EVALUATION OF NUTRITIONAL STATE

I. Indexes calculated from anthropometric parameters:

1) Broca's index:

♂: height in cm - 100 or (height in m)$^2 \times 23$

♀ : (height in cm - 100) - 10 % or (height in m)$^2 \times 21.5$

…… ……

Other calculations:

% ideal body mass*:

(actual body mass/ideal body mass) $\times$ 100

……

***** there are 4 degrees of obesity (tab.1).

Tab.1: Obesity classification according to Broca's index.

Obesity degree	% of ideal body mass
Mild	115–129
Middle	130–149
Heavy	150–199
Morbid	> 200

Body surface (m^2):

[body mass (kg)]$^{0,425} \times$ [height (cm)]^{0,725} / 139.32

……..

2) Body mass index (BMI):

$$BMI = \frac{weight\ (kg)}{height\ (m)^2}$$

$BMI =$ _____

Based on BMI, we can determine following categories (tab. 2)

Tab. 2: Classification of obesity according to BMI.

BMI ($kg.m^{-2}$)		
Category	**Men**	**Women**
Underweight	< 20	< 19
Normal weight	20–24.9	19–23.9
Overweight	25–29.9	24–28.9
Obesity	30–39.9	29–38.9
Pathological obesity	> 40	> 39

BMI does not comprehend differences in body fat distribution between men and women. That is why it is necessary to calculate the following parameters*:*

3) Waist circumference.

……

Waist circumference **(cm)**		
Category	**Men**	**Women**
Normal value	≤ 94	≤ 80
Necessity to decrease body mass	95–102	81–90
Necessity of medical assistance during decreasing of body mass	> 102	> 90

4) Determination of Waist/Hip ratio (WHR).

Recommended value <u>for women</u>: < 0.80

<u>for men</u> < 1.00

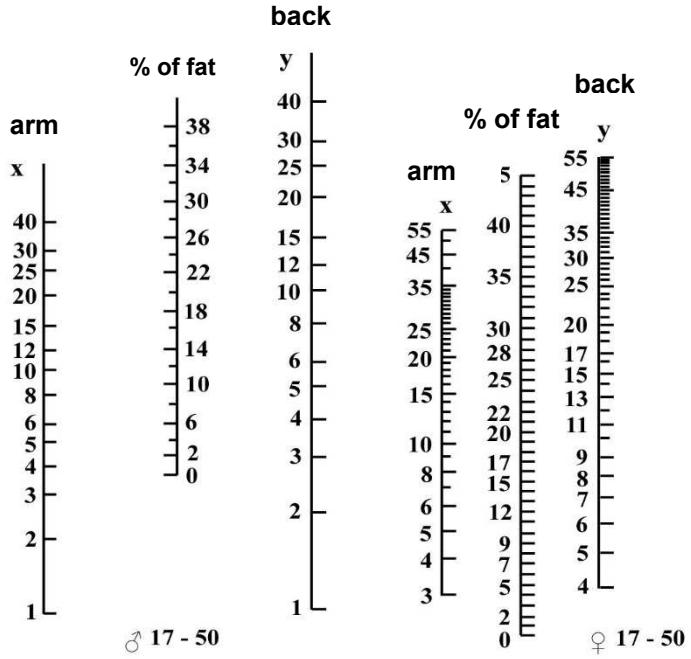
WHR = ——————

Note*: In case you need to calculate energetic expenditure to set up proper nutrition for obese patients, use the value of Broca's index and not the actual weight!*

II. Body fat measurement with calliper

	1. measurement	2. measurement	3. measurement	arithmetic mean
Above the triceps muscle (mm)				
Under the scapula(mm)				

Nomogram: fat percentage estimation.



Estimated proportion of fat (determined on the basis of two skinfolds, according to Slaughter)

♂: % fat = 0.735 * [*under the scapula* (mm)+ above *the triceps muscle* (mm)] + 1.0

♀: % fat = 0.610 * [*under the scapula* (mm)+ above *the triceps muscle* (mm)] + 5.1

…….

III. Body fat measurment by bio-impedance method

Measurement with a manual type of device

% of fat …… amount of fat in kg……

Measurement with a bio-impedance weight-scales

Body mass …….. % of fat …… % of water ……

Tab. 3: Body fat in the population- average normal values (%).

Age	< 30	> 30
Women	17–24	20–27
Men	14–20	17–23

IV. Measurement of amount of muscle tissue

In the clinical practice, circumference of arm muscles (CAM, cm) and corrected surface of arm muscles (c-SAM, cm^2) are used more often.

circumference of arm muscles (CAM)

…….

