the body
- Most nutrients in food require either degradation or release prior to absorption
- Includes GI tract (~16 feet) and accessory organs
- Digestion
  - Mechanical➔ chewing and peristalsis
  - Chemical ➔ enzymes, HCl

Diseases that often occur in the gastrointestinal tract of the elderly include gastritis and peptic ulcers, with symptoms that are usually nonspecific, weight loss, nausea, and stomach discomfort.
However, complaints such as bloating, and abdominal discomfort are often due to the inability to digest food due to decreased function of the digestive glands. Constipation/lack of appetite is also common.




Oral and Dental Diseases of the Elderly


As a result of oral and dental problems in the elderly, the appetite in the elderly often decreases. As a result, many elderly people experience malnutrition.

Endocrine Disorder Disease

- Some hormones are produced in large amounts in the time of stress. These hormones play an important role in the stress response. Therefore, hormone production in the elderly is declining, which makes them less able to deal with stress.
- Declining thyroid hormones also cause the elderly to appear lethargic and lackluster. The deterioration of other endocrine gland functions such as menopause in women, while in men there is a decrease in testicular gland secretion. Metabolic diseases that are commonly found are diabetes mellitus and osteoporosis.

Bone Joint Disease

- This joint disease is due to degeneration or damage to the surface of the joints of the bones, which is commonly found in the elderly. Elderly people often complain of sciatica, aches, and sometimes pain. Usually affected are the joints of the fingers, spine, knee, and hip joints. Disorders of uric acid metabolism in the body (gout) cause acute pain.
- The occurrence of osteoporosis causes elderly bones to break easily. Usually, fractures occur because the elderly fall, due to reduced muscle strength, decreased coordination of limbs, sudden dizziness, poor vision, and can be due to poor light and slippery floors.

**Factors Affecting Nutritional Needs in the Elderly**

- Reduced ability to digest food due to tooth decay or toothlessness.
- Reduced sense of taste results in a decrease in sweet, salty, sour, and bitter flavors.
- The esophagus is dilated.
- Decreased hunger and stomach acid production.
- Bowel movements or peristalsis are weak and usually lead to constipation.
- Food absorption in the intestines decreases.

***Angka Kecukupan Gizi* (AKG) 2013**

The nutritional needs of the elderly can be seen in the following table:

| Kelompok umur | BB* (kg) | TB* (cm) | Energi (kkal) | Protein (g) | Lemak (g) | | | Karbohidrat (g) | Serat (g) | Air (mL) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Total | n-6 | n-3 | | | |
| 50-64 tahun | 62 | 168 | 2325 | 65 | 65 | 14,0 | 1,6 | 349 | 33 | 2600 |
| 65-80 tahun | 60 | 168 | 1900 | 62 | 53 | 14,0 | 1,6 | 309 | 27 | 1900 |
| 80+ tahun | 58 | 168 | 1525 | 60 | 42 | 14,0 | 1,6 | 248 | 22 | 1600 |
| Perempuan | | | | | | | | | | |
| 50-64 tahun | 55 | 159 | 1900 | 57 | 53 | 11,0 | 1,1 | 285 | 28 | 2300 |
| 65-80 tahun | 54 | 159 | 1550 | 56 | 43 | 11,0 | 1,1 | 252 | 22 | 1600 |
| 80+ tahun | 53 | 159 | 1425 | 55 | 40 | 11,0 | 1,1 | 232 | 20 | 1500 |

