

CONCEPTS OF TRIDOSH AT ELEMENTAL LEVEL**Dr. Shambhu Sharan^{*1}, Dr. Vidyavati Pathak² and Dr. Rohit Ranjan³**¹Lecturer, Dept. of Kriyasharir, Govt. Ayurveda College, Patna.²Associate Professor, Dept. of Kriya Sharir, Govt. Ayurveda College, Patna.³Lecturer, Dept. of Samhita Siddhant, Govt. Ayurveda College, Patna.***Corresponding Author: Dr. Shambhu Sharan**

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ABSTRACT

Ayurveda is a holistic life science. It has many own principles, among them Panchamahabhut principle is back bone for Ayurveda and it is accepted worldwide. No one can challenge this principle. **Since human body is a part of this universe, whatever is available in the universe, those are also present in the human body.** Till date total no. of elements discovered are 112, out of them, only 26 elements are responsible for cent percent constitution, physical structure, as well as chemical and biological functions of the human body in varied concentration. These 26 elements present in the earth as well as in the human body are classified into Panchamahabhut. These 26 elements are first classified into Panchamahabhut and further classified into Vata, Pitta and Kapha (Tridosa). According to Ayurveda, among Tridosa Vata is made up of Akash and Vayu mahabhut, Pitta is made up of only Agni mahabhut and Kapha is made up of Jala and Prithvi mahabhut. It is seen that potassium is predominated in Akash mahabhut. sodium, calcium, magnesium and iodine are equivalent to Vayu mahabhut. Nine elements are equivalent to Agni mahabhut. i.e. vanadium, chromium, manganese, iron, cobalt, copper, zinc, molybdenum and hydrogen. Four elements viz. oxygen, nitrogen, fluorine and chlorine are mainly equivalent to Jala mahabhut. Eight elements viz. boron, aluminium, carbon, silicon, phosphorous, sulphur, selenium and tin are included under Prithvi mahabhut. Therefore whatever elements present in the Panchamahabhuta are classified into Vata, Pitta and Kapha because Tridosa are made up of Panchamahabhuta.

KEYWORDS: *Panchamahabhuta, Tridosa and elements.***INTRODUCTION**

Since human body is a part of this Universe, whatever available in the Universe, those are also present in the Human body. Ayurveda being the antique health care system in the world adopted this concept for implementation of its fundamental concepts such as Tridosha theory (Vata, Pitta and Kapha), Sapta dhatu (Seven tissue systems), etc Therefore ayurveda states that each and every creation of this universe is made up of panchamahabhut. Day from the creation of world man was amazed by the duality of the earth, the nature surrounding us, day, night, sun, moon, heat and coldness, disease and health and of course death and life taught him to correlate the relation of this duality. Being a science, Ayurveda has its own basic principles. Among the basic principles Panchamahabhuta is the first accepted principle to analyze this world. Panchamahabhuta principle is the basic tool that is helpful in the analysis of other principles like Sapta dhatu Concept (Seven tissue system), Tridosha theory (Vata, Pitta and Kapha), and Mala concept. Similarly, the basic constituents of Tridosha are; Vata is made up of

Vayu and Akasha, Pitta is made up of Agni, and Kapha is made up of Prithvi and Jala.

Till date total no. of elements discovered are 112, out of them, only 26 elements are responsible for cent percent constitution, physical structure, as well as chemical and biological functions of the human body in varied concentration. These 26 elements present in the earth as well as in the human body are classified into Panchamahabhut. These 26 elements are first classified into Panchamahabhut and on that basis further classified into Vata, Pitta and Kapha (Tridosa). in the present study.

Need of the study

Now a days Ayurveda is not able to accept scientifically at global level due to lack of parametric measurement. There was no any previous study to analyze and measure the Ayurvedic science at parametric levels. In the present study it is tried to establish some facts based on internationally accepted basic parameters that can be useful in the measurement and explanation of Ayurveda at present scenario.

OBJECTIVES OF THE PROPOSED WORK

The main objectives of this study were to compare the composition, properties and functions of Panchamahabhuta especially of Prithvi, with elements of earth, and to compare the composition, properties and functions of Panchamahabhuta and elements of earth with Tridosha.

Scheme of the study

- Comparison was done between elements of earth and human body on the basis of tridosha.
- Elements of earth present in human body are classified into Panchamahabhuta
- Elements of earth present in human body are classified into Vata, Pitta and Kapha

LITERARY REVIEW

Dosha and Panchamahabhuta

The word dosha is derived from the root *dushya vaikritye*, meaning that which is susceptible to vitiation. The doshas are primary constituent factors of the body, which maintains its integrity. The available description of dosha is qualitative and functional and hence can't be quantitatively determined. Basically dosha are three named as Vata, Pitta, and Kapha. The state of equilibrium of these dosha results in the orchestrated, harmonious well being of human body where as their disequilibrium may cause ill health or even death. All these dosha are basically made up of Panchamahabhuta as given below

Table No.1: Showing dosha and their bhautic composition.

Dosha	Panchabhautic composition
Vata	Vayu + Akasha
Pitta	Agni
Kapha	Prithvi+ Jala

These three-mega divisions of the body particles are called Tridhatu. These three not only build and sustain

Physical Properties of Dosha

Table No. 02: Showing physical properties of dosha.

S.N.	VATA	PITTA	KAPHA
1.	Ruksha (dry)	Ishat snigdha (little unctuous)	Guru (heavy)
2.	Sheeta (cold)	Ushna (hot)	Sheeta (cold)
3.	Laghu (small, light)	Teekshna (acuteness)	Mridu (soft)
4.	Sukshma (subtle)	Drava (liquid)	Snigdha (unctuous)
5.	Chala (motion)	Amla	Madhura
6.	Vishada (clear)	Sara (movement)	Sthira (stability)
7.	Khara (hard)	Katu	Pichhila (mucilaginous)

all parts of the body but also fulfill all biological function when alive. We must identify these with those parts of body where they predominate. Kapha is a combination of the materials used for structuring and sustaining the body. Pitta is the combination of materials that digest the food and transform it into the body constituents. Vayu is that body constituents that generates power and motility, besides these vayu includes that body constituents that carries O₂ to the part of the body for activating their bio-function.

Vata

The term Vata is derived from the root, "*Va gati gandhanayo*"^[110] meaning to move, to enthuse, to make know, to enlighten, to affect continued effort, perseverance etc. Vata can be described as self-generating and self-propagating force responsible for the conduct, regulation, and integration of all the vital functions and structure of the body. In other words the concept of Vata can be attributed to the activities of neuroendocrine system and in some instances catabolic activities also.

Pitta

The origin of word Pitta is from the root "*tap santaape*,"^[111] meaning to heat, to burn or to warm up. Pitta is described as Agni; its functions resemble that of fire like *dahana* (burning), *Pachana* (digestion) and *Parinama* (transformation). The function of Pitta can be attributed to those of digestion, assimilation, thermogenesis and metabolism.

