

LÉKAŘSKÁ FAKULTA
MASARYKOVY UNIVERZITY
A FAKULTNÍ NEMOCNICE BRNO



**KLINIKA DĚTSKÉ
ANESTEZIOLOGIE
A RESUSCITACE**

Refeeding syndrom. Quick look

Milan Kratochvíl

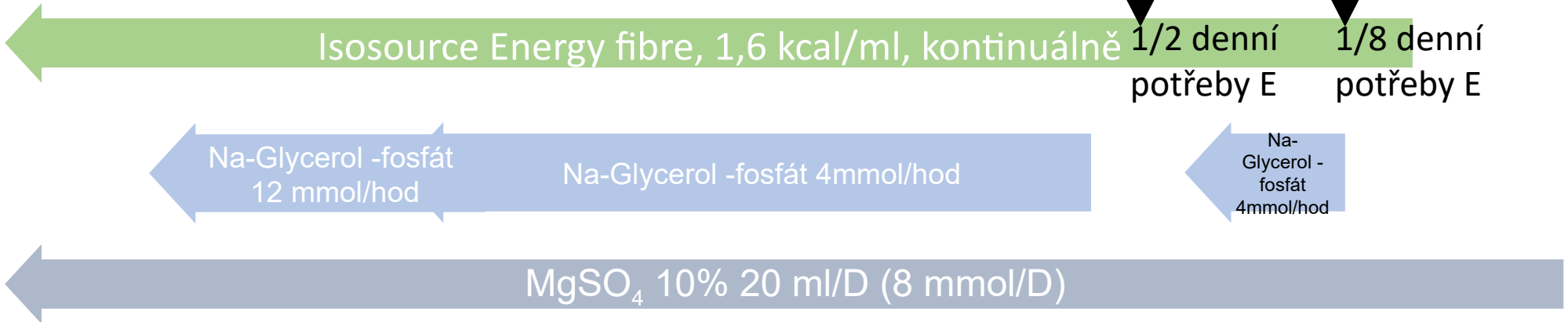


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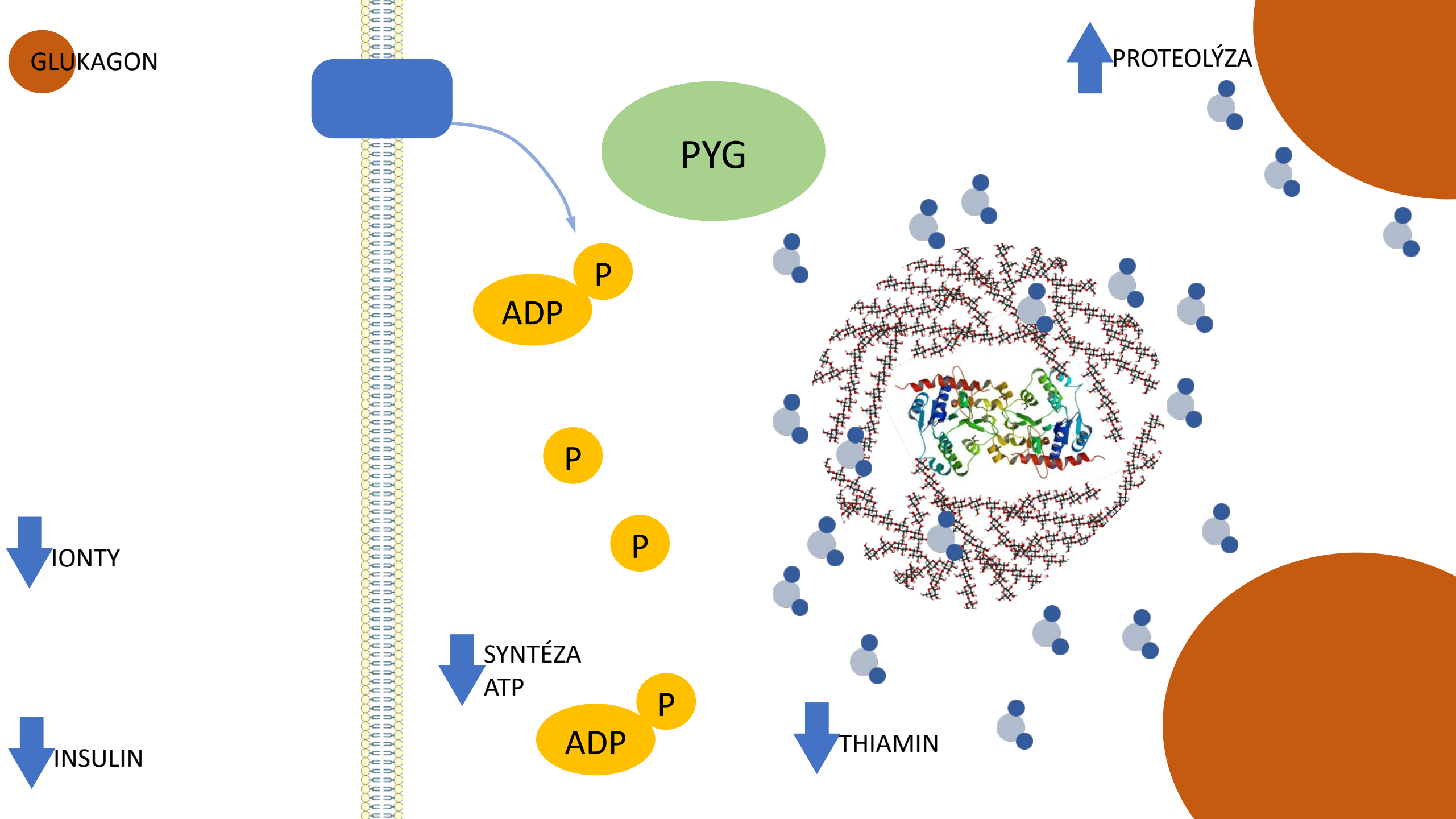
Kazuistika

