Protein:  The Tissue Builder

Amino acids

Building blocks of protein

Each has

an amino group (NH2)

an acid group (COOH)

a unique side chain

Formation of peptides and protein

Digestion & Absorption

Digestion of proteins

Must be free AA, di or tripeptides for absorption

Absorption of AA

Primarily in the jejunum and ileum

Essential amino acids absorbed more quickly than non-essential

“Predigested” AA?

Figure 4.4

Simplified Diagram of Protein Metabolism

Metabolism and Function Protein in the human body

Protein homeostasis ->

Protein anabolism=protein catabolism

Protein catabolism

Nitrogen: excreted as urea

Alpha-ketoacid:

Used as energy

Converted to carbohydrate or fat

Exogenous and endogenous sources

Formation of CHO and fat from excess protein

Glucogenic amino acids

Form pyruvate

Gluconeogenesis

14 glucogenic amino acids

Ketogenic amino acids

Form acetyl CoA -> ketone bodies

Leucine and lysine

Some AA are both gluco and ketogenic

Phenylalanine, isoleucine, threonine, tryptophan, tyrosine

Glucose-Alanine Cycle

Animal v. plant

Two main classes of amino acids

Essential (indispensable) amino acids

Must be obtained from foods

Nonessential (dispensable) amino acids

May be formed in the body

PDCAAS

Protein Content in Some Common Foods

Protein needs

RDA

Based on age and body weight

Acceptable Macronutrient Distribution Range (AMDR)

Based on percentage of daily energy intake

Use factor for g protein/kg/d\*\*\*

Based on type of sport

Protein RDA

Proteins and Exercise

Protein Use as Energy

During rest

< 5% of total daily expenditure

5-15% of E during long endurance ex

During resistance training

No increase in AA oxidation

May cause protein catabolism – what are the downstream consequences of more AA in blood?

Protein loss in sweat and urine ~4 g/d

“In general, exercise training produces a positive protein balance that may contribute to performance enhancement” (Williams et al., 2017).

When might this not be true?

Dietary protein needs: Resistance-type activities

1.6 to 2.0 grams/kg body weight

Even > for adolescent resistance exercisers

Adaptations w/ adequate protein & kcals

Dietary protein needs: Endurance-type activities

Carbohydrate is the main fuel for endurance-type athletes

More dietary protein is recommended to

Restore protein used for energy

Promote synthesis of oxidative enzymes and mitochondria

Help prevent *sports anemia*

Dietary protein needs: Endurance-type activities

1.1 to 2.0 grams/kg body weight

Mid to top of range for intermittent high-intensity sports

Prudent Protein Intakes for  Sedentary and Active Individuals

Recommendations for protein consumption

Consume protein, preferably with carbohydrate, before and/or after workouts

Food should contain all essential amino acids, and especially leucine

~ 0.4 g/kg body weight post-exercise

Ignore discussion of ratios

Positive Nitrogen Balance

Nitrogen balance

Negative Nitrogen Balance

GNC Pro Performance 24-hours Protein Complex Powder

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