

# PENENTUAN STATUS GIZI SECARA BIOKIMIA

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# Specific Lab Tests

- **Measurement of individual nutrient in body fluids (e.g. serum retinol, serum iron, urinary iodine, vitamin D)**
- **Detection of abnormal amount of metabolites in the urine (e.g. urinary creatinine/hydroxyproline ratio)**
- **Analysis of hair, nails & skin for micro-nutrients.**

# Advantages of Biochemical Method

- It is useful in detecting early changes in body metabolism & nutrition before the appearance of overt clinical signs.
- It is precise, accurate and reproducible.
- Useful to validate data obtained from dietary methods e.g. comparing salt intake with 24-hour urinary excretion.

# Limitations of Biochemical Method

- **Time consuming**
- **Expensive**
- **They cannot be applied on large scale**
- **Needs trained personnel & facilities**

# **PENGGUNAAN PSG BIOKMIA**

- **Dpt menentukan status gizi spesifik**
- **Dpt membuktikan pemeriksaan tk sub klinis**
- **Sebagai pemeriksaan pelengkap**

# PEMERIKSAAN DARAH

## ❖ Sampel Darah: Kapiler atau Vena

### 1. DARAH KAPILER

- Pd ujung jari , Daun Telinga, Tumor (Bayi)
- Sejumlah  $\pm 0,2$  ml – 1 ml
- Dpt langsung dipipet

### 2. DARAH VENA

- Pd Vena Cubiti (lengan)
- Plasma (+ Antikoagulan)
- Serum (tanpa Antikoagulan)

# PEMERIKSAAN URINE

- Langsung atau dg Kateter
- Pd penyimpanan dpt + pengawet (Toluol, Timol)
- Dpt Midstream/tidak
- Media yg baik utk tumbuh kuman

# PEMERIKSAAN FAESES

- Dpt mengetahui gangguan metabolisme zat gizi (KH, Lemak)
- Dpt mengetahui adanya infeksi



# Biochemical Tests

- ◆ Serum albumin level
  - Measures main protein in blood
  - Determines protein status
- ◆ Serum transferrin level
  - Indicates iron-carrying protein in blood
  - ↑ indicates iron stores low
  - ↓ indicates body lacks protein

# Biochemical Tests

- ◆ Blood urea nitrogen (BUN)
  - may indicate renal failure, insufficient renal blood supply, or blockage of the urinary tract
- ◆ Serum creatinine
  - indicates amount of creatinine in blood
  - used to evaluate renal function
- ◆ Creatinine excretion
  - indicates amount of creatinine excreted in urine over a 24-hour period
  - used in estimating body muscle mass
  - muscle mass depleted, as in malnutrition; level will be low

# Biochemical Tests

## ◆ Other tests

- CBC

- ◆ Hemoglobin (Hgb)

- ◆ Hematocrit (Hct)

- ◆ Red blood cells (RBCs)

- ◆ White blood cells (WBCs)