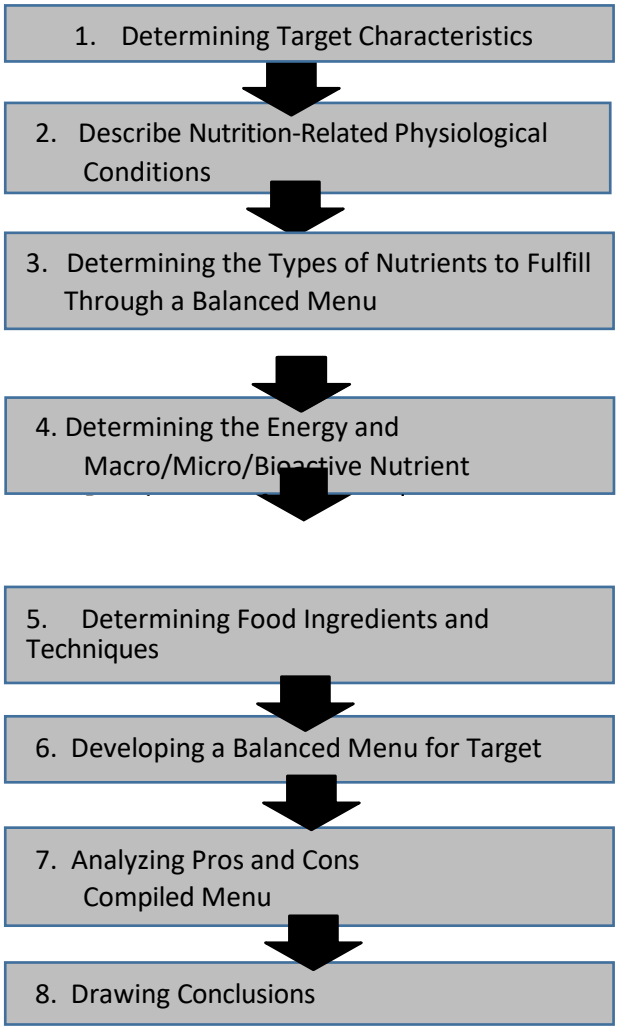
Apart from the AKG (2013), the estimated energy needs for the elderly can also be calculated based on Henry's formula (2005):

Tabel 4 Rumus perhitungan kecukupan energi usia lanjut >=65 tahun

| Model persamaan | Kecukupan Energi (Kal) |
|---|---|
| **Laki laki usia lanjut**<br>EB = (11.4xBB) + (541xTB) – 256<br>Keterangan :<br>PA = 1.0 (sangat ringan)<br>PA = 1.11 (ringan)<br>PA = 1.25 (aktif) | (EB x PA)+(0.1xTEE) |
| **Perempuan usia lanjut**<br>EB = (8.52xBB) + (421xTB) +10.7<br>Keterangan :<br>PA = 1.0 (sangat ringan)<br>PA = 1.12 (ringan)<br>PA = 1.27 (aktif) | (EB x PA)+(0.1xTEE) |

Sumber : Henry (2005)
Keterangan :
EB = Energi Basal
PA = Koefisien aktivitas fisik

**Healthy Dietetics Practicum Planning Workflow**
**For 1000 HPK Group**



**Work Instruction for Balanced Menu Preparation**

## 1. Goal Setting for Balanced Menu Development

| | |
|---|---|
| Name | |
| Age | Year Month |
| Job/Activity | |
| Gender | Male/Female*) |
| Pregnancy Condition | Pregnant/Not Pregnant*) |
| Nutrition-related Physiological Conditions | (e.g. chewing difficulties in infants and the elderly, nausea and vomiting in pregnant women, etc.) |
| Economic Conditions | |
| Environmental Conditions | Rural/Urban*) |
| Allergy History | |
| Body Weight | Kg |
| Height | Cm |
| Anthropometric Analysis | |

Notes: *)cross out the unnecessary

## 2. Describe the physiological condition of the target

a. General Physiological Condition

_____
_____
_____
_____
_____

_____
_____
_____

b. Specific Physiological Conditions to be Intervened through Dietary Menu Arrangement

_____
_____
_____
_____
_____
_____
_____
_____

3. **Determining the type of nutrients to fulfill through a balanced menu**

(At least 1 Macronutrient and 2 Micronutrients/Bioactive)

**a. Types of Macronutrients: .....**

- The role of nutrients in supporting target physiological conditions

_____
_____
_____
_____
_____
_____
_____
_____

– Characteristics of nutrients

_____
_____
_____
_____
_____
_____
_____

- Sources of nutrients in foods

_____
_____
_____

_____
_____
_____
_____

**b. Types of Micro/Bioactive Nutrients 1: .....**

- The role of nutrients in supporting target physiological conditions

_____
_____
_____
_____
_____
_____
_____
_____

- Characteristics of nutrients

_____
_____
_____
_____
_____
_____
_____

- Sources of nutrients in foods

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

**c. Types of Micro/Bioactive Nutrients 1: .....**

- The role of nutrients in supporting target physiological conditions

_____

_____
_____
_____
_____
_____
_____
_____

- Characteristics of nutrients

_____
_____
_____
_____
_____
_____
_____

- Sources of nutrients in foods

_____
_____
_____
_____
_____
_____
_____

## 4. Determining Energy and Macro/Micro/Bioactive Nutrient Requirements for Target

| | |
|---|---|
| Energy | |
| Protein | |
| Fat | |
| Carbohydrates | |

| | |
|---|---|
| Vitamin/Mineral/Bioactive | |
| Vitamin/Mineral/Bioactive | |
| Vitamin/Mineral/Bioactive | |