Kapha

The term kapha can be defined as "*ken jalena phalati iti kaphah*"^[112] meaning the product of water. The synonym of kapha '*shlesma*' is derived from the root "*Shlish aalingane*"^[113] meaning to embrace or to keep together. Kapha in general represents a potential source of strength that resists disease and decay. Its function can be ascribed to that of fluid balance, nutrition, tissue building, immunological and anabolic activities.

Functions of tridosha**Normal functions of tridosha****Table no. 3: Normal Functions of Tridosha.**

Functions of Tridosha			
S.N.	Vata	Pitta	Kapha
1.	Utasaaha (enthusiasm)	Pakti (digestion)	Sthiratva (stability)
2.	Uchvaasa (expiration)	Ushma (body heat)	Snigdhatva (unctuousness)
3.	Nisvaasa (inspiration)	Darshana (vision)	Sandhibandhatva (joining property)
4.	Chesta (motor activity)	Kshuta (hunger)	Kshama (forbearance)
5.	Vega pravartanam (regulation of natural urges)	Trishna (thirst)	-
6.	Samyak gati of dhatu (regulation of proper movement)	Ruchi (taste)	-
7.	Patava of akasha (regulation of function of sense organ)	Prabha (lustre)	-
8.	-	Medha (memory)	-
9.	-	Dhee (intellect and perception)	-
10.	-	Shourya (strength)	-
11.	-	Mardava of tanu (softness of body).	-

According to Modern science the human body is made up of 26 elements. Their properties and functions are described below.

Earth and Human body - Property level

According to Ayurveda the human body is made up of dosha, dhatu and mala. According to modern science human body is made up of 26 elements. The properties of dosha, dhatu and mala and the 26 elements are mentioned below.

Earth and Human body - Structural level

The Human body is one form of existence in this Universe, which contains the earthly matter. So, naturally all the elements present in earth will be present in varied quantity in human body. The total no. of elements present in earth is 112. Among these only 26 elements are present in human body. Twenty six elements present in earth are responsible for the structure of the human body.

Table No. 4: Structural components of Earth and Human body at elemental level.

S.N.	Elements	Symbol	Atomic weight.	Approximate % in Earth crust	Approximate % in Human body
1.	Oxygen	O	8	46.6	65
2.	Hydrogen	H	1	14	9.5
3.	Carbon	C	6	0.03	18.5
4.	Nitrogen	N	7	Trace	3.3
5.	Calcium	Ca	20	3.6	1.5
6.	Sodium	Na	11	2.8	0.2
7.	Potassium	K	19	2.6	0.04
8.	Magnesium	Mg	20	2.1	0.1
9.	Phosphorous	P	15	0.07	1
10.	Sulphur	S	16	0.03	0.3
11.	Chlorine	Cl	17	0.01	0.02
12.	Iron	Fe	26	5	0.005
13.	Silicon	Si	14	27.7	Trace
14.	Aluminum	Al	13	6.5	Trace
15.	Manganese	Mn	25	0.1	Trace
16.	Fluorine	F	9	0.07	Trace
17.	Tin	Sn	50	Trace	Trace
18.	Vanadium	V	23	0.01	Trace
19.	Chromium	Cr	24	0.01	Trace
20.	Copper	Cu	29	0.01	Trace
21.	Boron	B	5	Trace	Trace
22.	Cobalt	Co	27	Trace	Trace
23.	Zinc	Zn	30	Trace	Trace
24.	Selenium	Se	34	Trace	Trace
25.	Molybdenum	Mo	42	Trace	Trace
26.	Iodine	I	53	Trace	Trace

These 26 elements are members in the periodic table, and they belong to S - block, P - block and d - block. Block wise distribution of elements are mentioned below.

S - block elements**Table No. 05: Showing S- block elements and their concentration in human body.**

Group – I	Group – II
Hydrogen - 9.5%	-
Sodium - 0.2	Calcium - 1.5
Potassium - 0.04	Magnesium - 0.1

P - block elements**Table No. 06: Showing P block elements and their concentration in human body.**

Group - III	Group - IV	Group - V	Group - VI	Group - VII
Boron - Trace	Carbon -18.5%	Nitrogen -3.3%	Oxygen - 65%	Fluorine – Trace
Aluminum-Trace	Silicon – Trace	Phosphorous-1%	Sulfur - 0.3%	Chlorine - 0.2%
-	Tin – Trace	-	Selenium -Trace	Iodine - Trace

d - block elements**Table No 07: Showing d block elements and their concentration in human body.**

V b	VI b	VII b	VIII	VIII	I b	II b
V-Trace	Cr - Trace	Mn- Trace	Fe - 0.005	Co - Trace	Cu - Trace	Zn - Trace
-	Mo- Trace	-	-	-	-	-

These elements are arranged in periodic table following some periodic law. These elements in periodic table are shown in figure No. 1

Periodic Table of the Elements

Legend:

- hydrogen (green)
- alkali metals (yellow)
- alkali earth metals (orange)
- transition metals (blue)
- poor metals (light blue)
- nonmetals (light green)
- noble gases (red)
- rare earth metals (grey)

Figure No. 1: Showing Long form Periodic Table of the Elements.

Periodic laws are based on some basic parameters. The basic parameters that are useful in the present study are mentioned below.

1. Atomic mass
2. Atomic size
3. Atomic volume
4. Melting point
5. Boiling point
6. Ionization energy
7. Electron affinity

The different values of above mentioned parameters (Atomic Size, Atomic Volume, Melting Point, Boiling Point, Ionization Energy and Electron Affinity) for 26 elements present in the human body are shown in table No.08

Table No. 08: Showing basic parametric values of elements present in human body.

S.N.	Elements	Mass g/mol	Atomic radius A ⁰	Molar volume cm ³ /mol	M.P. ⁰ C	B.P. ⁰ C	I.P. KJ/mol	EA. KJ/mol
1	Hydrogen	1.008	0.74		14.01	-252.62	1312	72.8
2	Boron	10.81	0.82	4.62	2030	2550	800	83
3	Carbon	12.00	0.77	3.4	3727	4833	1086	122.3
4	Nitrogen	14.00	0.75	17.3	-210	-195.8	1402	00
5	Oxygen	15.99	0.73	14	-218.8	-183	1313.7	140.9
6	Fluorine	18.99	0.72	17.1	-218.6	188.16	1680.8	328.6
7	Sodium	22.9	1.54	23.68	97.8	883	495.2	52.8
8	Magnesium	24.31	1.36	19.97	650	1107	737	00
9	Aluminum	26.98	1.18	10	659	2450	577	50.2
10	Silicon	28	1.11	11.4	1410	2680	786	133.6
11	Phosphorous	30.97	1.06	17	44.1	280	1012	74.3
12	sulphur	32.064	1.09	15.5	114	444.6	999.4	200.7
13	Chlorine	35.45	0.99	18.7	-101	-34.6	1255.5	348.5
14	Potassium	39.1	1.96	45.36	64	756	418.7	48.4
15	Calcium	40.08	1.74	25.96	838	1440	590	2.37
16	Vanadium	50.95	1.22	8.35	1900	3450	650.2	50.6
17	Chromium	52.01	1.17	7.23	1875	2665	652.3	64.3
18	Manganese	54.94	1.17	7.3	1245	2150	716.3	00