- Lipid profile

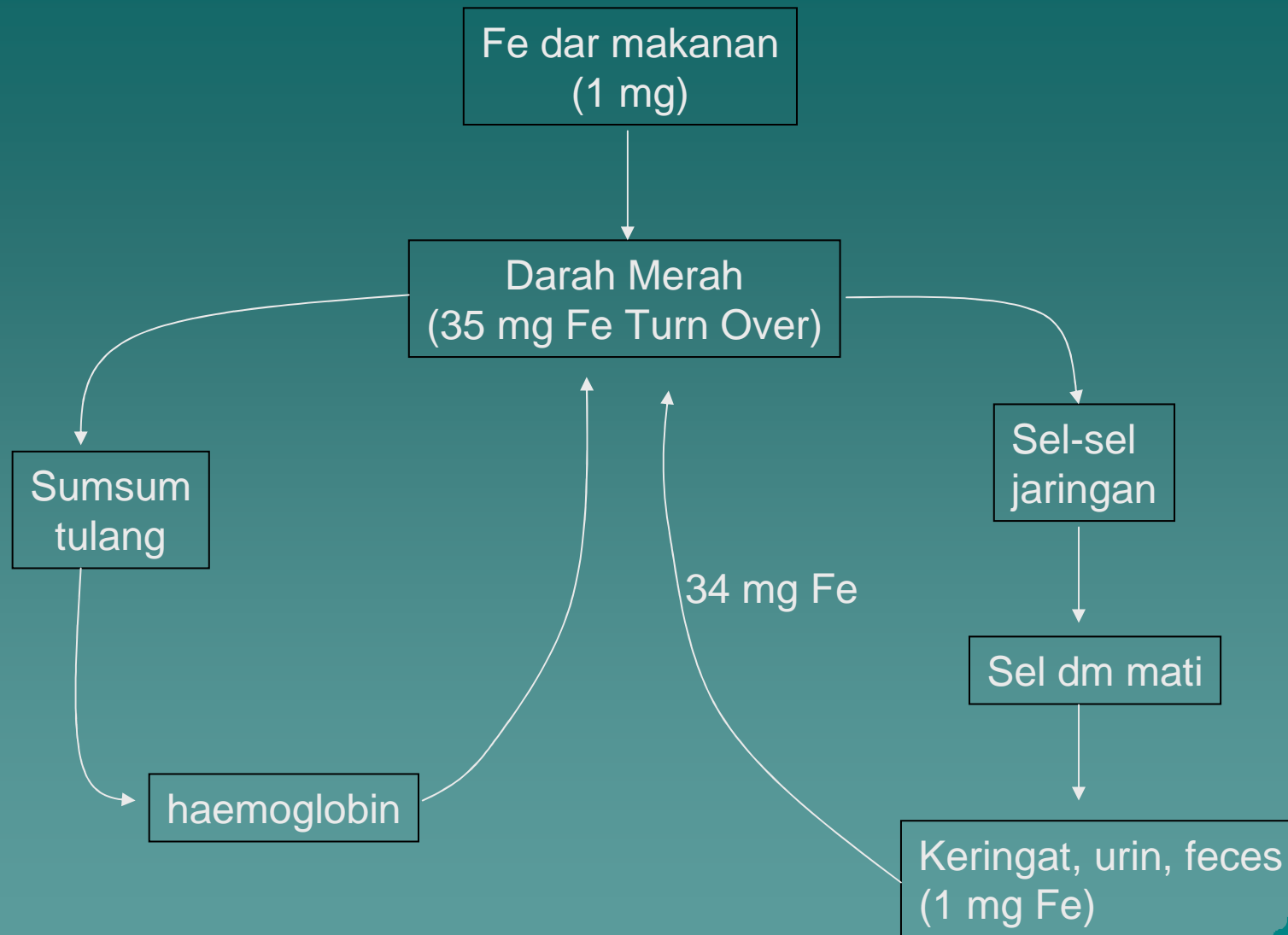
- ◆ high & low-density lipoprotein, serum triglycerides

- Urinalysis

# ANEMIA GIZI BESI

Besi dalam Tubuh:

- ◆ Volume darah 4 ltr
- ◆ Umur darah merah 3 bln
- ◆ Darah merah →turn over: 35 mg Fe/hari
- ◆ Wanita Hamil butuh tambahan: 0,5 – 1 mg/hari