5. **Determine the food ingredients and processing techniques to be used**

| Ingredients | Nutritional Value | Cooking Techniques |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

6. **Developing a Balanced Menu for Target**
   **URT: Ukuran Rumah Tangga/Household Measurements**

| Name of Menu | Ingredients | Weight | | E | P | F | CH | Micro 1 | Micro 2 |
|---|---|---|---|---|---|---|---|---|---|
| | | URT | Gram | | | | | | |
| **Type of Food : (Meal/Snack) Meal Time: (Breakfast/Lunch/Dinner) Time :** | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| **% Subtotal Fulfillment** | | | | | | | | | |
| **Type of Food : (Meal/Snack) Meal Time: (Breakfast/Lunch/Dinner) Time :** | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| **% Subtotal Fulfillment** | | | | | | | | | |
| **Type of Food : (Meal/Snack) Meal Time: (Breakfast/Lunch/Dinner) Time :** | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| **% Subtotal Fulfillment** | | | | | | | | | |
| **Type of Food : (Meal/Snack) Meal Time: (Breakfast/Lunch/Dinner) Time :** | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **%Fulfillment** | | | | | | | | | |
| **Type of Food : (Meal/Snack) Meal Time: (Breakfast/Lunch/Dinner)** | | | | | | | | **Time :** | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| **% Subtotal Fulfillment** | | | | | | | | | |
| **Total** | | | | | | | | | |
| **Requirement** | | | | | | | | | |
| **%Fulfillment** | | | | | | | | | |

**7. Analyzing the Advantages and Disadvantages of the Compiled Menu**

(The advantages/disadvantages of the menu can be seen in terms of energy and nutrient content, economic value of the menu, processing methods/types of dishes, ingredients, etc.)

**a. Menu Advantages**

_____
_____
_____
_____
_____
_____
_____

**b. Menu Disadvantages and Improvement Solution**

| Disadvantages | Solution |
|---|---|
| | |
| | |

| | |
|---|---|
| | |
| | |
| | |

8. **Conclusions**

_____
_____
_____
_____
_____
_____
_____

**Attachment**

1. **Recipe and Portion Standards**
2. **Ingredients Shopping List**
3. **Tool Requirements**
4. **Practicum Work Distribution**

**PRACTICUM PLANNING LAYOUT**

PRACTICE OF HEALTHY DIET PLANNING

UNAIR LOGO

Group 7

NAME NIM

...

...

...

...

UNIVERSITAS AIRLANGGA
UNDERGRADUATE NUTRITION PROGRAM
FACULTY OF PUBLIC HEALTH
2017

* COVER PRINTED ON YELLOW
COLOR HVS PAPER
SHOULD NOT BE BOUND

**ASSESSMENT SHEET**

**GROUP .....**

**DISH'S NAME**

1. **.....**
2. **.....**
3. **.....**

| **Assessment Aspect 1-10** | **Score** | **Assessment Aspect 1-100** | **Score** |
|---|---|---|---|
| Discipline | | Accuracy of energy and nutrient requirements calculation | |
| Personal Hygiene | | Accuracy of ingredients selection | |
| Workplace Sanitation & Hygiene | | Accuracy of portion size | |
| Teamwork | | Menu variations | |
| Appearance | | Menu innovation | |
| Taste | | | |
| Texture | | | |
| Color | | | |
| Total Score | | | |

**Assessment Lecturer**

:.....

**A.** STUDY CASE

**Personal data**

Name : Mrs. Fitri

Age : 30 years old
Occupation : Housewife
Status : First 6 months of breastfeeding

**Anthropometric Data**

Weight : 55 kg

Height : 159 cm

**B. DIAGNOSIS**

**C. INTERVENTIONS**

**Dietary Objectives**
**Dietary Requirements**

**D. CALCULATION OF REQUIREMENTS**

***Example: calculation of daily needs and menu division**

**1. Daily needs**

Requirement based on AKG 2013,

Energy : 2150 kcal + 330 kcal = 2480 kcal
Protein : 57 grams + 20 grams = 77 grams
Fat : 60 grams + 11 grams = 71 grams
Carbohydrates : 323 grams + 45 grams = 368 grams

**2. Menu Distribution**

- Breakfast= 20% x Energy =..... kcal
- Snack I = 10% x Energy =..kcal
- Lunch = 25% x Energy =..... kcal
- Snack II = 10% x Energy = kcal

Menu distribution adjusted to the calculations of each group that have been collected for the assignment.