19	Iron	55.98	1.16	7.1	1536	3000	762.3	15.7
20	Cobalt	58.94	1.16	6.7	1495	2900	758.1	63.7
21	Copper	63.54	1.17	7.1	1083	2595	744.7	118.4
22	Zinc	65.38	1.25	9.2	419.5	906	906.7	00
23	Selenium	78.96	1.16	16.5	217	685	940.9	195
24	Molybdenum	95.94	1.39	9.4	2610	5560	694.5	71.9
25	Tin	118.89	1.41	16.3	231.8	2270	708	107
26	Iodine	126	1.33	25.7	113.9	185.2	1008	295.5

Properties of 26 elements

The elements are having two types of properties, physical and chemical. Common physical properties are

1. Colour
2. Taste
3. Odour
4. States of matter- Gas, Liquid, Solid
5. Melting point
6. Boiling point

Among six physical properties colour, taste and odour represents the inherent qualities presents in Panchamahabhuta. Colour represents the inherent quality of Agni mahabhuta, and can be measured by measuring d block elements which are generally coloured in nature. Taste represents the inherent quality of jala mahabhuta which can be expressed by solvent nature of water, which helps in the perception of taste. Odour represents the inherent character of Prithvi mahabhuta which can be observed in any elements present in earth because Prithvi mahabhuta has qualities of all previous mahabhuta.

Remaining three i.e. States of matter- Gas, Liquid, Solid, Melting point and Boiling point also represent the Physical qualities. These Physical properties are associated with their physical existence. All these three properties depend upon force of attraction between the atoms. Vata having least force of attraction hence exist in the gaseous form. Pitta is having more force of attraction than Vata but less than Kapha. Therefore Pitta exists in liquid form inside the human body. Kapha is having maximum force of attraction among Tridosha. Therefore Kapha molecules are almost solid. Melting point and Boiling points are generally low for Vata molecules and maximum for Kapha molecules and intermediate for Pitta molecules.

Chemical properties

Chemical properties describe the ability of a substance to form new substance either by reaction with other substance or by decomposition. So finally reactions and decompositions are the responsible factors for making and breaking of any substance. Substances are recognized and differentiated by their properties. No two substances are having identical chemical properties.

By this quality molecules are able to combine with other elements and to perform different functions. Apart from these qualities Atomic Mass, Atomic Radius, Atomic Volume, Electron Affinity and Ionization Energy are responsible factors for various properties of elements. On

close observation it is clear that force of attraction is main factor that is product of Mass and Gravity, determines difference in different parametric values of different elements.

Earth and Human body - Functional level

The functions are the ability to perform their actions. The actions depend upon many factors like Mass, Gravity, Internal arrangement and Basic composition. There are two types of functions, Normal and Abnormal. Normal functions can be observed when the concentration would be in the appropriate amount. Any deviation from appropriate concentration leads to abnormal functions. According to Ayurveda the human body is made up of dosha, dhatu and mala. Their functions are dependent on their bhautic compositions and their concentration. Similarly according to Modern science the human body is made up of 26 elements. The functions of dosha, dhatu and mala and the 26 elements are described below.

Normal functions of elements

According to Modern science human body contains 26 elements. Their normal functions are described under three main groups as S block elements P block elements d block elements.

Normal functions of S block elements

There are five elements belongs to this block are Hydrogen, Sodium, Potassium, Magnesium and Calcium present in the human body.

The main functions of Sodium ion is the contraction of muscle, the transmission of nerve impulse in the nerve fibers, maintaining the electrolyte composition of various body fluids and normal hydration.

The main functions of Potassium ion is the contraction of muscle, transmission of nerve impulse, maintaining the electrolyte composition of various body fluids, biochemical activities inside the cell, to regulate pH by exchange against for hydrogen ion.

Calcium is associated with vitamin D and phosphorous in the hardening of bones. It is also involved in the coagulation of blood and in impulse propagation and in muscle contraction. Calcium is also essential for the release of Acetylcholine from the pre ganglionic nerve terminals.

Magnesium has a role in several enzyme systems. Functionally, Mg^{2+} activates enzyme involved in

carbohydrate and protein metabolism. It is also important in neural transmission, myocardial function and neuromuscular activity. It is required for operation of $\text{Na}^+\text{K}^+\text{ATPase}$ pump system.

Normal functions of P block elements

Carbon, Hydrogen, Oxygen, Nitrogen, Phosphorous and sulphur, when combined together, result in the formations of carbohydrates, proteins and fats. Their functions can be observed in the form of same. They are mainly nutritive source. They provide energy after digestion for cellular functions.

Phosphorous plays an important role in buffering system of the body. Serum inorganic phosphate has an important regulatory role in erythrocyte – glucose metabolism.

The functions of Sulphur can be observed in the form of sulphur containing amino acid, Cysteine and Methionine. Sulphur is mostly present in the organic form. Phosphoadenosine phosphosulphate is the active sulfate utilized for several reactions e.g. synthesis of glycosaminoglycans, detoxification mechanism. The sulphur - containing amino acid Methionine is actively involved in transmethylation reactions.

Fluorine is found in the form of Fluoride, essential for proper development of bones. It inhibits the activities of certain enzymes. Fluorine increases hardness of bones and teeth.

Chlorine is present as chloride ion in the body. Chloride is the major extracellular anion and is principally responsible for maintaining proper hydration, osmotic pressure, and normal cations - anions balance in the vascular and interstitial fluid compartment.

Chloride ion serves two functions in the body fluids. Together with sodium ion it is responsible for maintenance of osmotic balance between the different body fluids. Being able to pass freely through all membrane, it is responsible for maintenance of charge balance between intracellular and extracellular fluids.

Iodine is a constituent of thyroxin and triiodothyronine. It is stored in thyroid as thyroglobulin. The thyroid gland contains large amount of iodine (0.06%) almost all of which is firmly bound to the protein. Iodine is essential for synthesis of thyroid hormones. Iodine increases mitotic division of cells. Iodine may also be used as an expectorant. It may be used as a fibrolytic agent in syphilis, leprosy.

Silicon plays an important role in calcification of bone and in glycosaminoglycans. It helps in metabolism in cartilage and connective tissue.

Selenium along with vitamin E prevents the development of hepatic necrosis and muscular dystrophy. It is involved in maintaining structural integrity of biological

membrane. Selenium prevents lipid peroxidation and protects the cell against the free radicals, including superoxide (O_2^-).

The functions of Boron, Aluminium and Tin are not known in detail.

Normal functions of d block elements

Copper is an essential element for hematopoiesis, connective tissue metabolism, maintenance of vascular, neural, and skeletal integrity and humoral immunity. It is a component of the ferroxidase enzyme, which regulates the rate of iron uptake by transferrin. It is also component of cytochrome oxidase enzyme involved in the final step for the reduction of molecular oxygen. A copper containing enzymes, tyrosinase, is involved in the initial stages of production of melanin, a pigment that decides colour of human skin.