# Causes of iron deficiency

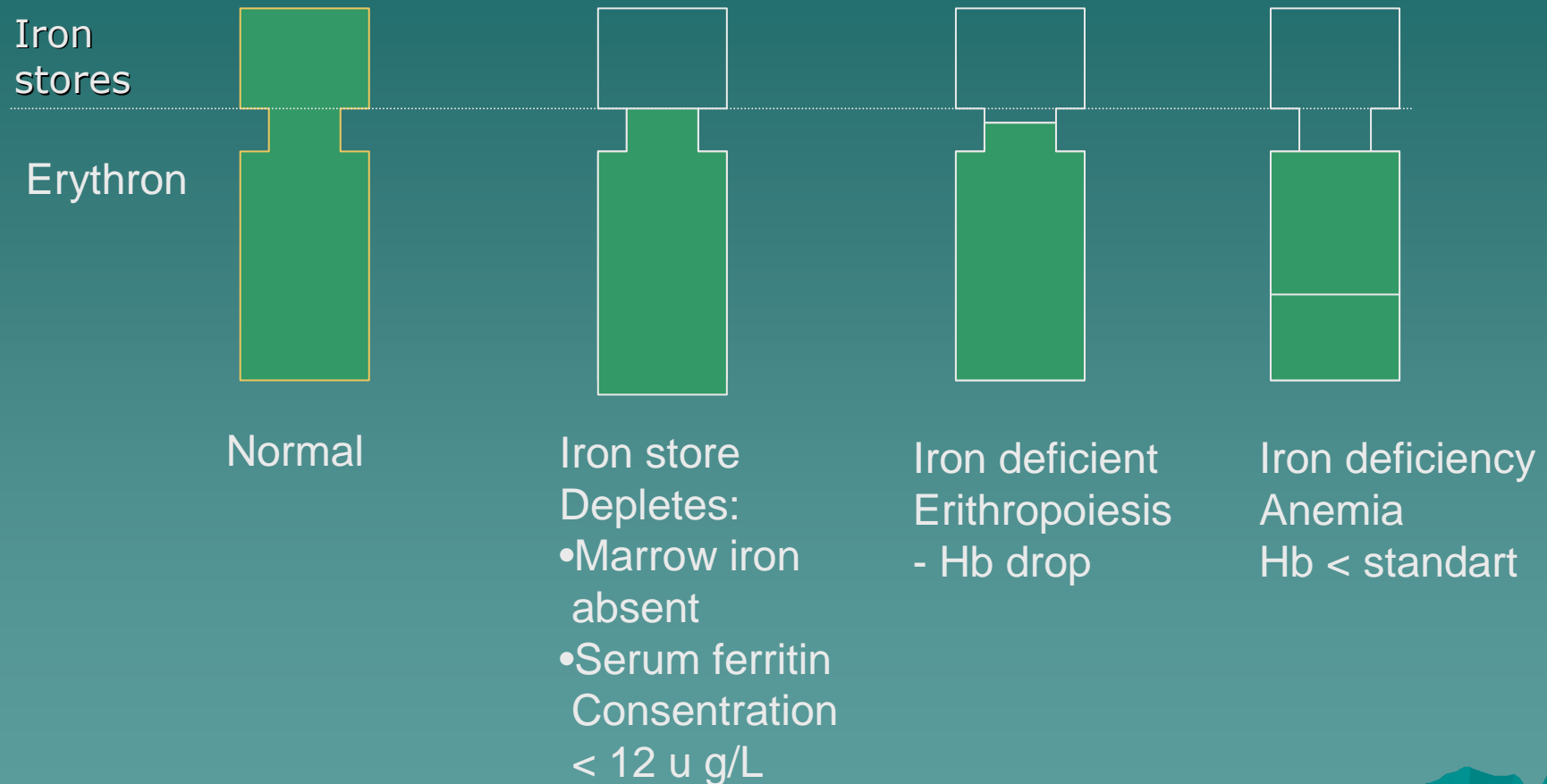
- Blood loss:
  - ◆ Menstruation
  - ◆ Worm infection
- Increased iron need due to physical growth:
  - ◆ Pregnant women
  - ◆ Children
- Low intake of absorbable iron
  - ◆ Plant diet

# Tingkatan Anemi besi

(Gibson, 1990)

