**Sampling errors**

\*Blood sampling technique

difficulty in obtaining blood specimen may lead to hemolysis that lead to increament of potassium, AST, LDH.

\*Prolong stasis

If prolong occlusion the protein and protein bound components of plasma such as calcium and thyroxine will be falsely elevated.

\*Insufficient specimen

Small volume specimen is impossible for tests.

\*Error in timing

Like 24- hour urine specimen may have inaccurate timed volume of urine.

\*Incorrect specimen container

\*Inappropriate sampling site

Like blood sample taken from intravenous drip that gives false high result for serum glucose level.

**Collection tubes**

Also called vacationers because they are evacuated tubes with negative pressure to facilitate collection, sterile, with universal coloured –coded rubber stoppers to denote tube types which are:

\*Red –top tubes contain no anti coagulant or preservatives, used for collecting serum, so allow blood to clot before centrifuge.

\*Gold or tiger top tubes

Contain a gel that forms physical barrier bet. Serum and cells after centrifuge with no additives .

\*Gray –top tube

Used for glucose measurement because . It contain sodium fluoride or sodium iodoacetate, and both inhibit enzymes in glycolytic pathway

Sodium fluoride inhibit enolase, and iodoacetate inhibits glucose-3- phosphate dehydrogenase.

\*Green-top tubes

Contain heparine that blood doesnot clot so we obtain plasma.

\*Lavender –top tubes

Contain EDTA so used for hematological studies.

\*Blue-top tubes

Contain sodium citrate that used for coagulation studies.

\*Brown and royal blue top tubes

Used for trace elements

Brown for lead

Royal blue tube is acid washed used for other trace elements.

**Types of urine specimen collection**

\*Random specimen

Most commonly used for urine analysis and micoscopical analysis.

\*First morning specimen also called 8 hour specimen

It is taken when patient first awake in the morning , it is specimen of choice for urine analysis with concentrated cellular elements, and proteins.

\*Midstream clean catch specimen

This is preferred type of specimens for culture and sensitivity because Reduce incidence of cellular and microbial contamination.

\*Timed collection specimen

To measure creatinine , urine urea nitrogen, glucose, sodium, and potassium.the bladder is emptied prior to beginning of collection.

**Quality control**

It is a set of measures useful in detecting errors or measures in each test to verify that test is working properly. The aim of quality control is to ensure that the results are correct.

**Quality assurance**

is the overall program that ensure that the final results reported by lab. Are correct or it ensure that the right test is carried out on right specimen , and the right results is delivered to right person at the right time.

**Errors detecting by Q.C can be minimized by controlling variables which are:**

-Pre-analytical variables:

\*Patient identification

\*Patient preparation(like blood glucose after fasting)

\*Specimen collection(hemolysed sample, insufficient sample )

\*Specimen handling(incorrect container, incorrect specimen storage)

\*Timing of collection( like 24 h. urine test)

\*Other factors: -Sex of the patient , Age of patient , Patient posture and Exercise

-Analytical variables:

\*Selection of appropriate method

\*Standardization and calibration

\*Verification of procedures

\*Monitor critical equipment

**Types of errors**

1.Random errors

Is difficult to eliminate but repetition reduce influences of random errors. examples :errors include error in pipetting , changes in incubation period, random air bubbles during pipetting, inappropriate storage of control, power supply.

2.systemic error

It create bias in results and can be accounted for by applying correction. Systemic errors induced by factors such as variation in chamber temperature, blockage of plate washer, modification in test method, deterioration of reagent or calibrator or control products in use and storage.

**Internal quality control**

It is asset of procedures undertaken by lab. staff for continuous monitoring of operation and results to decide wether results are reliable or not, here we use either patient serum or international serum standers .

**External quality control**

It is a participation in a scheme were that lab. Can compare its performance to other laboratories using the same method and instrument on weekly or biweekly basis.

Internal Q.C programis most useful for precision, but external Q.C program useful for accuracy.

**International definitions**

Precision: it is closeness or agreement between test results under prescribed conditions.

Accuracy: it is closeness of estimated value to true value(reference values).

Bias: difference between test results and reference values.

Specificity: it is the ability of method to measure solely the component of interest.

Sensitivity: it is the ability to detect small quantities of measured component .

**Control chart (levey-jenning chart)(shewhart chart)**

It is a method of presenting Q.C data . We analyse a single batch of control serum for 30 consecutive days, then calculate the mean and SD ,Then draw horizontal line for the mean, then draw line at 1SD,2SD,3SD above above and below the mean line.

The value obtained on each day by analysis of samples is plotted in this chart (single chart for each parameter).

**Westgard rules**

\*Warning rules

\*Mandatory rules