Obtained value has to be correkted:

*CAM =CA - π ·skinfold on the arm**

OSP=

** CA is circumference of arm (cm).*

Tab. 4: *Muscle tissue estimation.*

Muscle tissue loss	**Not present**	**Middle**	**Heavy**
Women	> 23.2 cm	14–21 cm	< 14 cm
Men	> 25.3 cm	15–23 cm	< 15 cm

Corrected surface of arm muscles (c-SAM*)*

CAM is not corrected to the bone. From this reason, c-SAM value is used:

for men

$$\text{c-SAM} = \frac{(CA - \pi \cdot \text{skinfold on the arm})^2}{4 \times \pi} - 10$$

for women

$$\text{c-SAM} = \frac{(CA - \pi \cdot \text{skinfold on the arm})^2}{4 \times \pi} - 6.5$$

c-SAM=

Calculated values (in cm^2) can be compared to the values in the following table:

Tab. 5: *Estimation of corrected surface of arm muscle.*

Deficiency	**Not present**	**Light**	**Middle**	**Heavy**
Women	> 36.3	29.1–36.3	25.5–29.0	< 25.4
Men	> 40.9	32.8–40.8	28.7–32.7	< 28.6

Conclusion:……
……
……
……
……
……
……

MEASUREMENT OF BASAL METABOLIC EXPENDITURE (BME) USING INDIRECT CALORIMETRY

Actual energetic expenditure at rest and after work load:

Values of oxygen consumption (l/s) in each case (rest – work load) to be corrected to 0 ˚C and 101,325 kPa (760 mmHg) according to the following formula:

$$v_r = v_n \cdot \frac{273}{273+t} \cdot \frac{B-e}{101{,}325} \quad \text{(l/s)}$$

v_n – measured consumption of O_2 in *l/s*
t – *room temperature in ℃*
B – *barometric pressure in **kPa** (1 torr = 1 mmHg = 0,133 kPa)*
e – *partial pressure of water vapors*

Tab.: partial pressure of water vapors (e) in kPa at various temperatures.

t (°C)	0	1	2	3	4	5	6	7	8	9
10	1.219	1.303	1.391	1.485	1.585	1.691	1.801	1.920	2.044	2.174
20	2.314	2.462	2.617	2.781	2.953	3.134	3.328	3.529	3.741	3.965
30	4.201	4.449	4.709	4.986	5.269	5.570	5.887	6.225	6.567	6.933

REST	WORKLOAD
v_n (measured consumption)……l/s	v_n (measured consumption)……l/s
v_r (corrected consumption)……l/s	v_r (corrected consumption)……l/s

Measurement of actual energy expenditure (AEE) by indirect calorimetrie can be performed using of the following equation: *If we know the amount of consumed oxygen in liters per time unit (VO_2=v_r), we can used the equation with energetic equivalent of oxygen for mixed diet (EE = 20,19 kJ/liter of O_2):*

AEE (kJ/time) = 20.19 · VO_2 (about 8 % error)

REST	WORKLOAD
AEE=……kJ/s	AEE=……kJ/s
AEE=……kJ/day	AEE=……kJ/day

Conclusion……
……
……

CALCULATION OF ENERGY EXPENDITURE

a) Basal energetic expenditure (BEE):

Calculation of BEE according to Harris-Benedict formula:

♂: **BEE = 66 + (13.7 x *m* + 5 · *h*) – (6.8 · *r*)**.

♀: **BEE = 655 + (9.6 x *m*) + (1.7 · h) – (4.7 · *r*)**

m = body mass in kg,
h = height in cm,
r = age in years.

The result in kcal/day transferm to kJ/day (1 kcal = 4,18 kJ, 1 J = 0,2388 kcal).

BEE:

b) Actual energetic expenditure (AEE):

AEE = BEE x AF x TF x IF

Where the factors are:

activity– AF	lying patient lying, but mobile patient mobile patient	1.1 1.2 1.3	Healthy - light working Healthy - middle working Healthy -hard working	1.55 ♀ 1.64 ♀ 1.82 ♀	1.60 ♂ 1.78 ♂ 2.10 ♂
body temperature-TF	37 ºC 38 ºC 39 ºC 40 ºC 41 ºC		1.0 1.1 1.2 1.3 1.4		
injury– IF	non complicated patient after surgery fractures sepsis peritonitis multiple injuries multiple injuries+ sepsis burnings 30–50 % burnings 50–70 % burnings 70–90 %		1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 2.0		

*Note: in this practical, use ,*Healthy - light working' as an activity factor for your calculation. BEE a AEE transform to kJ/den.

AEE=

Conclusion:……
……
……
……

COMPILING DAILY DIET. PRINCIPLES OF CORRECT NUTRITION.

Recommended doses for adults (19–50 years) for one day.

Proteins	0.8 g/kg	**Vitamins A**	0.8–1 mg
Lipids	60–80 g	**Vitamins C**	75 mg
Saccharides	5 g/kg	**Vitamins B_1**	1.3–1.5 mg
Energy	2200kcal	**Vitamins B_2**	1.5–1.7 mg

FOOD	AMOUNT (G)	ENERGY		P (g)	L (g)	S (g)	VITAMÍNS						
		kJ	kcal				A (µg)	B_1 (mg)	B_2 (mg)	C (mg)			
The total sum													
The recommended values													

Conclusion……

……

……

……