- Těžce kachektický pacient, BMI 15,7 kg/m², vstupní albumin 25 g/l, v indukci ALL, na kortikoterapii
- Přijímaný 11.9. pro sepsi a respirační insuficienci při levostranné pneumonii, etiologicky *P. aeruginosa*. 12.9 zaintubován, napojen na UPV.
- Od 15.9 vysazována sedace, přítomna těžká slabost kriticky nemocného. Trvá hepatopatie s poruchou syntetické a eliminační funkce jater.
- Postupně dosažena enterální výživou energetická potřeba, nedaří se navodit pozitivní N-bilance, ale výrazně stoupají nutriční parametry (prealbumin, transferin), progreduje hypertriglyceridémie při hepatopatii.
- Pro obtížné odpojování od ventilátoru založena 21. 9. tracheostomie. Nutná pokračující nutriční intervence, proto 26.9. zavedena bez komplikací PEG. Od 26.9 odpojen od ventilátoru.

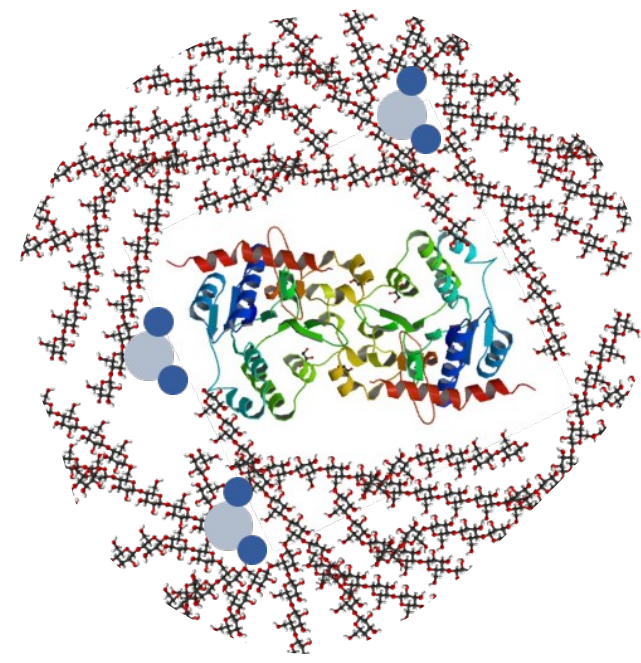
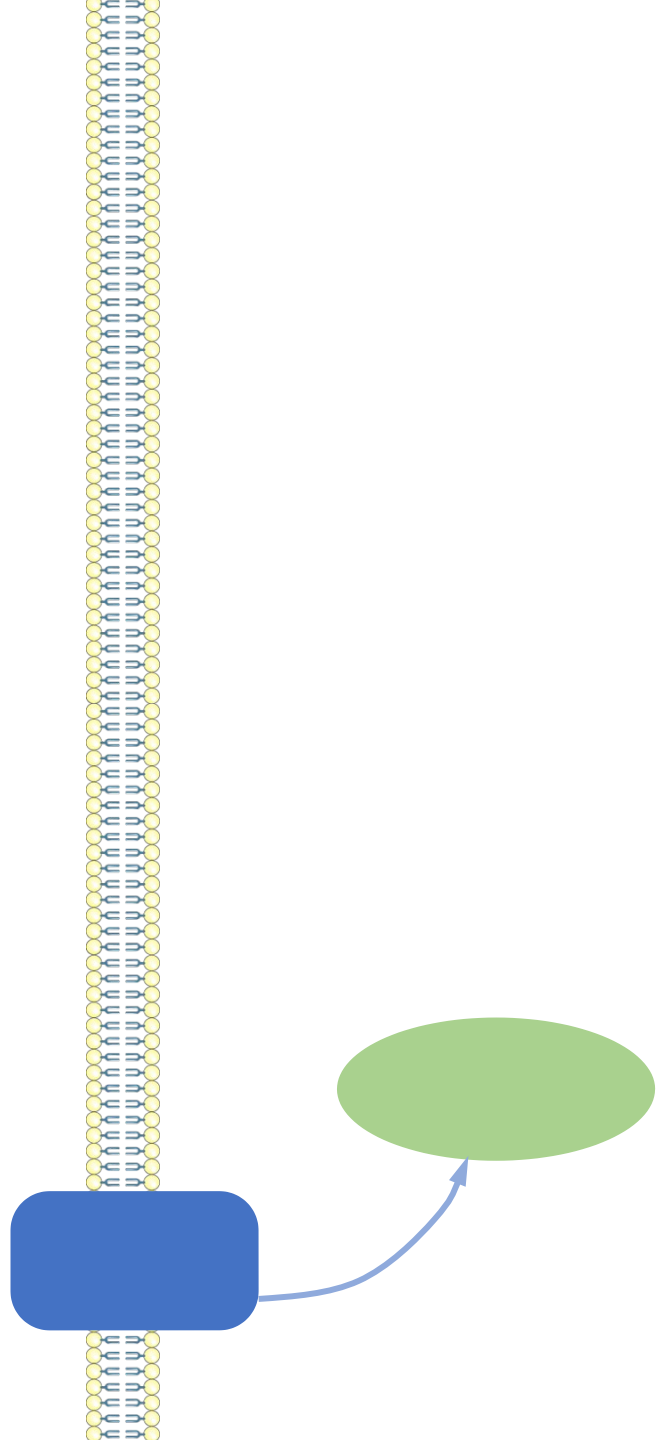
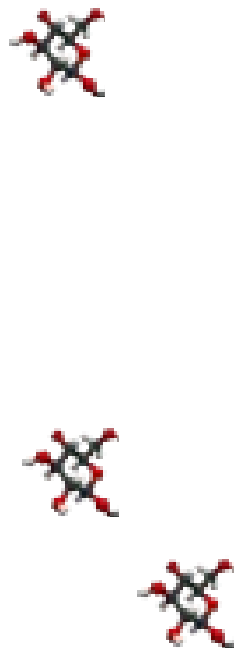
Vyšetření	Jedn.	2018	2018	2018	2018	2018	2018	2018	2018	2018	2018	2018	2018	2018	2018	2018	2018	2018	2018	2018	2018	2018	2018	2018	2018		
		17.09 23:43	17.09 17:25	17.09 17:15	17.09 12:14	17.09 05:17	17.09 05:00	16.09 17:10	16.09 17:00	16.09 05:00	16.09 05:00	16.09 04:57	17.09 17:46	17.09 17:21	17.09 17:15	17.09 12:16	15.09 09:15	15.09 05:15	15.09 04:56	14.09 17:31	14.09 13:41	14.09 05:00	13.09 05:15	13.09 05:06	12.09 22:36	12.09 22:35	
Urea	mmol/l											5.7						7.5					6.9		5.3		
Kreat.	umol/l											26						30					33		27		
CKD-EPI	ml/s											3.26						3.1					2.95		3.2		
KM	umol/l											34											47		29		
Ca	mmol/l																						2				
P	mmol/l																						1.43		0.74		
Mg	mmol/l			1.23																			1.13		0.89		
