① Non controlable variables

* Biological Influence:-

⇒ Importance of genetics in determining the conc. of blood constituents:-

↓

Similarity has been observed in serum con. or activities of several constituents has been noted b/w monozygotic twins batter them in diazygotic twins.

⇒ Asso. of blood type ē conc. of certain constituents :-

⇓

In women ē blood group O, blood Hb conc. is less than in women ē other blood groups.

(1) Age:- NB.

(A) Newborn:-

→ composit" of blood is affected by maturity of infent at birth.

→ Erythrocyte count & Hb conc., at birth much higher

↓

ēin few days of birth erythrocytes count les in response to higher O_2 conc than that to ē fetus exposed in utero.

→ If immature infant

↓

HbF is more than HbA

→ Arterial blood O2 saturat^{n} is very low.

→ metabolic acidosis develops as a result of accumulat^{n} of organic acid like lactic acid.

↓

Reverts to (N) ĉ in 24 hrs.

⟹ ĉ in few minutes of ~~infl~~ infant's birth

↓

Fluid passes from blood vessel into extra vascular space

↓

∴ Plasma protein conc. ↑es.

⟹ due to ↑ed RBC destruction in newborn

↓

even in absence of any d'se

↓

conc. of bilirubin rises due to

i) less conjugat^{n} ∴ ~~trans~~ less activity of liver UDP-glycuronyl transferase enzyme.

usually ↓ will not ~~be~~ high than 5mg/dl

⟹ blood glucose conc is low in neonates
↓
∵ their small glycogen reserves.

⟹ Plasma urea nitrogen con.:-
↓
↓es after birth due to infant synthesizes new proteins (-ve balance)
↓
conc. does not begins to rise until tissue catabolism predominate

⟹ Plasma A.A conc :-
↓
low as it is utilized in the synthesis of proteins.

⟹ urinary A.A. excretion :-
↓
High at birth b'coz immaturity of tubular reabsorptive mech.

(B) Childhood to puberty :-

⇒ Serum ALP level :-

High in infancy

↓

but ↓es during childhood

↓

again ↑ with growth before puberty

↓

∵ ↑ osteoblastic activity & bone growth

⇒ Serum (GGT) level :-

↑es same above reason,

⇒ Total LDL & cholesterol level ↑ during rapid growth spurt

&

⇒ Serum creatinine ↑es steadily from infancy to puberty

↓

Parallel to development of skeletal muscle

(C) The Adult :-

conc. of most test constituents remain constant b/w puberty & menopause in women & b/w puberty & middle in men.

→ Serum total cholesterol & TG conc.

↓

↑es in both men & women at a rate of 2 mg/dl/year to max. b/w ages 50 & 60 years.

→ Activity of most enzymes in serum is greater during adolescence than during adult life.

↓

∴ greater physical activity of the adolescent.

(B) The Elderly Adult:-

⇒ creatinine clearance

↓

Renal concentrating ability is reduced in elderly adult.

↓

So that, creatinine clearance may ↓ by as much as 50% b/w 3rd & 9th decade

↓

↓ed clearance, is mainly a result of ↓ lean body mass than by altered renal funct°.

blood hemoglobin conc.

→ Higher reticulocyte count in women due to ↑ turnover of erythrocytes.

→ Serum iron conc. is low during fertile yrs of women

↓

∵ loss of iron during menstruation.

→ Plasma conc. of urea, creatinine, UA

↓

Higher in men than in women

↓

∵ ↑ muscle mass

→ Creatinine clearance greater in men.

(3) Race :-

→ Serum Total Protein conc. :-

Higher in black than in whites.

↓

∵ much higher gamma globulin (40% Serum IgG higher & Serum IgA 20% higher)

↓

α, & β globulin are higher in black than in white

↓

Serum albumin is less in black than in white.

⇒ Proximal tubular max. capacity for glucose reabsorptⁿ declines.

⇒ Hormone conc. are affected by aging but change in conc. are less pronounced than an endocrine organ's response to stimuli.

⇒ Thyroid Thyroxine conc.

↓

not changed as secretⁿ as well as degradationⁿ, both are led.

⇒ Basal insulin conc. is unaffected by aging, but its response to glucose is reduced.

⇒ Testosterone → ↓ in men

- FSH & LH → ↑ in women
- Estrogen → ↓ in both
- Gonadotropin → reciprocally ↑ed.

⇒ ↑ CHD → ∵ ↓ estrogen

(2) Sex :-

⇒ AST, CK & aldolase are greater in man than female

↓

∵ greater muscle mass in men

⇒ S. Bilirubin conc is low in women than in men due to low

⇒ CK & LD activity

higher in black than in white due to higher amount of skeletal muscle

⇒ ALP activity :-

in black children → higher

∵ greater skeletal development

⇒ carbohydrate & lipid metabolism diff in black & white.

A * Environmental Factors :-

① Altitude :-

At high Altitude, PO_2 is ↓ed

leads to ↑ in blood Hb & erythrocyte count & ↑ in hematocrit

in erythrocyte, 2,3-BPG conc. also ↑ed

Shift of O_2-dissociation curve to right

→ ↑ erythrocyte conc. leads to ↑ turnover of nucleoproteins & excess of urate.

② Ambient Temperature :-

(2) Ambient Temperature:-

Acute exposure to heat

↓

Causes plasma volume to Expand by influx of interstitial fluid into intravascular space & reduct" of Glomerular filtrat"

↓

plasma protein conc. may ↓ by upto 10%

→ If sweating is extensive

↓

hemoconcentration occur.

(3) Place of Residence:-

→ Carboxyhemoglobin conc. are higher in areas where there is much heavier automobile traffic. than in rural areas.

