

All actions of hormones

Growth Hormone

Protein

- ↳ Anabolic Effect
- ↳ ↑ Amino acid uptake
- ↳ ↑ Protein synthesis in ribosomes
- ↳ ↑ Transcription

Fat

- ↳ ↑ Circulating FFA
- ↳ mobilizes fat from adipose tissues
- ↳ ↑ FA → Acetyl CoA
- ↳ Protein Sparing
- ↳ Ketogenic

Carbohydrate

- ↳ Diabetogenic
- ↳ ↑ Glucose by liver
- ↳ ↑ Insulin
- ↳ ↓ sensitivity to Insulin

Electrolyte

- ↳ Intestinal absorption of Ca^{2+}
- ↳ ↓ Renal excretion of Na^+ , Ca^{2+} , PO_4^{3-} , K^+

Growth

↳ Before closure of epiphysis

- ↳ ↑ length of bones
- ↳ ↑ Chondrocyte, Osteogenic
 - ↳ ↑ Protein deposition
- ↳ Chondrocyte → Osteogenic

↳ After closure of epiphysis

- ↳ X Linear Growth
- ↳ Bone thickening (Periosteal Growth)

• Thyroid Hormone - \uparrow O_2 consumption, \uparrow heat
 - \rightarrow BMR
 - \uparrow Nat-K⁺ ATPase
 L Xx Brain, Testes, Uterus, Lymph node, Spleen, Ant. pituitary

Carbohydrate
 L \uparrow Uptake Glucose
 L \uparrow Gluconeogenesis
 L \uparrow Absorption from GIT
 L \uparrow Insulin

Fat
 L mobilization of fat from adipose tissue
 L \uparrow FFA level
 L \uparrow oxidation of FFA
 L \downarrow Cholesterol
 L \downarrow Triglyceride & Phospholipid

Protein
 L Anabolic
 L \uparrow RNA, Protein synthesis
 L \uparrow conc. - catabolic effect

Vitamin
 L \uparrow need for vitamins
 L Relative deficiency of vitamins

Growth
 L Skeletal maturation
 L \uparrow Protein & Enzymes
 L \uparrow GIT
 L Growth & Dev. of brain postnatal life
 [Fetal life 1st few yr.]

Endocrine Gland
 L \uparrow secretion of other gland
 L \uparrow need of tissue for hormone

Body weight
 L \uparrow \rightarrow \downarrow Body weight

• Heart
 L \uparrow HR, SV, CO
 L \uparrow in metabolism
 L \uparrow in β -adrenergic receptor (Quantity & Affinity)
 L \uparrow in α -MHC (Myosin Heavy Chain)

• BV
 L Systolic \uparrow due to \uparrow in CO
 L Diastolic \downarrow due to peripheral (vasodilation)
 L \uparrow heat

• Respiratory
 L \uparrow utilization of O_2 & formation of CO_2
 L Active - \uparrow rate & depth of respiration

• GIT
 L \uparrow appetite, food intake, Secretion, motility

• CNS

- ↳ Brain Development
- ↳ ↑↑ - Psychoneurotic (Anxiety, Complexes, Extreme Worry)
- ↳ ↑↑ - Reaction Time ↓↓
- ↳ Normal formation of Synapse, Myelination } mental Retardation

• Skeletal muscles

- ↳ ↑ - more vigor
- ↳ ↑↑↑ - Weakness in muscle (catabolism of protein)
- ↳ Fine muscle tremor

• Sleep

- ↳ Tired (Excitable effects)
- ↳ Difficult to sleep
- ↳ ↓↓ - Excess sleep - Somnolence

• Reproductive

- ↓↓ - Loss of libido
- ↑↑ - Impotence
- ↑↑ Bleeding
- ↓↓ - menorrhagia, Polymenorrhagia
- ↑↑ - Oligomenorrhoea
- ↓↓ Bleeding
- Frequent menstruation

Insulin

↳ ↑ Glucose entry into cell (XX ABC, liver, brain)