Osmol.	mmol/kg																						312		290		
Bi-celk.	umol/l																						312		290		
Bil-přím	umol/l																						106.7		148.4		
ALT	ukat/l																						90.9				
AST	ukat/l																						1.26		1.02		
GGT	ukat/l																						0.92		0.71		
ALP	ukat/l																						0.91				
AMS	ukat/l																										
B-Na	mmol/l	141	145		146	147		148				149		150		152						150		152	148	142	133
B(v)HCO3	mmol/l	33.9	34.4		36.4	37.8		36.9				39.1		37		37.1						39.1		39.7	39.4	35.9	33.7
B-K	mmol/l	4.3	3.6		3.4	3.1		3.1				3.7		3.8		4						3.9		3.7	4	3.8	3.6
B(v)BE+	mmol/l	8.3	9.7		11.6	13.7		13.1				13		11.1		11.1						13.9		14.2	14.1	12.3	9.1
B-Cl	mmol/l	100	103		102	101		103				105		107		108						107		107	105	100	95
B-laktát	mmol/l	2	1.7		1.6	1.7		2.4				1.9		2.1		1.8						1.8		1.2	0.9	1.7	2.1
B-gluk.	mmol/l	10.3	5.8		5.9	6.7		8.7				9.1		12		9.6						8.4		7.3	6.6	6.7	9.6
B(v)sO2		0.753	0.711		0.769	0.636		0.753				0.835		0.843		0.826						0.839		0.798	0.817	0.886	0.773
B(v)COHb		0.01	0.011		0.011	0.011		0.013				0.016		0.016		0.016						0.017		0.016	0.014	0.01	0.012
B(v)MeHb		0.011	0.008		0.008	0.008		0.011				0.009		0.007		0.008						0.008		0.009	0.008	0.005	0.008
B(v)Ca2+	mmol/l	1.02	1.03		1.03	1.01		1.07				1.1		1.11		1.09						1.11		1.13	1.09	1.13	1.08
B(v)CapH	mmol/l	1.03	1.07		1.08	1.09		1.16				1.12		1.13		1.1						1.16		1.17	1.14	1.22	1.13
B(v)Hb	g/l	99	100		100	94		85				90		87		84						86		91	90	81	87
B(v)Hct		0.3	0.31		0.31	0.29		0.26				0.27		0.27		0.26						0.26		0.28	0.28	0.25	0.27
Teplota	stupen C	36.5	36.7		37.7	37.4		37.9				37		37		36.6						37		36.3		37.2	36.2