Zinc is mainly present within the red cells, in the enzymes carbonic anhydrase and in the pancreas (where it may play a role in prolongation of the action of insulin). It is mainly absorbed through duodenum. It binds to all plasma proteins. Albumin facilitates its transports to and from tissue. It is present in all tissues, with very high concentration in the prostrate and choroid of the eye. Zinc is found to be necessary for the action of at least 20 enzymes. Zinc mainly helps in the formation of carbonic acid from carbon dioxide and water inside red blood cells.

Iron is essential for the formation of hemoglobin in red blood cells. It is necessary for the tissue oxidation.

Cobalt stimulates the production of the hormone erythropoietin, which promotes erythropoiesis. Prolonged administration of cobalt is toxic as it results in polycythemia (increased RBC in the blood).

Chromium promotes several biochemical functions. In association with insulin, Cr promotes the utilization of glucose. It is a component of protein namely chromodulin, which facilitates the binding of insulin to cell receptor sites. It lowers the serum cholesterol level. It is involved in lipoprotein metabolism. It decreases low density lipoprotein and increases high density lipoprotein thus promotes health. It is believed that Chromium promotes the transport of amino acids into the cell (Heart, lungs). Trivalent chromium is a constituent of glucose tolerance factor which binds to and potentiates insulin.

The Manganese (II) enzymes produced in the liver, convert nitrogenous waste product into urea. It also acts as an essential cofactor in the functioning of other enzymes. It is essential for the functioning of mitochondria. It is required for the synthesis of mucopoly-saccharides of cartilage. It also plays a role in protein synthesis, oxidative phosphorylation, fatty acid metabolism and cholesterol synthesis.

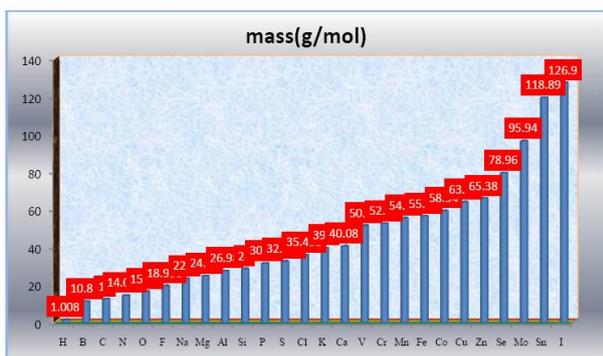
Molybdenum is a constituent of oxidase enzyme (Xanthine oxidase), aldehyde oxidase and sulfite oxidase. Nitrite reductase (containing Mo) is a plant enzyme, required for nitrogen fixation. Some workers have reported that it decreases the mobilization and utilization of copper in the body.

The functions of vanadium are not known in detail till now.

DISCUSSION

The total number of elements present in earth is 112 and only 26 are present in human body as mentioned in table No. 08. These 26 elements are members of periodic table in three blocks i.e. S-block, P-block, and d-block. The name of elements and their concentration are mentioned in table No.05, 06, and 07. The essential periodic properties of these elements are also mentioned in table No.08. These basic parameters are Mass, Volume, Size, Melting Point, Boiling Point, Ionization Energy and Electron Affinity. The Human body is made up of dosha, dhātu and mala. Dosha contributes functional aspects of body. According to Ayurveda among dosha mass of Kapha is highest, Vata has lowest and Pitta has intermediate. Size of Vata molecule is largest and Kapha molecule is lowest and Pitta is intermediate. The force of attraction is maximum for Kapha minimum for Vata and intermediate for Pitta. The comparative relationship among 26 elements on the basis of above mentioned parameters are explained below.

1. Atomic mass

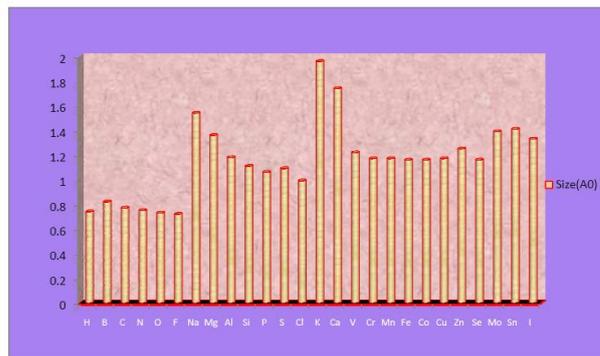


Graph No. 1: Showing ascending order of mass of elements present in human body.

The ascending orders of atomic mass of 26 elements present in the human body are shown in Graph No.1. Mass of S block element is least in a respective period and maximum for P block. d block elements are having intermediate mass. In Ayurveda, among Tridosha Vayu is considered as the most light (Laghu) and Kapha as the most heavy (Guru), even Pitta is considered as Laghu but it is liquid (drava) in nature. So Pitta can be considered as heavier than Vata. On mass basis S block elements can be considered as Vata except Hydrogen, because properties of Hydrogen are different from S block elements. P block elements can be considered as Kapha except Iodine because properties of Iodine are similar to

S block elements. d block elements can be considered as Pitta.

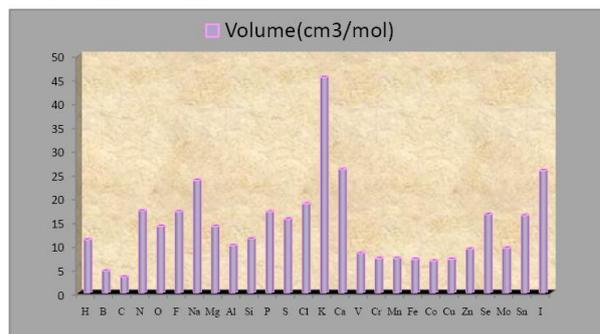
2. Atomic size



Graph No. 2: Showing size of elements present in human body.

The graphical representation of atomic size of 26 elements present in the human body is shown in Graph No.2. Size of Vata is maximum and minimum for Kapha, Pitta having intermediate size. This is due to the force of attraction between molecules in Vata, Pitta and Kapha. The force of attraction depends upon mass and distance between the particles. The force of attraction is least for Vata, maximum for Kapha and intermediate for Pitta. Size of S block element is largest and smallest for P block elements in their respective period. d block elements having intermediate size between S block and P block elements. On size basis S block elements can be compared as Vata, d block elements can be compared as Pitta and P block elements can be compared as Kapha.

3. Atomic volume

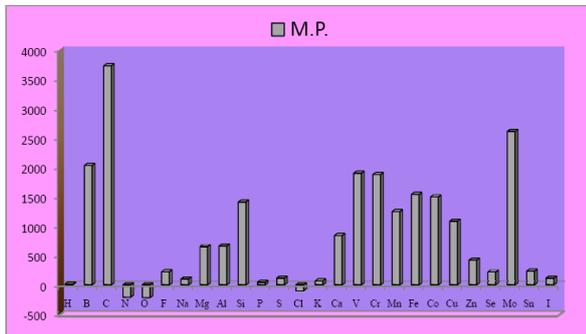


Graph No. 3: Showing Volume of elements present in human body.