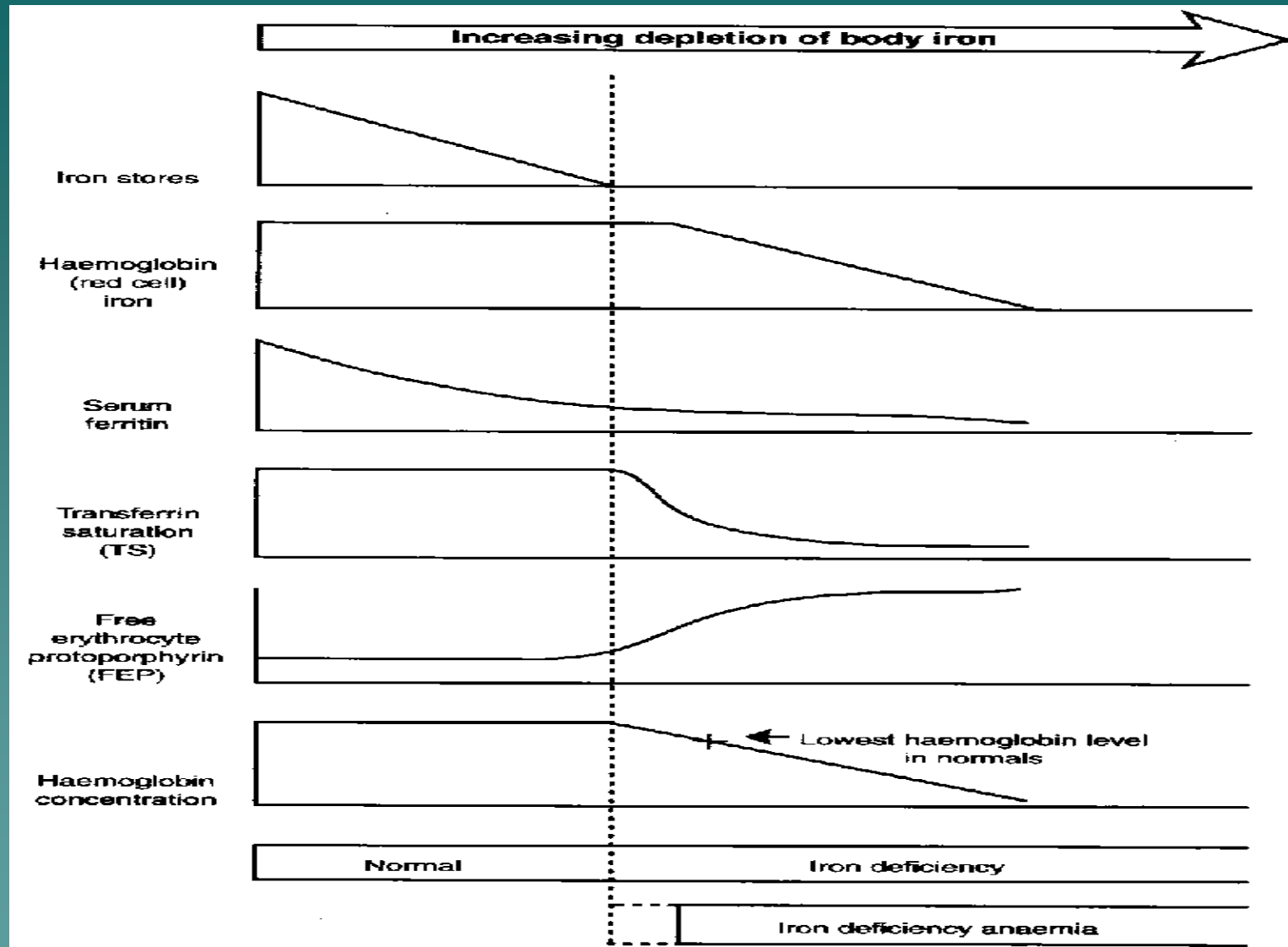
- ◆ Hilangnya zat besi (iron depletion) :
  - Pengurangan jumlah cadangan besi pada hati
  - Tingkat transport besi dan Hb normal, tetapi cadangan besi hilang ditandai dengan rendahnya serum ferritin
- ◆ Erythropoiesis defisiensi besi (iron deficient erythropoiesis):
  - Suplai besi dalam plasma pada sel erythropoiesis turun dan akan menyebabkan turunnya saturasi tranferrin
- ◆ Anemi defisiensi besi (iron deficiency anemia):
  - Cadangan besi habis
  - Terjadi penurunan sirkulasi besi, ditandai penurunan konsentrasi Hb di dalam sel darah merah.

# Stage of iron deficiency





# Changes in body iron compartments and laboratory parameters of iron status during development of iron deficiency due to a continuous negative iron balance



Source: International Nutritional Anemia Consultative Group, 1977

# INDIKATOR ANEMIA GIZI BESI

- ◆ Hemoglobi (Hb),
- ◆ Hematokrit,
- ◆ Serum Besi/Serum Ferritin (Sf),
- ◆ Transferin Saturation (Ts),
- ◆ Free Erythrocytes Protophophyrin (FEP)
- ◆ Unsaturated Iron-binding Capacity Serum

# 1. HAEMOGLOBIN (Hb) :

Dpt tentukan prevalensi Anemia

Macamnya:

## A. METODE SAHLI

- Kesalahan 2 – 3 kali
- $\text{Hb} + \text{Hcl} \rightarrow \text{Globin Fe}^{++} + \text{Heme} \rightarrow \text{O}_2$   
 $\rightarrow \text{Fe}^{+++} + \text{Heme} + \text{Ion Cl} \rightarrow \text{Ferri Hemeclorid (coklat)}$
- Sangat subyektif

## **B. METODE CYANMETHEMEGLOBIN**

- Hb Oksidasi K. Peroksida → Methemoglobin → Ion Sianida → Sian – Methemoglobin (merah)
- Hasil lbh obyektif

### **❖ HARGA NORMAL**

- Laki – Laki : 14 – 18 g %
- Wanita : 12 – 16 g %
- Wanita Hamil : 11 gr %

## 2. HEMATOKRIT (HCT)

- Volume SDM yg terpisah dr plasma
- Estimasi scr tdk langsung Hb (HCT 3 X Hb)