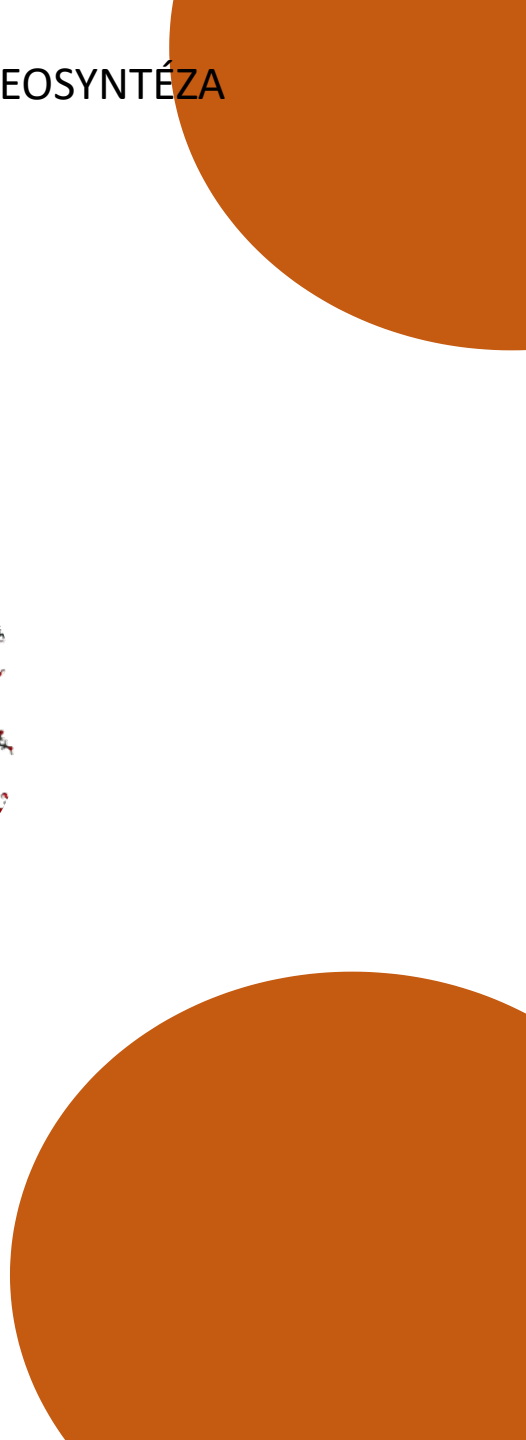
IBW 65 kg, 1950 kcal
100 g bílkovin