- Dinner = 25% x Energy =.....kcal
- Snack III = 10% x Energy = kcal

3. Morning Menu

Carbohydrate= 60% x energy

=……..kcal: 4

=…… gram

Protein= 15% x energy

=……kcal: 4

=.... ……gram

Fat= 25% x energy

=…….kcal: 9

=.... …….gram

## E. MENU

### □□DAILY MENU

| Menu | Ingredients | Total (g) | E (kcal) | P (g) | F (g) | CH (g) | Micronutrient* | Micronutrient* | Micronutrient* |
|---|---|---|---|---|---|---|---|---|---|
| Breakfast | | | | | | | | | |
| Rice | White rice | 150 | 195 | 3,6 | 0,3 | 42,9 | | | |
| Stir-Fry Vegetables | Chicken | 50 | 98,4 | 18,5 | 2,1 | 0 | | | |
| | Know | 50 | 38 | 4,1 | 2,4 | 0,9 | | | |
| | Carrots | 50 | 12,9 | 0,5 | 0,1 | 2,4 | | | |
| | Choy sum | 25 | 4,5 | 0,7 | 0,1 | 0,6 | | | |
| | Napa cabbage | 25 | 4,5 | 0,7 | 0,1 | 0,6 | | | |
| | Oil | 10 | 86,2 | 0 | 10 | 0 | | | |
| Subtotal | | | | | | | | | |
| Banana pudding | cornstarch | 3 | 11,4 | 0 | 0 | 2,7 | | | |
| | Bananas | 100 | 92 | 1 | 0,5 | 23,4 | | | |
| Subtotal | | | | | | | | | |
| Lunch | | | | | | | | | |
| Etc..... | | | | | | | | | |
| Subtotal | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| Total | | | 543 | 29 | 15,5 | 73,6 | | | |
| Needs | | | | | | | | | |
| Percentage of fulfillment | | | 25% | 35% | 25% | 22% | | | |

### □□BREAKFAST MENU *menu to be practiced

| Menu | Ingredients | Quantity (g) | E (kcal) | P (g) | F (g) | CH (g) | Micronutrients* (mg) | Micronutrients* | Micronutrients* |
|---|---|---|---|---|---|---|---|---|---|
| Breakfast | | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Rice | White rice | 150 | 195 | 3,6 | 0,3 | 42,9 | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Stir-Fry Vegetables | Chicken | 50 | 98,4 | 18,5 | 2,1 | 0 | | | |
| | Tofu | 50 | 38 | 4,1 | 2,4 | 0,9 | | | |
| | Carrot | 50 | 12,9 | 0,5 | 0,1 | 2,4 | | | |
| | Choy sum | 25 | 4,5 | 0,7 | 0,1 | 0,6 | | | |
| | Napa cabbage | 25 | 4,5 | 0,7 | 0,1 | 0,6 | | | |
| | Oil | 10 | 86,2 | 0 | 10 | 0 | | | |
| Subtotal | | | | | | | | | |
| Needs | | | | | | | | | |
| Percentage of fulfillment | | | | | | | | | |

***Micronutrient units are customized**

***Give a table head on each page, so that the table can be read clearly (Repeat Header Rows)**

*** Writing commas until the 2 digits behind the comma only**

***Percentage of fulfillment is**

**= (total of nutrient content/needs) x 100%**

## F. MENU

* EXAMPLE OF RECIPE WRITING

* RECIPE WRITING IS ADJUSTED TO THE SERVING PORTION

**Vegetable stir-fry**

a. Material

1. Chicken 50 grams
2. Tofu 50 grams
3. Carrot 30 grams
4. Choy sum 25 grams
5. Napa cabbages 25 grams
6. Oil 10 grams
7. Shallots 2 cloves
8. Garlic 1 clove

9. Ginger 1 rj

b. How to make

1. Dice the tofu and chicken
2. peel and wash carrots, cut into matchstick-size pieces
3. Cut the choy sum.
4. Heat a wok, pour oil, and stir-fry the chopped herbs.
5. Add the carrots and then the napa cabbages and choy sum.
6. Add salt and sugar to taste.