### ❖ HARGA NORMAL

- |               |             |        |
|---------------|-------------|--------|
| - Laki – laki | : 40 – 54 % | Kepler |
| - Wanita      | : 37 – 47 % |        |
|               |             |        |
| - laki – laki | : 42 – 50 % | Wells  |
| - Wanita      | : 40 – 48 % |        |

## Suggested criteria for diagnosis of anaemia using haemoglobin (Hb) and haematocrit (PCV) determinations

<b>Subject</b>	<b>Hb below</b>	<b>PCV below</b>
	<b>(g/dl)</b>	<b>(%)</b>
Adult male	13	42
Adult female (non-pregnant)	12	36
Pregnant female	11	30
Child 6 months to 6 years	11	32
Child 6 to 14 years	12	32

*Source: WHO, 1975a.*

### **3. SERUM FERRITIN (SF)**

- **Menilai status besi di hepar**
- **SF < 12  $\mu\text{g}$  /L (Defisiensi Fe)**
- **Metode : IRMA, RIA, ELLISA**

## **4. TRANSFERIN SATURATION (TS)**

- Menilai kadar Fe dlm serum**
- TS < 16 % (Defisiensi Fe)**
- TIBC tinggi (Anemia Gizi Besi)**



## 5. FREE ERYTHROCYTE PROTOPHOPHYRIN (FEP)

- Menilai kecukupan Fe utk pembtk Sel Darah Merah di sumsum Tulang
  - ◆ Normal : 35 – 50  $\mu\text{g}/\text{dl}$  RBC
  - ◆ FEP > 100  $\mu\text{g}/\text{dl}$  ( Defisiensi Fe)
  - ◆ Metode : Flurometic

# DEFISIENSI Fe

- Tahap 1 : Cadangan Fe hepar <<
- Tahap 2 : Fe << utk sintesis SDM di SSM Tulang
- Tahap 3 : Kadar Hb <<

# **PSG BIOKIMIA KEP**

- ❖ **ANALISIS BIOKIMIA YG DIGUNAKAN**  
**Nilai Protein & Hasil Metabolit**  
**Protein ( Darah, Urine)**
- ❖ **INDIKATOR**
  - **Hidroksi Prolin Indeks (Urine)**
  - **Rasio As Amino Bebas (Plasma)**
  - **Plasma Protein, Albumin, Pre – Albumin**
  - **Plasma Transferin**

## ❖ HARGA NORMAL

- Albumin : 3,5 – 5 gr/dl
- Globulin : 1,5 – 3 gr/dl
- Fibrinogen : 0,2 – 0,8 gr/dl

## ❖ PRE – ALBUMIN

- Gizi Baik : 23,8 ± 0,9 mg/dl
- Gizi Sedang : 16,5 ± 0,8 mg/dl
- Gizi Kurang : 12,4 ± 1,0 mg/dl
- Marasmus : 7,6 ± 0,6 mg/dl
- Mars – Kwas : 3,3 ± 0,2 mg/dl
- Kwashiorkor : 3,2 ± 0,4 mg/dl

## ❖ **SERUM ALBUMIN**

- **< 1 Th** : **Cukup > 2,5 gr/dl**
- **1 sd 5 Th** : **Cukup > 3 gr/dl**
- **6 sd 16 Th** : **Cukup > 3,5 gr/dl**
- **16 Th**
  - Cukup** : **> 3,5 gr/dl**
  - Kurang** : **< 2,8 gr/dl**
  - Margin** : **2,8 – 3,4 gr/dl**
- **Wanita Hamil**
  - Cukup** : **> 3,5 gr/dl**
  - Kurang** : **< 3,5 gr/dl**
  - Margin** : **3 – 3,4 gr/dl**

## ❖ SERUM PROTEIN

- < 1 Th : Cukup > 5 gr/dl  
Margin < 5 gr/dl
- 1 sd 5 Th : Cukup 5,5 gr/dl  
Margin < 5,5 gr/dl
- 6 sd 16 Th : Cukup 6 gr/dl  
Margin < 6 gr/dl
- > 16 Th : Cukup 6 gr/dl  
Kurang 5,5 gr/dl  
Margin 6,5 – 5,9 gr/dl

## ❖ INDIKATOR KEP

**Albumin/Globulin, Kolest & Hb turun**

## Levels of serum albumin concentrations in malnourished children

Concentration	Interpretation
(g/dl)	
> 3.5	Normal
3-3.4	Subnormal
2.5-2.9	Low
< 2.5	Pathological