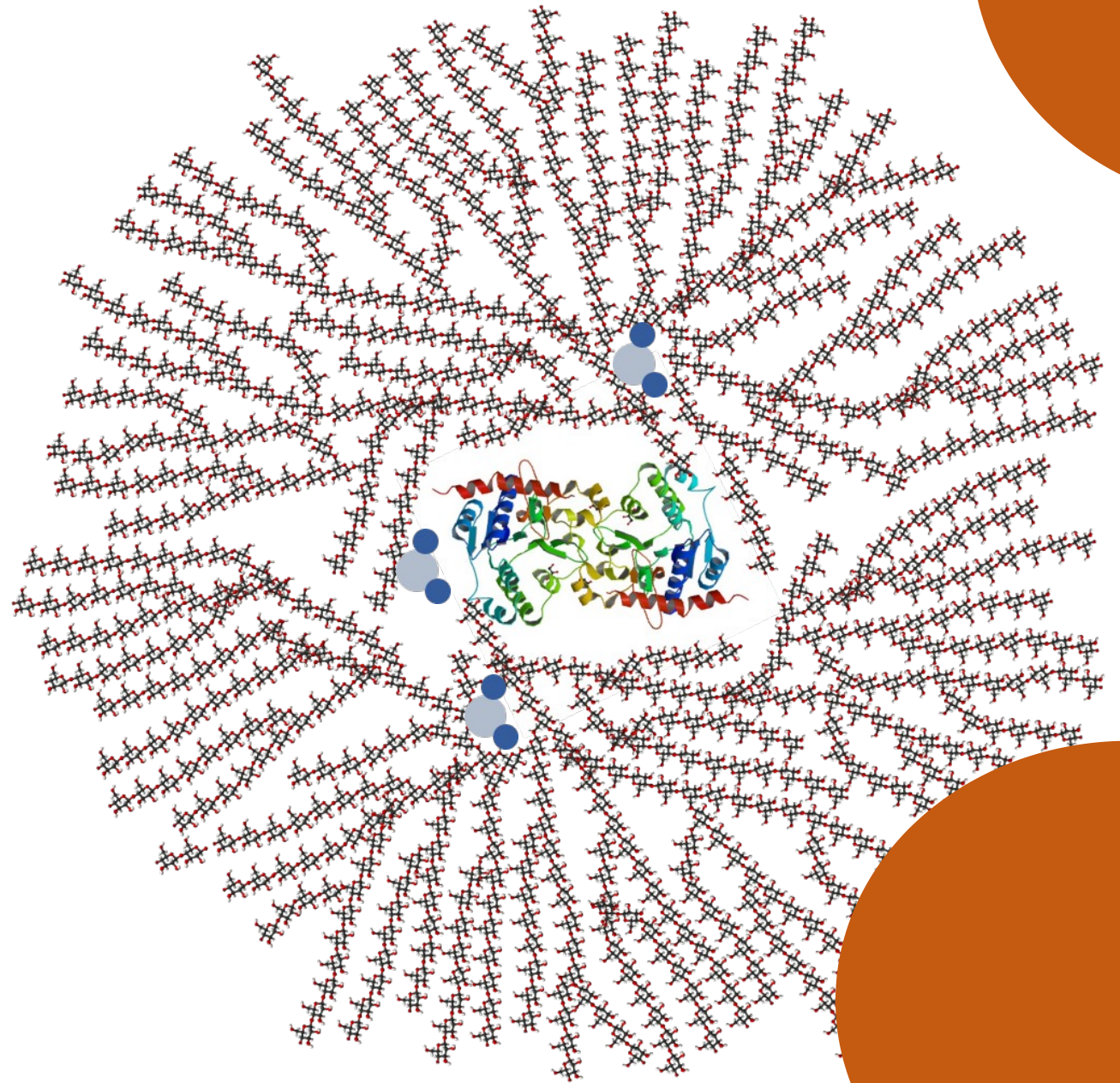
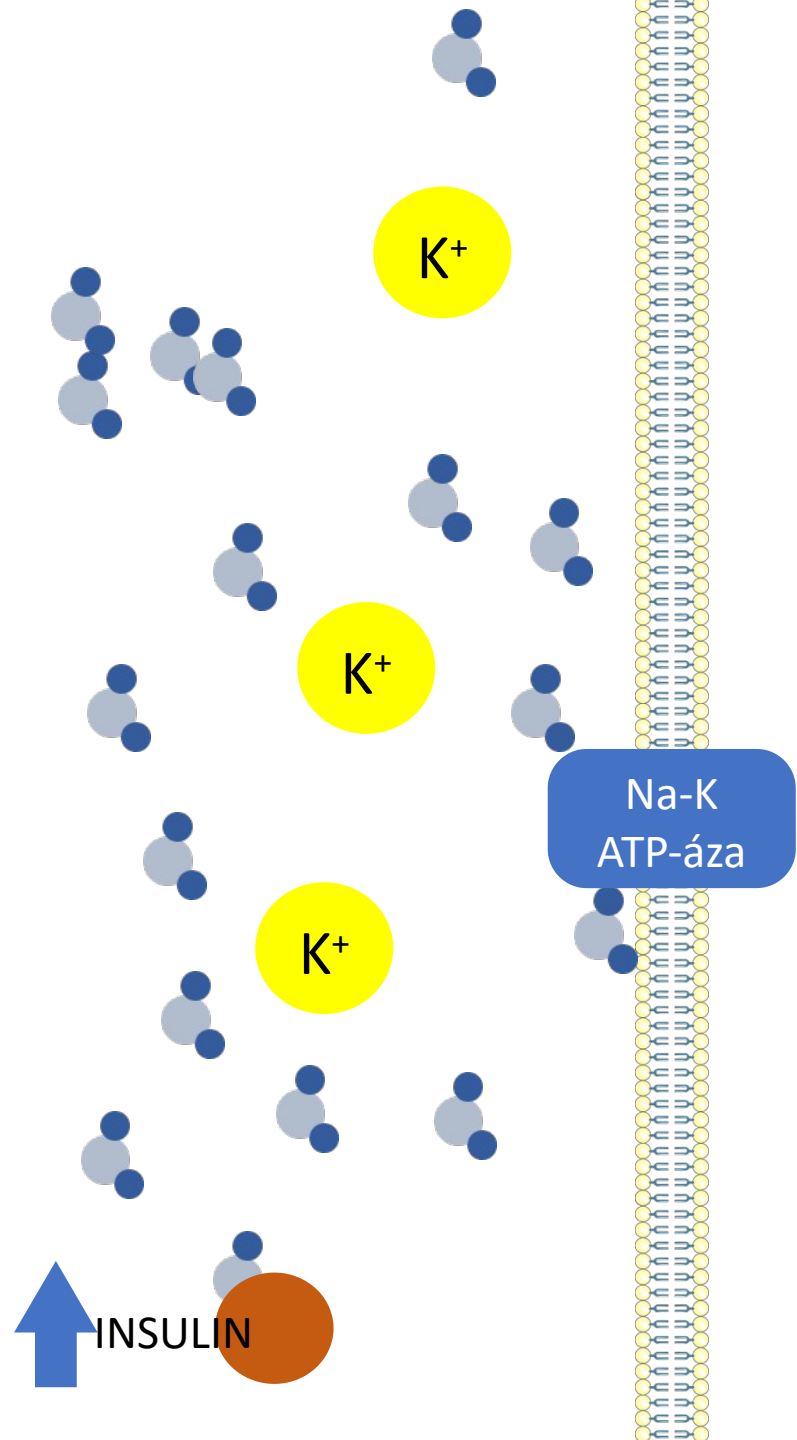