Carbohydrate

- ↳ ↑ utilization of glucose
- ↳ ↑ uptake of carb by liver
- ↳ Stimulation of GLUT
- ↳ Stimulate glucokinase
- ↳ Activate glycogen synthetase (Liver, muscle)
- ↳ XX Glycogenolysis, Gluconeogenesis
- ↳ XX Glucagon

Protein

- ↳ Anabolic
- ↳ Amino Acid into cell from blood
- ↳ ↑ Protein Synthesis (Translation)
- ↳ X Gluconeogenesis
 - ↳ ↓ Protein Breakdown
- ↳ Promote growth

Fat

- ↳ in FA ↓ TG synthesis
- ↳ ↑ Glucose into liver cells
- ↳ Acetyl CoA carboxylase activated
- ↳ Deposition of TG by breaking down circulating TG by lipoprotein lipase

Miscellaneous

- ↳ ↑ Urea output from liver
- ↳ ↑ uptake of K^+ & PO_4^{3-}
- ↳ ↑ K^+ into cell, ↓ ECF $[K^+]$
- ↳ Activate ATPase activity
 - ↳ ↑ K^+ entry to cell

Aldosterone

<u>Renal Tubule</u>		<u>ECF</u>
↳ Net reabsorption		↳ ↑ in vol.
↳ K^+ , H^+ excretion		↳ of ECF

Salivary & Sweat Gland

↳ Net reabsorption from sweat gland

Intestine

↳ Net reabsorption from intestine especially in colon

Cortisol

Carbohydrate

- ↳ Anti-insulin
- ↳ ↑ Gluconeogenesis
- ↳ ↑ Breakdown of protein
- ↳ ↑ Enzymes for
- ↳ X Glucose uptake & utilization

Protein

- ↳ ↓ Cellular Protein
- ↳ ↑ Liver & Plasma protein
- ↳ X A.A transport to extrahepatic cell
- ↳ X Formation of RNA
- ↳ Catabolism of protein in all except liver
- ↳ ↑ A.A transport into liver
- ↳ ↑ Liver enzyme for protein synthesis

Fat

- ↳ Mobilize fat from adipose tissue
- ↳ ↑ Oxidation of F.A
- ↳ ↑ Utilization of fat for energy

- Electrolyte, H₂O
 - ↳ Retention of Na⁺
 - ↳ Excretion of K⁺
 - ↳ Excretion of H₂O

- Muscle
 - ↳ muscular weakness (protein catabolism)

- Bone
 - ↳ ↑ Bone Absorption
 - ↳ ↓ Bone formation

- Blood Cells
 - ↳ - Eosinophil, Basophil, Lymphocytes, size of lymph node & thymus
 - ↳ - Neutrophil, Platelet, ABC

- BV
 - ↳ Imp. for constrictor action of catecholamines

- CNS
 - ↳ ↓ Irritability, Leak of conc.

- Permissive
 - ↳ Catabolic of Glucagon
 - ↳ Pressor, Bronchodilation & Lipolytic of catecholamine

• Anti-allergic

- Circadian Rhythm
 - ↳ ↑ Early morning
 - ↳ ↓ Late evening

- Stress
 - ↳ Immediate A.A → New protein
 - ↳ FA release → energy supply
 - ↳ ↑ vascular reactivity to catecholamine
 - ↳ Prevent severity of other changes caused by stress

- Anti-inflammatory
 - ↳ Block early stage of inflammation
 - ↳ Besin, Rapid Resolution
 - ↳ ↑ rapidity of healing
 - ↳ Stabilize lysosomal membrane - proteolytic enzyme not released
 - ↳ ↓ permeability to capillary
 - ↳ ↓ migration of WBC to inflamed area
 - ↳ ↓ phase of damaged cell
 - ↳ suppress T-cell & other leukocyte
 - ↳ ↓ release of IL-1
 - ↳ ↓ phospholipase A₂