The graphical representation of atomic volume of 26 elements present in the human body is shown in Graph No.3. Generally atomic volume of S block elements are more than P block elements and d block elements are having intermediate volume in their respective period. According to Ayurveda volume of Vata is maximum, minimum for Kapha and intermediate for Pitta. It is due to the force of attraction between the molecules of Vata, Pitta and Kapha. Attractive force for Kapha is maximum, so volume is minimum. Similarly the attractive force between Vata molecules is minimum, so volume is

maximum. For Pitta molecules attractive force is intermediate between Vata and Kapha, so volume is also intermediate. Therefore on volume basis S block elements can be compared as Vata, d block elements as Pitta and P block elements as Kapha.

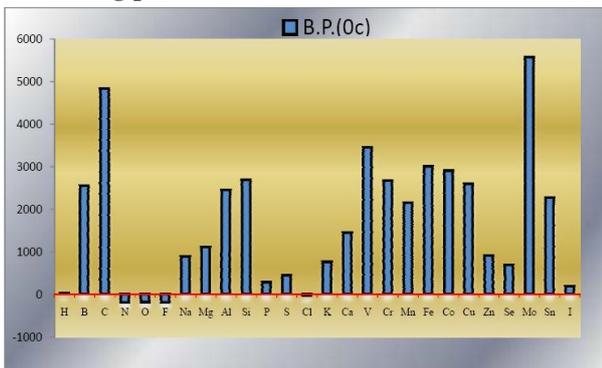
4. Melting point



Graph No. 4: Showing Melting point of elements present in human body.

The graphical representation of melting point of 26 elements present in the human body is shown in Graph No.4. S block elements are larger in size and having less force of attraction than P block elements. Therefore S block elements having less Melting point than P block elements. d block elements are smaller than S block elements and having more attractive force. Therefore P block elements having more Melting point than S block elements. Therefore on Melting point basis S block elements are considered as Vata, P block elements as Kapha and d block elements as Pitta.

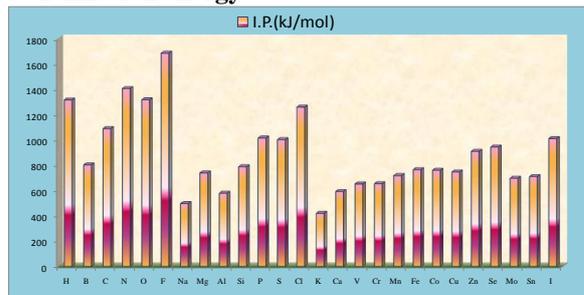
5. Boiling point



Graph No. 5: Showing Boiling point of elements present in human body.

The graphical representation of boiling point of 26 elements present in the human body is shown in Graph No.5. S block element are larger in size than P block elements. So boiling point of P block element is higher than S block elements. d block elements are smaller in size than S block elements in respective period. So boiling point of d block elements are higher than S block elements. Therefore on boiling point basis, S block elements are considered as Vata, P block elements as Kapha and d block elements as Pitta.

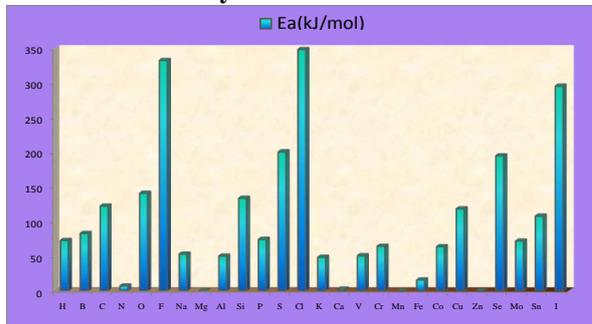
6. Ionization energy



Graph No. 6: Showing Ionization energy of elements present in human body.

The graphical representation of Ionization energy of 26 elements present in the human body is shown in chart No.6. Generally ionization energy is maximum for P block elements and minimum for S block elements in their respective period. d block elements are having more ionization energy than S block element. Therefore on ionization energy basis S block elements can be compared as Vata, P block elements as Kapha and d block elements as Pitta.

7. Electron affinity



Graph No. 7: Showing Electron affinity of elements present in human body.

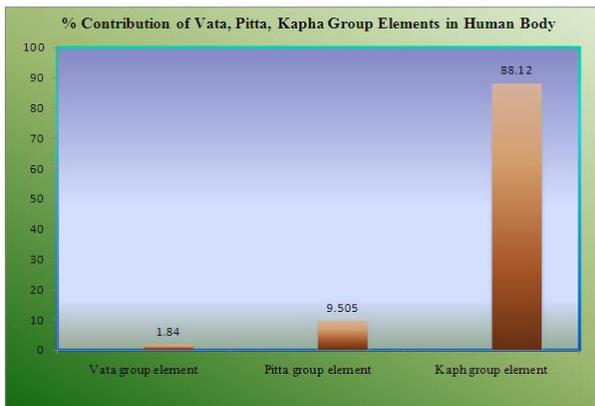
The graphical representation of Electron affinity of 26 elements present in the human body is shown in Graph No.7. The electron affinity is a measure of attraction that an atom has for the electrons. Electron affinity of an atom measures the tightness with which it binds an additional electron to itself. Among Tridosha Kapha has maximum attraction capacity and Vata has minimum attraction and Pitta has intermediate attraction capacity. Generally the electron affinity for P block element is higher than S block element and even d block element have more electron affinity than S block element. Therefore on the basis of electron affinity P block elements can be considered as Kapha which has maximum attraction capacity. S block elements as Vata having least attraction capacity, and d block elements as Pitta having intermediate attraction capacity.

On the basis of above mentioned basic parametric qualities, the total elements present in human body can be classified in three groups as Vata group elements, Pitta group elements and Kapha group elements. These elements in different groups are shown below.

Table No. 09: Showing division of elements into Vata, Pitta and Kapha group elements.

Vata group elements		Pitta group elements		Kapha group elements	
Sodium	Potassium	Hydrogen	Vanadium	Boron	Aluminium
Calcium	Magnesium	Chromium	Manganese	Carbon	Silicon
Iodine	-	Iron	Cobalt	Nitrogen	Phosphorous
-	-	Copper	Zinc	Tin	Oxygen
-	-	Molybdenum	-	Sulphur	Selenium
-	-	-	-	Fluorine	Chlorine

According to percentage contribution, the graphical representation of Vata group elements, Pitta group elements and Kapha group elements in the human body is shown below.



Graph No. 8: Showing % contribution of Vata, Pitta, Kapha elements in human body

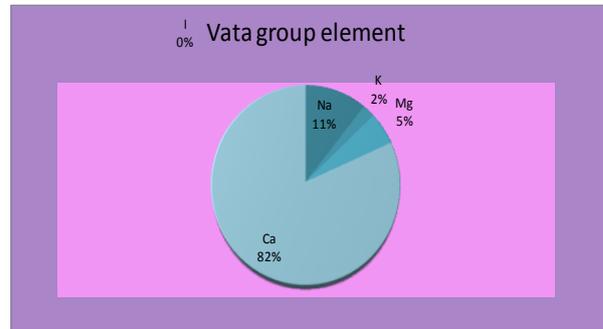
The above graph shows that Kapha group elements contribute 88.12%, Pitta group elements contribute 9.505% and Vata group elements contribute 1.84% of the human body weight.