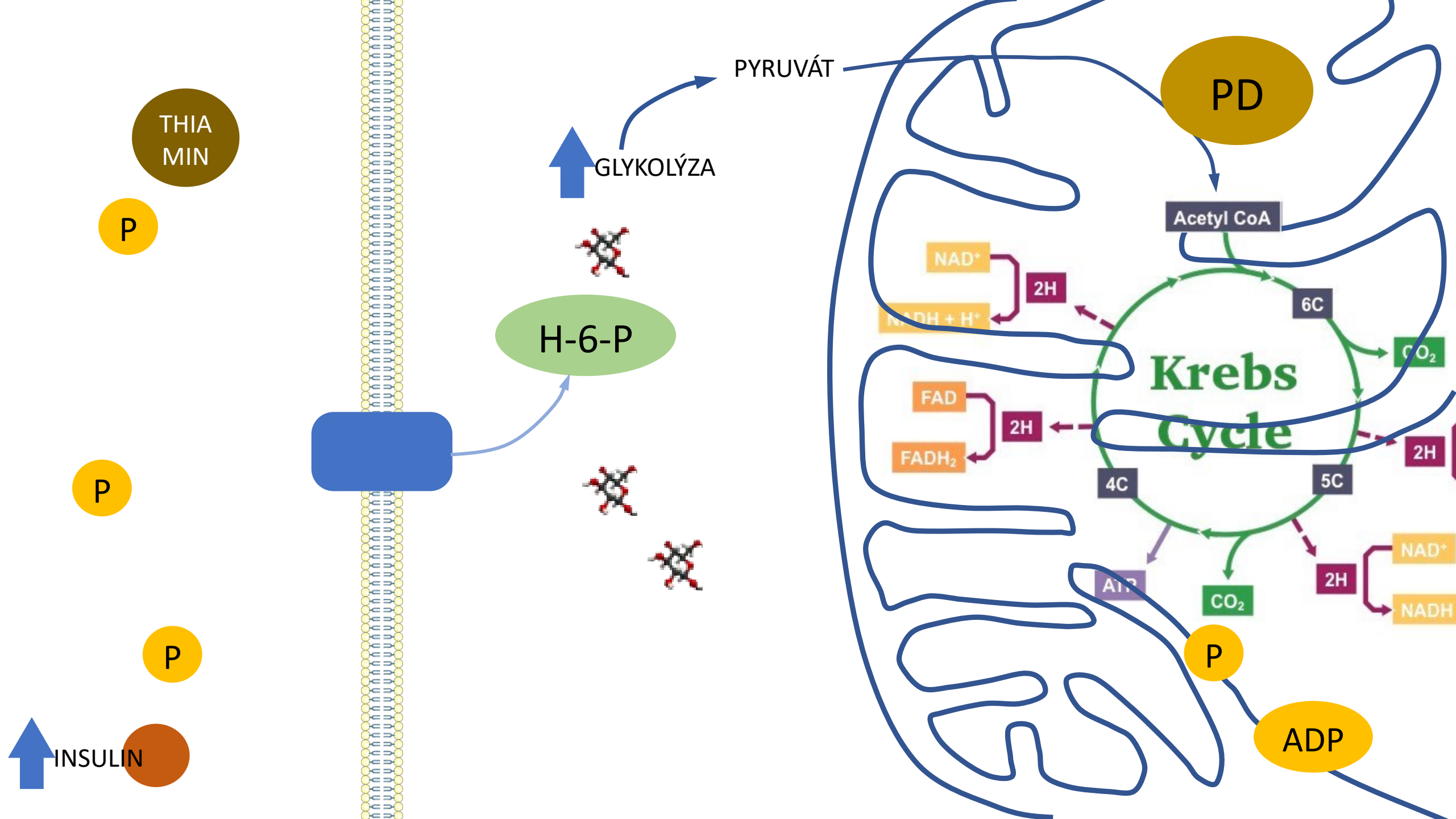
↑ INSULIN



↑ PROTEOSYNTÉZA







Refeeding syndrom

- Hypofosfatémie
- Hypokaliémie
- Hypomagnezémie
- Změny v metabolismu glukózy, proteinů a tuků
- Deficit tiaminu
- Retence vody a sodíku