**Banana Pudding**

**etc..etc..**

## G. NEEDS AND COST PLANNING

*Example of Material Requirements

| No. | Material Name | Net weight (g) | Gross weight (g) | Purchase of materials | Unit Price | Price |
|---|---|---|---|---|---|---|
| | Main ingredients | | | | | |
| 1 | Rice | 75 | 75 | 100 g | IDR 12,000/kg | 900 IDR |
| 2 | Chicken | 50 | 80 | 100 g | IDR 30,000 /kg | 2400 IDR |
| 3 | Tofu | 50 | 50 | 1 pack | Rp 3000/pack | 1000 IDR |
| 4 | Carrots | 50 | 65 | 100 | IDR 10,000/ kg | 650 IDR |
| 5 | Choy sum | Etc... | Etc... | | Dst... / bundle | Etc... |
| 6 | Napa cabbages | Etc... | Etc... | | Etc... / kg | Etc... |
| 7 | Oil | Etc... | Etc... | | Etc... / lt | Etc... |
| 8 | Cornstarch | Etc... | Etc... | | Etc... / ounce | Etc... |
| 9 | Bananas | Etc... | Etc... | | Etc... / piece | Etc... |
| 10 | Shallots | 8 grams | Etc... | | | |
| 11 | Garlic | 4 grams | Etc... | | | |
| 12 | Ginger | 3 grams | Etc... | | | |
| 13 | Salt | | | | | |

## H. TOOL LIST

| NO | TOOL NAME | NEED | SPECIFICATIONS |
|---|---|---|---|
| A. Preparation Tools | | | |
| 1. | Cutting board | 2 | Wood |
| 2. | Basin | 2 | Plastic |
| 3. | Plastic plate | 8 | Plastic |
| 4. | Knife | 3 | Stainless |
| 5. | Tray | 2 | Plastic |
| 6. | Plastic bowl | 2 | Plastic |
| 7. | Wooden spoon | 2 | Wood |
| 8. | Spatula | 2 | Plastic |
| 9. | Etc... | | |
| B. Processing Tools | | | |
| 1. | Stove | 2 fireplaces | Stainless |
| 2. | Pot | 1 | Stainless |
| 3. | Boiler pot | 1 | Stainless |
| 4. | Wok | 1 | Stainless |
| 5. | Pan | 1 | Stainless |
| 6. | Etc. | | |
| C. Serving Tools | | | |
| 1 | Dessert plate | 2 | Ceramics |
| D. Linen | | | |
| 1. | Napkin | 12 | Fabric |
| 3. | Apron | 3 | Fabric |

## E. WORK DISTRIBUTION

*Example of Work Distribution

| No | Person in Charge | Kartika | Anna |
|---|---|---|---|
| | Time | | |
| 1. | 13.15 - 14.15 | Stir-frying vegetable | Cooking bananas pudding |
| 2. | 14.15-14.30 | Presentation | Presentation |
| 3. | 14.30-15.00 | Evaluation | Evaluation |
| 4. | 15.00 - 15.40 | Washing tools | Cleaning leftover materials |

*THIS PAGE DOES NOT NEED TO BE PRINTED NOTES:

- EVERY PRACTICUM, STUDENTS ARE EXPECTED TO BRING PERSONAL EQUIPMENT INCLUDING :

  □□CLEAN CLOTH

  □□TISSUES

  □□KNIFE

  □□SPOON

  □□ LAB COAT

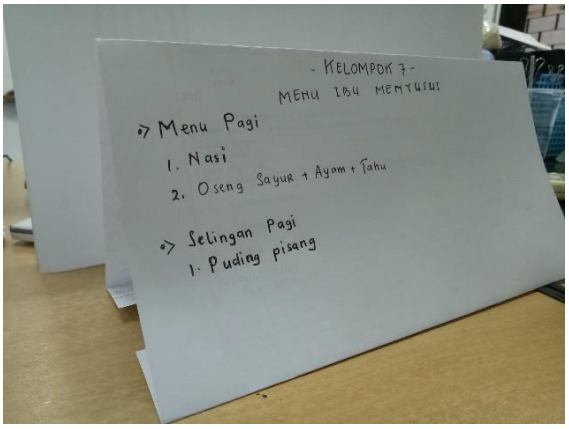
  □□HEAD COVER *FOR NON HIJAB USER

  □□GLOVES

  □□MASK

- DURING THE ASSESSMENT INCLUDE A LIST OF MENUS AND STUDY CASES

  *EXAMPLE




- JEANS ARE PROHIBITED
- ARRIVE ON TIME, TARDINESS WILL RECEIVE A REDUCTION IN GRADES AND OR NOT BEING ALLOWED TO TAKE PART IN PRACTICUM
- TOOL BORROWING IS DONE H-1 PRACTICUM
- ALWAYS KEEP THE PRACTICUM SITE CLEAN