There are five elements in Vata group elements. These are Sodium, Potassium, Magnesium, Calcium and Iodine.

There are nine elements in Pitta group elements. These are Vanadium, Chromium, Manganese, Iron, Cobalt, Copper, Zinc, Molybdenum and Hydrogen. Among these elements only concentration of Hydrogen (9.5%) and Iron (0.005%) are known. Rests of the elements are present in trace amounts.

There are twelve elements in Kapha group elements. Among these only six elements (Oxygen - 65%, Carbon - 18.5%, Nitrogen - 3.3%, Phosphorous - 1%, Sulphur - 0.3%, Chlorine - 0.2%) are mainly responsible. Remaining Six (Boron, Fluorine, Aluminium, Silicon, Tin, Selenium and Iodine) elements are present in trace amounts.

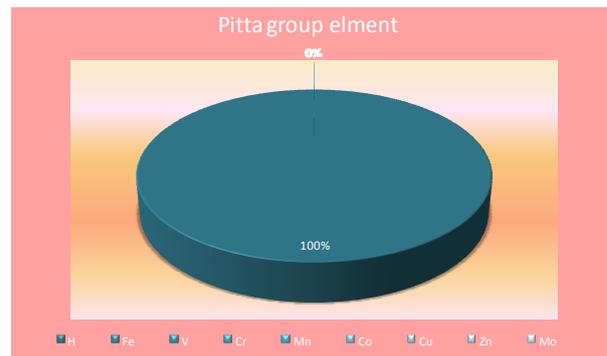
The distributions of elements present in the human body as Vata are shown below.



Graph No. 9: Showing % of elements present in Vata.

The above graph shows that 82% of Vata is contributed by Calcium, 11% is contributed by Sodium, nearly 5% by Magnesium, 2% by Potassium and rest by Iodine. Most of the Calcium, Sodium, Potassium and Magnesium are present in bone. According to Ayurveda the main site of Vata is considered as Asthi (bone). These similarities in concepts show strong intimate relation in Ayurveda as well as in Modern science.

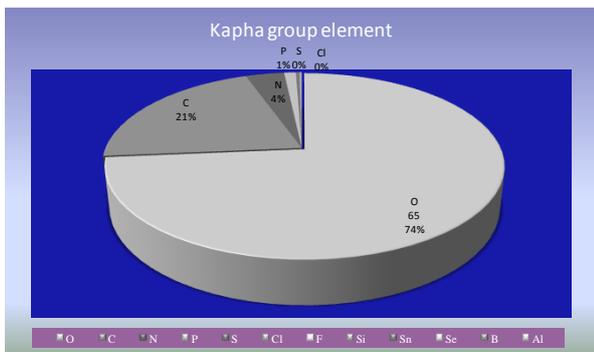
The distributions of elements present in the human body as Pitta are shown below



Graph No. 10: Showing % of elements present in Pitta.

The above chart shows that pitta is mainly contributed by Hydrogen (9.5%) and Iron (0.005%). Rests of the elements are present in trace amounts and shows the functional similarity with pitta as explained in Ayurveda.

The distributions of elements present in human body as kapha are shown below



Graph No. 11: Showing % of elements present in Kapha.

Above graph shows that Kapha mainly contains six elements. 74% of Kapha is contributed by Oxygen, 21% by Carbon, 4% by Nitrogen, 1% by Phosphorous, Chlorine in 0.3% and Sulphur as 0.2% in the human body. Remaining six like Boron, Aluminium, Fluorine, Silicon, Selenium and Tin are present in trace amounts.

These 26 elements can be equivalent to Vata, Pitta and Kapha. The bhautic composition of Vata is Vayu and Akasha. Pitta has Agni and Kapha is made up of Jala and Prithvi mahabhuta. The distribution of elements at bhuta level is shown below.

Table No. 10: Showing distribution of elements at Panchamahabhuta level.

Akasha	Vayu	Agni	Jala	Prithvi
Potassium	Sodium	Hydrogen	Oxygen	Carbon
-	Calcium	Chromium	Nitrogen	Phosphorous
-	Magnesium	Iron	Chlorine	Sulphur
-	Iodine	Copper	Fluorine	Silicon
-	-	Molybdenum	-	Selenium
-	-	Vanadium	-	Tin
-	-	Manganese	-	Boron
-	-	Cobalt	-	Aluminium
-	-	Zinc	-	-

Therefore 26 elements can be compared at bhautic level. The division of these elements into Panchamahabhuta is based on their functions and properties mainly. According to Ayurveda the human body is made up of Panchamahabhuta. The structures, properties and functions of dosha, dhatu and mala are basically similar to structures, properties and functions of 26 elements present in the human body as well as in the earth.

Some basic parameters are selected for the scientific and internationally acceptance of the study. These parameters are Atomic mass, Atomic volume, Atomic radius, Melting point, Boiling point, Ionization energy and Electron affinity. The basic comparative properties and functions of Panchamahabhuta and 26 elements are explained on above mentioned parameters. These parameters are also applied to compare the structure, properties and functions of dosha along with corresponding structure, properties and functions of twenty six elements. These parameters are also used to explain the basic concepts of dosha.

These 26 elements are included into three blocks in the periodic table into S block, P block and d block. The S block elements are commonly called metals, P block elements are commonly called non - metals and having just opposite qualities of each other. The d block elements are having intermediate qualities of S block elements and P block elements.

Among Tridosha concept, Vata and Kapha are having just opposite qualities except Sheeta quality. Pitta has some qualities of Jala mahabhuta and predominantly of

Agni mahabhuta. The structures, properties and functions of Vata have strong similarity with S block elements i.e. Sodium, Potassium, Calcium, Magnesium along with one P block element i.e. Iodine.

The structures, properties and functions of Kapha have strong similarity with P block elements i.e. Boron, Aluminium, Carbon Silicon, Tin, Nitrogen, Phosphorous, Oxygen, Sulphur, Fluorine, Chlorine, along with one S block element (Hydrogen) respectively.

The structure, properties and functions of d block elements like Vanadium, Chromium, Manganese, Iron, Cobalt, Copper, Zinc, and Molybdenum and one S block element i.e. Hydrogen in ionic form having strong similarity with the structure, properties and functions of Pitta.

In the periodic table Hydrogen is present along with S block elements, but performs functions of Pitta in ionic form and when combine with P block elements perform functions of Kapha.

All the S block elements are compared with Vata except hydrogen along with one P block element i.e. iodine.

All the P block elements are compared with Kapha except iodine. All the d block elements are compared with Pitta along with one S block element i.e. Hydrogen.

P block elements are mainly compared with dhatu and mala because dhatu are made up of mainly Jala and Prithvi mahabhuta. Mala are mainly by product of dhatu.

Therefore mala is also compared with P block elements except iodine.