→ Individuals exposed to UV light from sunshine ↓ typically have higher conc of 25-OH-vit D than those ∈ minimal exposure

→ Vit D conc.:- also affected by diet, season & age, gender

* Long - Term cyclical Changes :-

① Seasonal Influences :-

→ Probable factors for variat^{n} in composit^{n} of body fluids due to seasons

↓

is because diff. foods come into diff. seasons.

→ In summer, Northern hemisphere

↓

higher temperature

↓

↑ blood volume

→ In summer, serum cholesterol conc is higher

↓

∵ - less physical exercise,
- more food intake
- less amount of sunshine

→ Activity of ~~physical~~ serum enzymes ari's from skeletal muscles

↓

higher in summer than in winter

↓

∵ ↑ed physical activity

→ Calcium metabolism is affected by individual's exposure to sunlight.

(i) in summer →

→ • improved glucose tolerance in summ.
• TSH response to thyroid releasing hormone is red.
• red excret" of metabolites of adrenal hormones

↓

all this occurs due to ↑ physical activity.

(ii) Influence of Menstrual Cycle :-

→ plasma corticosterone conc.
plasma androstenedione conc. } ↑ in Luteal phase
plasma aldosterone conc.

→ Plasma iron conc. very low with the onset of menstruat".

→ Plasma Sodium & chloride conc. ↑ upto the onset of menstruat"

↓

but fall by 2 mmol/L with postmenstrual diuresis.

* Underlying medical conditions :-

(1) Obesity :-

→ Serum conc. of CHO, TG & β-lipoprotein are positively correlated with obesity

→ ↑ LDL- cholesterol

→ ↑ serum LD activity & Glucose con

→ plasma insulin conc. is ↑ed

↓

but glucose tolerance is impaired in obe & plasma glucose conc ↑ed.

↓

∴ ↓ed response of insulin sensit receptors in adipose tissue & skeletal muscle

→ Fasting conc. of pyruvate, lactate, citrate & unesterified FA is ↑ed.

→ ↑ leptin conc. while ↓ adiponec conc.

↓

leads to insulin resistance

(2) Blindness :-

→ with blindness, normal stimulat" of hypothalamic pituitary axis is reduced.

↓

So, certain features of hypopituitarism & hypogonadism observed.

Plasma sodium & chloride are often loco
↓
∴ ↓ aldosterone secretion.

(3) Pregnancy :-

→ during preg., great ↑ in blood volume from about 2600 ml early in preg to 3500 ml at about 35 wks
↓
hemodilut" occurs
↓
↓ conc. of plasma proteins (∴ ↓ albumin)
→ ↑ conc. of ceruloplasmin & thyroxine-binding globulin ↓
∴ ↑ estrogen stimulated hepatic synthesis.
↓
This will cause ↑ conc. of copper, cortisol & thyroxine.

→ ↑ urine volume during preg.
↓
25% greater in 3rd trimester.

→ Preg. leads to physiological stress reactions
↓
∴ ↑ conc. of acute-phase reactant proteins.

→ ↑ erythrocyte sedimentation rate

↓

∵ ↑ fibrinogen conc.

④ Stress :-

→ Anxiety stimulates

↓

↑ secretion of aldosterone, angiotensi cat echolamines, cortisol, Prolactin, renin, GH, TSH, ADH

⑤ Fever :-

→ fever provokes many hormonal responses.

→ ↓ food intake & wasting of skeletal muscle in fever leads to

↓

↑ glycogenolysis & a negative nitrogi balance

→ ↑ plasma conc. of acute phase reactants & glycoproteins. as well as cytokines.

→ fever ↑ lipid metabolism

↓

↓ c. cholesterol, non esterified FA,

→ respi. alkalosis occurs due to hyperventil

↓

leads to reduc" in plasma phosphate conc. with ↑ed excretion of phosphate.

⑥ Shock & Trauma :-

⟹ ↑ serum conc. of

↓

angiote, renin — Corticotropin, Aldosterone, renin, GH, glucagon, insulin.

⟹ Anxiety & stress leads to ↑ in excretion of catecholamines.

⟹ Following acute myocardial infarction & other cardiac event

∴ ↓

f skele — ↓ occur in LDL & HDL cholesterols, apolipoprotein B

↓

ive mit — So, it is not recommended to assess serum lipids for future cardiac risks

: phas — during acute phase of such

is cell — events.

⟹ Immediately after an injury

↓

n — loss of ~~extra~~ intravascular fluid occurs

↓

d FA, — ↓ plasma volume

hyperver

↓

impair circulat^{n} & ↓ glomerular filtrat^{n}

↓

accumulat^{n} of urea and other end products of protein meterbolisms.

⇒ In burned patients,

↓

fall in serum total protein conc occurs

↓

∵ loss to extravascular spaces & ↑ catabolism

⇒ ↑ conc. of C-reactive protein.

⇒ ↑ activity of serum enzymes originating from muscle after surgical trauma

↓

∵ muscle damage occurs in surgery

⇒ during trauma,

↓

↑ tissue catabolism

↓

requires ↑ O_2 consumption & leads: production of acid meterbolites.

↓

∴ ↑ blood lactate (due to tissue anoxia)

↓

metabolic acidosis

(7) Transfusion and Infusions :-

⟹ Serum LD activity ↑es after transfusion ↓ due to ↑ breakdown of transfused erythrocytes.

⟹ Extensive blood transfusion may lead to siderosis & ↑ serum iron.

⟹ ↑ serum K^+ due to transfusion of stored blood

⟹ Infusion of solⁿ of albumin may increase plasma ALP activity ↓ if albumin has been prepared from placenta.