*Source: Alleyne et al., 1977.*

# PSG BIOKIMIA KVA

## ❖ PROSES

Cadangan Vit A Hepar << →  
Deplesi Vit A dlm tbh → Kadar Vit A  
plasma turun → Disfungsi Retina →  
perubahan epitel

## ❖ INDIKATOR

1. Vit A Plasma Normal :  $\geq 30 \mu\text{g/dl}$   
KVA :  $< 5 \mu\text{g/dl}$
2. Vit A Hepar Normal :  $\geq 15 \mu\text{g/dl}$   
KVA :  $< 15 \mu\text{g/dl}$
3. RBP Normal :  $\geq 20 \mu\text{g/dl}$   
KVA :  $< 20 \mu\text{g/dl}$



## Prevalence criteria for determining public health significance of vitamin A deficiency

<b>Sign</b>	<b>Prevalence above (%)</b>
<b>Night blindness</b>	<b>1</b>
<b>Bitot's spots</b>	<b>0.5</b>
<b>Corneal xerosis/corneal ulceration/keratomalacia</b>	<b>0.01</b>
<b>Corneal scar</b>	<b>0.05</b>
<b>Plasma vitamin A &lt;10 µg/dl</b>	<b>5</b>

*Source: WHO, 1982.*

# Pemeriksaan GAKI

## Test Laboratorium :

- TSH : kadar normal 0,4 – 4,8  $\mu\text{g/ml}$
- Urinary Excretion Iodine (UEI) :

Median UIE $\mu\text{g/l}$	Asupan iodium	Status(gizi) iodium
<20	Kurang	Kurang iodium <u>berat</u>
20-49	Kurang	Kurang iodium <u>sedang</u>
50-99	Kurang	Kurang iodium <u>ringan</u>
100-199	Cukup	Optimum
200-299	Lebih	Resiko IIH dlm 5-10 th program pada kel umur tertentu.
>300	Sangat kelebihan	Beresiko thd kesehatan lebih luas IIH, Autoimmune, penyakit hiper thyroid dll.

# TSH neonatal

- ◆ Sangat penting untuk kabupaten/kota endemik sedang & berat atau pernah dinyatakan endemik berat
- ◆ Satu-satunya cara untuk mengetahui adanya kretin baru
- ◆ Dilakukan pada semua bayi baru lahir.
- ◆ Dapat mendeteksi dini bayi hypothyroid transient maupun permanent.
- ◆ Perlu keterlibatan bidan/penolong persalinan.
- ◆ Menggunakan bercak darah pada kertas saring (Blood spot) atau Indek hipothyroid T.
- ◆ Perlu disiapkan sistem pelaporan.

# Pemeriksaan Urinary Excretion Iodine (UEI)

- ◆ Sampling random 300 orang kelompok terawan(ibu hamil) untuk diambil urine sesaat.
- ◆ Frekuensi 1x/1 – 2th
- ◆ Kirim ke Laboratorium dgn Prosedure baku kirim 10 % u/pemeriksaan duplo di Lab – terakreditasi/rujukan.
- ◆ Hasil urutkan terendah hingga tertinggi
- ◆ Tentukan nilai median.

# Severity and public health significance of IDD

Severity	Clinical features <sup>a</sup>			Typical goitre prevalence (%)	Median urinary iodine (µg/litre)	Need for correction
	Goitre	Hypothyroidism	Cretinism			
Mild						
(Stage I)	+	0	0	5.0-19.9	>50-99	Important
Moderate						
(Stage II)	++	+	0	20-29.9	20-49	Urgent
Severe						
(Stage III)	+++	+++	++	>30	<20	Critical

*Source:* Adapted from WHO, 1994.

<sup>a</sup> 0 = absent; + = mild/least severe; ++ = moderate/more severe; +++ = most severe.

# Batasan GOAL indikator dalam surveilans GAKI

INDIKATOR	GOAL
<b>Garam beriodium</b> Proporsi rumah tangga yang mengkonsumsi garam beriodium (efektif)	> 90 %
<b>Iodium dalam urine</b> Proporsi dibawah 100 $\mu\text{g}/\text{L}$ Proporsi dibawah 50 $\mu\text{g}/\text{L}$	< 50% < 20%
<b>Gondok</b> Anak usia sekolah (6-12 th) Hasil Palpasi/ultrasound)	< 5%
<b>Neonatal TSH</b> Proporsi bayi dengan kadar TSH darah lebih dari 5 mU/L	< 3 %