CONCLUSION

- ❖ Structurally and functionally Vata is made up of five elements i.e. Sodium, Potassium, Calcium, Magnesium and Iodine.
- ❖ Dominance of Calcium is mainly found in Vata.
- ❖ Structurally and functionally Pitta is made up of nine elements i.e. Vanadium, Chromium, Manganese, Iron, Cobalt, Copper, Zinc, Molybdenum and Hydrogen.
- ❖ Dominance of Hydrogen is mainly found in Pitta.
- ❖ Kapha is made up of twelve elements i.e. Boron, Aluminium, Carbon, Silicon, Tin, Nitrogen, Phosphorous, Oxygen, Sulphur, Selenium, Fluorine and Chlorine.
- ❖ Kapha mainly contains six elements i.e. Oxygen, Carbon, Nitrogen, Phosphorous, Chlorine, and Sulphur.
- ❖ Vata is union of certain qualities and their functions are contribution of combined functions of S block elements except Hydrogen.
- ❖ Pitta is union of certain qualities and their functions are contributions of combined functions of d block elements along with Hydrogen.
- ❖ Kapha is union of certain qualities and their functions are contributions of combined functions of P block elements except Iodine.
- ❖ Vata contributes 1.84% of human body weight.
- ❖ Pitta contributes 9.505% of human body weight.
- ❖ Kapha contributes 88.12% of human body weight.
- ❖ Vata and Kapha have opposite qualities that can be expressed in the form of functions of S block elements and P block elements.
- ❖ Vata is a form of Kinetic energy.
- ❖ Pitta is a form of energy helps in conversion of mass into energy and vice versa, and from one form of energy to another form of energy.
- ❖ Kapha is a form of Potential energy.
- ❖ Kapha can be converted into Vata by the help of Pitta.
- ❖ Mainly P block elements contribute structural component of human body.
- ❖ Vata, Pitta, and Kapha can be measured in laboratory.

REFERENCES

1. Cha.sha.2/37.
2. Panchabhutaviveka.
3. Su. Sha. 1/3-7.
4. Su. Sha. 1/9.
5. Nyaya darshana 4/ 15-22.
6. Cha. Su. 1/44.
7. Cha. Su. 1/44.
8. Cha. Su. 1/50.
9. Su. Sha. 1/27.
10. Cha.Sha.1/27.
11. Su. Sha. 1/28.
12. Su. Sha 1/26.
13. A. H. Su. 9/5-9.
14. Cha. Sha. 1/29.
15. Cha. Su. 26/11.
16. Amarakosha 2/6/70.
17. Garbhopanishat.
18. Amarakosha 2/6/71.
19. Garbhopanishat.
20. Cha.Sha.5/4.
21. Cha. Sha. 5/7.
22. Cha. Sha.5/3.
23. Cha. Sha.5/3.
24. Cha. Sha.7/16.
25. Cha. Vi. 8/95.
26. Su. Sha. 5/79.
27. Ch. Chi.15/12-14.
28. Cha. Chi. 15/4.
29. Rasapradeep.
30. Cha. Su. 30/12.
31. Cha. Su. 30/12.
32. Cha. Su. 30/12.
33. Cha. Su. 30/12.
34. Cha. Vi.5/3.
35. Cha. Vi.5/3.
36. Cha. Su. 26/10.
37. Cha. Su. 26/38-40.
38. Dravya guna Vijnan Page No. 71.
39. Cha. Su. 26/57-58.
40. Cha. Su. 26/57-58.
41. Cha. Su.26/67.
42. Cha. Su. 26/43.
43. Cha. Su. 25/36.
44. Hemadri.
45. Hemadri.
46. Bhavprakasha.
47. Hemadri.
48. Su. Su. 46/522.
49. Hemadri.
50. Rasa Vaisheshika 3 sutra 113.
51. Hemadri.
52. Prashastapada Bhashyakara.
53. Bhavprakasha.
54. Hemadri.
55. Hemadri.
56. Hemadri.
57. Hemadri.
58. Hemadri.
59. Hemadri.
60. Hemadri.
61. Hemadri.
62. Hemadri.
63. Hemadri.
64. Hemadri.
65. Hemadri.
66. Hemadri.
67. Hemadri.
68. Hemadri.
69. Su. Su.46/533.
70. Cha. Su. 28/ 3.
71. Su. Su. 14/13.

72. Su. Su. 42/3.
73. Dalhan on Su.Su.42/7.
74. A.H. Su.14/4-6.
75. Su. Su 42/9.
76. Su. Su 42/9.
77. Su. Su 42/9.
78. Su. Su 42/9.
79. Cha. Su. 22.
80. Cha.Su.23.
81. The primer of Ayurveda prof. P.H. Kulkarni 22nd edition.
82. Su.Su.42/11.
83. Su.Su.42/11.
84. Su.Su.42/12.
85. Su.Su.42/12.
86. Su.Su.42/13.
87. Su.Su.42/13.
88. Anne. E. Egger.
89. www.geography4kids.com, Date 7/8/08.
90. www.geography4kids.com, Date 7/8/08.
91. www.geography4kids.com, Date 7/8/08.
92. www.geogoraphy4kids.com, date 7/8/08.
93. Text book of inorganic chemistry, Sharma and Puri.
94. Text book of inorganic chemistry, Sharma and Puri
95. Text book of inorganic chemistry, Sharma and Puri, 28th edition.
96. Text book of inorganic chemistry, Sharma and Puri, Page No. 73.
97. Text book of inorganic chemistry, Sharma and Puri, Page No. 399.
98. Text book of inorganic chemistry, Sharma and Puri, Page No. 399.
99. Text book of inorganic chemistry, Sharma and Puri, Page No. 86.
100. Text book of inorganic chemistry Sharma and Puri, Page No. 81.
101. Biological Thermodynamics Page No. 9.
102. Biological Thermodynamics Page No. 23.
103. Text book of inorganic chemistry, Sharma and Puri.
104. Text book of inorganic chemistry, Sharma and Puri, Page No.419 & 449.
105. Text book of inorganic chemistry, Sharma and Puri, Page No.479, 524, 581, 642, 681.
106. Text book of inorganic chemistry, Sharma and Puri, Page No777, 841.
107. Cha. Sha 3/3.
108. Su. Sha 1/21.
109. A.S. Su. 20/3.
110. Su.Su.21/5.
111. Su.Su.21/5.
112. Amarakosha 2/6/62.
113. Su.Su.21/5.
114. Su. Su. Chakrapani 15/8.
115. Sha.Purvakhanda5/24.
116. Su. Su. Chakrapani 15/8.
117. Principle of Anatomy and Physiology (Tortora) Chapter 2, Page No.30.
118. Principle of Anatomy and Physiology (Tortora) Chapter 2, Page No.30.
119. Principle of Anatomy and Physiology (Tortora) Chapter 2, Page No.30.
120. Human Biology, Chapter 2, Table 2-1.
121. Biochemistry, Page No. 9.
122. Biochemistry, Page No. 43.
123. Biochemistry, Page No. 43.
124. Biochemistry, Page No. 28.
125. Biochemistry, Page No. 569.
126. Tortora, chapter-2, page- 70.
127. Tortora.
128. Cha. Su.1/59 – 61.
129. Purushavichaya, Page. No. 153.
130. Su. Su. 14/22.
131. Su.Su.14/9.
132. Dalhan on Su. Su 15/10.
133. Dalhan on Su. Su 15/10.
134. Cha.Chi.15/24.
135. Su. Sha. 2/13.
136. Su.Su.15/8.
137. A.H. Su. 11/1, 2, 3.
138. Su. Su. 15/7.
139. Su. Su 15/18.
140. Su. Su 15/11.
141. Su. Su 15/18.
142. Su. Su 15/11.
143. Su. Su 15/18.
144. Su. Su. 15/11.
145. Su. Su 15/19.
146. Su. Su 15/13.
147. Su. Su 15/19.
148. Su. Su 15/13.
149. Su. Su 15/19.
150. Su. Su 15/13.
151. Su. Su 15/19.
152. Su. Su 15/13.
153. Su. Su 15/19.
154. Su. Su 15/13.
155. Su. Su 15/13.
156. Su. Su 15/19.
157. Su. Su 15/19.
158. Su. Su 15/13.
159. Su. Su 15/20.
160. Su. Su 15/15.
161. Su. Su 15/20.
162. Su. Su 15/15.
163. Su. Su 15/20.
164. Su. Su 15/15.
165. Biochemistry, Page. No. 09.
166. Biochemistry, Page. No. 43.
167. Biochemistry, Page. No. 43.
168. Biochemistry, Page. No. 29.
169. Biochemistry, Page. No. 69.
170. Inorganic Pharmaceutical 8/3.
171. Inorganic Pharmaceutical 8/3.
172. Inorganic Pharmaceutical 8/5.
173. Inorganic Pharmaceutical 8/5.
174. Inorganic Pharmaceutical 11/3.
175. Inorganic Pharmaceutical 8/4.
176. Inorganic Pharmaceutical 8/6.
177. Biochemistry, Chapter 18, Page. No. 413.