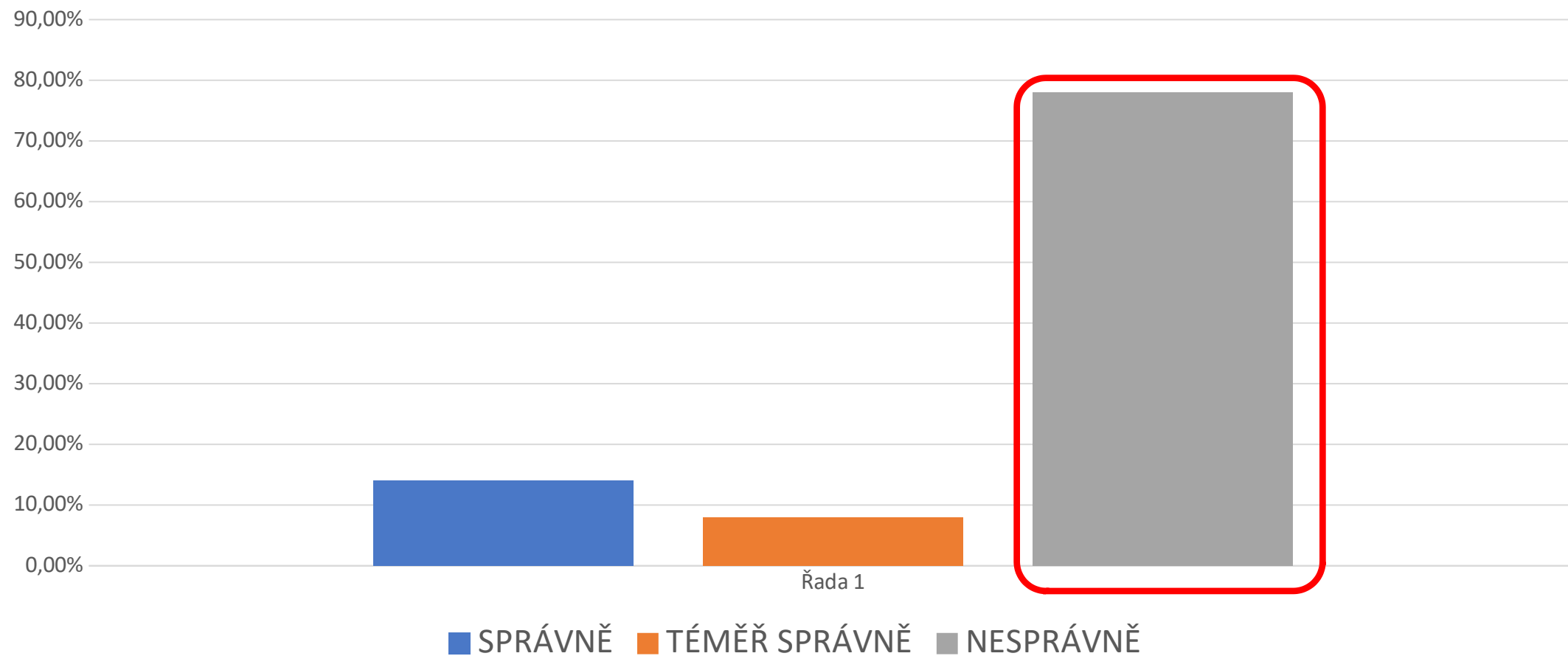
Refeeding syndrom – klinický obraz

- **Kardiální:** hyper/hypotenze, srdeční selhání, kardiomyopatie, arytmie, náhlá srdeční smrt
- **Respirační:** respirační selhání, obtížné odpojování od UPV, plicní edém
- **Neurologické:** slabost, parestezie, porucha vědomí, delirium, křeče, záchvaty, ataxia, tremor, vertigo, tetanie, rabdomyolýza, myalgie
- **Hematologické:** trombocytopenie, hemolytická anémie, leukopenie
- **Gastrointestinální:** zácpa, bolesti břicha, průjem, nechutenství, paralytický ileus
- **Renální:** snížená koncentrační schopnost ledvin
- **Metabolické:** alkalóza, glukózová intolerance, hypernatrémie, ketoacidóza

Víme o něm?

- Mobilní starší žena, bydlící v komunitě, nepozorovaný úbytek na váze 7 kg za poslední 4 měsíce. Aktuální váha 55 kg, body mass index 17.8 kg/m². Je slabá. Užívá Ramipril a Hydrochlorothiazid z důvodu AH. Předpsáno 200 ml HP a HE (1.5 kcal/ml) nutričního přídatku dvakrát za den k normální dietě.
- Jak odhaduješ EE u pacientky?kcal/den
- Jaké laboratorní testy předepíšeš před začátkem nutriční terapie?
- Po jaké době zkontroluješ laboratorní parametry?
- Jaké laboratorní parametry zkontroluješ?
- Po několika dnech se celkový stav pacientky zhorší, rozvíjí se otoky, progreduje únava a slabost, je lehce dezorientovaná.
- Na co máš podezření? Jaké diagnostické kroky podnikneš?