178. Inorganic Pharmaceutical 8/6.
179. Inorganic Pharmaceutical 11/1.
180. Inorganic Pharmaceutical 8/3.
181. Inorganic Pharmaceutical 8/5.
182. Inorganic Pharmaceutical 8/4.
183. Inorganic Pharmaceutical 8/4.
184. Inorganic Pharmaceutical 8/4.
185. Inorganic Pharmaceutical 8/6.
186. Inorganic Pharmaceutical 8/6.
187. Biochemistry chapter 18, Page No. 416.
188. Biochemistry chapter 18, Page No. 416.
189. Inorganic Pharmaceutical 8/4.
190. Biochemistry chapter 18, Page No. 410.
191. Inorganic Pharmaceutical, Chapter 11, Page. No. 11.6.
192. Biochemistry, Chapter 18, Page. No. 417.
193. Biochemistry, Chapter 18, Page. No. 420.
194. Biochemistry, Chapter 18, Page. No. 422.
195. Biochemistry, Chapter 18, Page. No. 420.
196. Harpers Biochemistry Chapter-54, Table No. 54-7 Page. No.659.
197. Biochemistry, Chapter 18, Page. No. 420.
198. Biochemistry, Chapter 18, Page. No. 418.
199. Biochemistry, Chapter 18, Page. No. 421.
200. Harrison, Page. No. 2591, Symptoms No. 8-11.
201. Harrison's Medicine, Page. No. 469, 15th edition.
202. Text book of inorganic chemistry.
203. Harrison's Medicine Page. No. 469.
204. Harrison's Medicine Page. No. 2591.
205. Harrison's Medicine Page. No. 2591.
206. Text book of inorganic chemistry.
207. Inorganic pharmaceutical chemistry, 7th edition Dr. K.G. BOTHARA, Mineral metabolism, Chapter 11, Page No. 11.6.
208. Harrison's Medicine Page. No. 2591.
209. Review of Medical Physiology, Chapter 9, Page No. 176.
10. Principles of inorganic chemistry, Sharma, Puri and Kalia, Vallabh publication, 28th edition.
11. Harrison's Principles of internal medicine, 15th edition, Mc Graw Hill publications.
12. Charaka Samhita - Part I, Vidyotini Hindi commentary, Dr. Kashinath Pandey and Dr. Gorakhnath Chaturvedi, Chaukhambha Publication.
13. Charaka Samhita - Part II, Vidyotini Hindi commentary, Dr. Kashinath Pandey and Dr. Gorakhnath chaturvedi, Chaukhambha publication.
14. Sushruta Samhita Ayurveda TattvaSandipika, Hindi Commentary, 11th Edition, 1997. Editor, Kaviraja Ambikadutta Shastri, Chaukamba Sanskrit Bhavana Varanasi.
15. Dalhana, Sushruta Samhita, Nibandha Sangraha Sanskrit Commentary, Editor Jadavaji Trikamaji Acharya, Reprint 1999. Chaukambha Surabharati Prakashana, Varanasi.
16. Ashtanga Hridaya, Vidyotini Hindi commentary, Kaviraja Atrideva Gupta, and Vaidya. Yadunandan Upadhyaya, Chaukhambha publication, 8th edition 1985.
17. Ashtanga Samgraha, of srimada vriddhavaagbhat (sutrsthana) Edited with Saroj hindi commentary by Dr. Ravi Dutta Tripathi, Chaukhambha publication, 1996.
18. DravyaGuna Vijnana, Vol-1 (Basic Concepts), Prof. P.V. Sharma, Chaukhambha Bharti Academy Publication - 2000.
19. Padartha Vijnana, Dr. V.K. Dvivedi, Krishnadas Academy Varanasi, 1st edition - 1999.
20. Purushavichayah, Prof. Vinayaka Jayanada Thakur A.M.S. (B.H.U.), published by basic principle deptt. I.P.G.T.and R.Gujraat Ayurveda university Jaamnagar- 1984.
21. Nyaya darshana, Acharya Dhundhiraj Shastri, Chaukhambha Sanskrit Sansthan, 5th edition – 2001.
22. Bhavprakash.
23. The primer of Ayurveda, Prof. Dr. P.H. Kulkarni, 22nd edition, Sataguru Publications.
24. Amarakosha, Pandita Haragoinda Shastri, Chowkhambha Sanskrita Sansthana, Varanasi, U.P.

BIBLIOGRAPHY

1. Biological Thermodynamics, DONALD T. HAYNIE, Cambridge University Press Publication, first south Asian edition - 2007.
2. Human Biology Sandra S. Gottfried, Mosby Publication, 1st edition.
3. Review of Medical Physiology, William F. Ganong, Mc Graw Hill publication, 22nd edition.
4. Science Encyclopedia, The Dorling Kindersley, Revised edition 1997.
5. Text book of Medical Physiology, Guyton and Hall, Elsevier publication, 11th edition.
6. Principle of Anatomy and Physiology Tortora and Derrickson, Wiley publication, 11th edition.
7. Harpers Biochemistry, Lange publication, 25th edition.
8. Biochemistry, U. Satyanarayan and U. Chakrapani, books and allied (P) Ltd. publication, 3rd revised edition.
9. A hand book of Inorganic Pharmaceutical chemistry, Dr.K.G.Bothara, Nirali Prakashan, 7th edition.