Povědomí o RFS



Krok 1. Zhodnocení rizika

Table 1. Initial risk assessment before start of nutritional therapy

Initial risk assessment

Minor risk factors

BMI < 18.5 kg/m²
Unintentional weight loss >10% in the past 3–6 months
Little or no nutritional intake for >5 days
History of alcohol or drug misuse, including insulin, chemotherapy, antacids or diuretics

Major risk factors

BMI < 16 kg/m²
Unintentional weight loss >15% in the past 3–6 months
Little or no nutritional intake for >10 days
Low levels of potassium, phosphate or magnesium before feeding

Specific patients at high risk (careful assessment is recommended)
Hunger strike, chronic severe dieting
After bariatric surgery, short bowel syndrome
Oncology patients and frail elderly (chronic debilitating disease)

Krok 2. Prevence

Risk stratification for RFS	No Risk	Low Risk	High Risk	Very high risk:	
		1 minor risk factor	1 major or 2 minor risk factors	<ul style="list-style-type: none"> BMI < 14 Weight loss >20% Starvation > 15 days 	
Preventive measures before/during nutritional therapy	Correct the existing deficit of dehydration and replace previous or ongoing abnormal fluid losses (see Table 1): % dehydration x BW (kg) = volume to be replaced in L (rough estimate of fluid loss)				
	No other preventive measures needed	<p>Electrolyte substitution if lower than normal* with adaption of daily dose according to serum levels: 1-1.5 mmol/kg/d potassium, 0.2-0.4 mmol/kg/d magnesium, 0.3-0.6 mmol/kg/d phosphate *Mg <0.70 - 0.75mmol/l, PO₄ <0.80mmol/l, K <3.5mmol/l</p> <ul style="list-style-type: none"> Thiamine: 200-300mg on days 1-5 Multivitamins during days 1-10 Replace specific deficiency of trace elements Sodium restriction (<1 mmol/kg/d) for the days 1-7 			
Days 1-3*	Energy (by all routes): Full requirements (40-60% carbohydrates, 30-40% fat, 15-20% proteins)	Energy (by all routes): 15-25 kcal/kg/d (40-60% carbohydrates, 30-40% fat, 15-20% proteins)	Energy (by all routes): 10-15 kcal/kg/d (40-60% carbohydrates, 30-40% fat, 15-20% proteins)	Energy (by all routes): 5-10 kcal/kg/d (40-60% carbohydrates, 30-40% fat, 15-20% proteins)	
Day 4*		Energy (by all routes): 30 kcal/kg/d (40-60% carbohydrates, 30-40% fat, 15-20% proteins)	Energy (by all routes): 15-25 kcal/kg/d (40-60% carbohydrates, 30-40% fat, 15-20% proteins)	Energy (by all routes): 10-20 kcal/kg/d (40-60% carbohydrates, 30-40% fat, 15-20% proteins)	
Day 5*		Energy (by all routes): full requirements (40-60% carbohydrates, 30-40% fat, 15-20% proteins)			Energy (by all routes): 30 kcal/kg/d (40-60% carbohydrates, 30-40% fat, 15-20% proteins)
Day 6*			Energy (by all routes): full requirements (40-60% carbohydrates, 30-40% fat, 15-20% proteins)	Energy (by all routes): full requirements (40-60% carbohydrates, 30-40% fat, 15-20% proteins)	
Days 7-9*					Energy (by all routes): full requirements (40-60% carbohydrates, 30-40% fat, 15-20% proteins)
> 10 Days*					
* individual clinical judgment is recommended for deciding the best rate to increase nutritional support in order to reach the full target in all three phases of the replenishment/feeding period.					
Fluids	No restriction in fluids	Fluids to maintain zero balance, approx. 30-35ml/kg/d	Fluids to maintain zero balance, D1-3 25-30ml/kg/d, >D4 30-35ml/kg/d	Fluids to maintain zero balance, D1-3 20-25ml/kg/d, D4-6 25-30ml/kg/d, >D7 25-35ml/kg/d	
Salt	No restriction in salt intake	No restriction in salt intake	Restrict Na to <1mmol/kg/d (D1-7)	Restrict Na to <1mmol/kg/d (D1-10)	
Iron	No iron substitution within the first 7 days even if patients have iron deficiency				
Monitoring	<ul style="list-style-type: none"> Serum electrolyte levels daily up to day 3, then every 2-3 days Daily clinical examination focusing on hydration status Continuous monitoring of the cardiac rhythm or electrocardiogram daily in patients at very high risk for RFS 				

Krok 3. Diagnostika

3. Re-Assessment and Diagnosis during Nutritional Therapy

(for all risk categories)

Diagnosis of RFS	Shift in electrolytes within 72 hours after start of nutrition therapy: <ul style="list-style-type: none"> - decrease of <i>phosphate</i> from baseline >30% or below <0.6mmol/l - or <i>any two other electrolyte</i> shifts below normal range (Mg <0.75mmol/l, PO₄ <0.80mmol/l, K <3.5mmol/l) 		
	NO ↓	YES ↓	
	No RFS <i>No change of therapy algorithm.</i> <i>Substitution of electrolytes if they drop below reference range.</i>	Associated with clinical symptoms**?	
		NO ↓	YES ↓
	Imminent RFS Start and/or adapt electrolyte substitution. Repeat assessment every 2-3 days.	Manifest RFS Increase electrolyte substitution and treat clinical conditions adequately. Adapt nutrition therapy as in high risk patients. Repeat assessment every day.	

Závěr

- Nutriční skríníng
- Postupná eskalace nutriční terapie
- Pravidelné laboratorní kontroly – Na, K, P, Mg, Ca, (thiamin)
- Preemptivní substituce iontů
- High-dose thiamin u rizikových pacientů
- Mikronutrienty

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Děkuji za pozornost



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