Appendix A

Tables A.1, A.2, A.3, A.4, A.5, A.6, A.7, A.8, A.9, A.10 and A.11

Table A.1 Calculation of weakly working hours

	Male	Female
Average working hrs. as per questionnaire	8 h	8 h
Resting period during the working hrs.	1 h (Lunch)	1.43 h (Lunch)
Time consumed in drinking water, tobacco chewing and smoking	0.75 h	0.50 h
Toilet and other activities	0.50 h	0.50 h
Total resting hrs.	2.25 h	2.43 h
Real working hrs. (Average working hrs. − Total resting hrs.)	8−2.25 = 5.75 h	8−2.43 = 5.57 h
Total working days in a weak (4–5 days)	4.5 days	4.5 days
Average working hrs. per day	$\frac{\text{Total working days in a weak} \times \text{Real working hrs.}}{7}$	
	4.5 × 5.75 / 7 = 3.70 h	4.5 × 5.57 / 7 = 3.58 h

Excerpts of the results obtained during the studies (the work was further extended by Dr. Prasanna K. Ghosh, in the I.A.Sc., Allahabad for his Ph.D Thesis under the guidance of the author)

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Table A.2 Nutritional analysis for males (No. 30, age: 20–40)

S. No.	Age (Yr.)	Wt. (Kg)	Prot. (gm)	Fat (gm)	Carb. (gm)	Ca (mg)	Fe (mg)	Mg (mg)	Na (mg)	K (mg)
1.	26	50	64.96	18.60	416.68	285.03	24.25	725.91	2432.07	1209.70
2.	27	47	67.20	19.05	436.68	266.04	24.11	762.23	2509.54	1225.37
3.	32	49	64.25	18.95	421.71	263.44	23.69	734.93	2547.18	1152.8
4.	32	49	64.13	17.70	406.95	268.50	23.62	724.32	2592.19	1301.97
5.	29	55	70.15	19.80	461.96	277.46	25.30	813.65	2628.15	1231.85
6.	33	42	71.18	21.99	393.45	284.54	23.39	679.51	2665.50	1167.50
7.	30	37	56.61	15.72	355.91	255.42	21.55	630.29	2701.26	1106.71
8.	35	45	73.19	19.23	467.54	287.10	26.31	819.58	2756.08	1404.76
9.	28	55	70.90	19.15	453.31	291.07	25.87	790.92	2834.25	1382.87
10.	29	63	69.11	18.92	448.20	273.84	24.89	784.04	2866.49	1270.60
11.	33	47	71.28	23.05	393.49	282.08	23.30	677.57	2900.69	1163.77
12.	35	44	63.24	18.82	410.17	255.34	22.96	709.50	2507.57	1169.44
13.	33	57	66.87	19.44	431.06	254.94	25.70	758.75	2988.76	1296.84
14.	35	53	68.98	19.69	454.85	270.38	24.91	800.97	3060.48	1218.12
15.	33	65	67.72	19.85	440.16	271.96	24.54	770.16	3140.43	1245.64
16.	28	52	73.91	22.29	406.93	292.00	24.29	703.87	3219.24	1224.60
17.	26	47	66.98	18.78	428.70	271.13	24.21	744.95	2434.15	1268.61
18.	27	56	68.08	19.96	437.18	273.51	24.72	762.84	2513.78	1273.83
19.	28	64	67.99	17.94	437.59	281.12	25.10	765.31	2592.35	1258.39
20.	35	50	65.08	18.57	419.74	262.87	23.55	730.5	2665.95	1193.72
21.	35	50	73.07	23.94	407.34	281.31	23.72	704.2	2745.98	1223.79
22.	30	54	64.95	17.57	415.44	272.81	23.92	722.05	2825.75	1215.71
23.	28	54	70.75	22.52	399.16	270.75	22.84	689.48	2897.34	1122.01
24.	35	35	68.49	21.36	379.43	264.42	21.89	650.71	2974.24	1098.18
25.	36	55	69.02	20.03	447.85	284.84	25.48	785.21	3066.59	1300.47
26.	27	45	63.24	17.46	412.11	272.21	23.35	713.68	3138.00	1197.87

(continued)

Table A.2 (continued)

S. No.	Age (Yr.)	Wt. (Kg)	Prot. (gm)	Fat (gm)	Carb. (gm)	Ca (mg)	Fe (mg)	Mg (mg)	Na (mg)	K (mg)
27.	29	43	62.11	17.51	408.54	253.05	22.52	709.57	3211.87	1117.71
28.	29	49	73.54	19.24	460.93	352.41	29.52	812.54	2449.37	1421.18
29.	31	52	64.82	18.26	415.49	271.35	23.86	720.17	2511.04	1219.42
30.	29	49	60.64	17.9.0	390.98	252.76	21.81	670.45	2584.17	1160.59

S. No	Carotene (μg)	Thiamine (mg)	Riboflavin (mg)	Niacin (mg)	Total B6 (mg)	Folic Acid (μg)	Vitamin C (mg)	Choline (mg)	Energy (Kcal)
1.	2320.94	2.01	1.26	20.65	2.07	132.96	36.81	158.05	2093.22
2.	1778.33	2.11	1.27	21.76	2.15	129.93	31.11	154.83	2186.26
3.	2081.84	2.02	1.25	21.00	2.08	128.00	33.44	140.77	2113.67
4.	1800.88	2.04	1.14	20.83	2.05	134.89	36.53	183.74	2042.65
5.	1963.05	2.19	1.31	23.03	2.29	131.55	33.31	156.58	2305.86
6.	2250.72	1.95	1.32	19.53	1.94	152.80	34.64	150.26	2055.76
7.	1998.06	1.78	1.06	18.04	1.81	122.74	32.36	139.18	1790.88
8.	1661.64	2.35	1.35	23.75	2.33	149.61	30.98	158.15	2335.09
9.	1880.06	2.28	1.33	22.97	2.25	149.02	34.61	154.27	2268.32
10.	1874.72	2.18	1.3	22.46	2.22	136.55	33.34	156.85	2238.75
11.	2247.94	1.94	1.32	19.50	1.94	151.21	33.04	146.73	2065.85
12.	1855.37	1.99	1.22	20.41	2.01	126.81	31.05	142.72	2062.24
13.	1892.04	2.10	1.24	21.49	2.14	143.05	17.97	176.39	2165.89
14.	1873.53	2.17	1.30	22.76	2.25	132.42	33.55	154.57	2271.76
15.	1873.86	2.13	1.28	22.02	2.17	134.19	33.52	158.44	2209.40
16.	2259.63	2.04	1.36	20.36	2.02	159.90	33.65	146.69	2123.25
17.	1873.17	2.11	1.27	21.45	2.12	136.47	33.15	157.58	2150.98
18.	1873.45	2.16	1.29	21.98	2.17	138.89	32.17	150.73	2199.93
19.	2096.68	2.15	1.30	21.97	2.18	138.66	33.00	148.57	2183.01
20.	1867.36	2.03	1.25	20.9	2.07	129.94	32.06	151.20	2105.67

(continued)

Table A.2 (continued)

S. No	Carotene (μg)	Thiamine (mg)	Riboflavin (mg)	Niacin (mg)	Total B6 (mg)	Folic Acid (μg)	Vitamin C (mg)	Choline (mg)	Energy (Kcal)
21.	1931.99	2.04	1.33	20.34	2.00	154.29	31.28	150.94	2136.41
22.	2094.66	2.04	1.26	20.75	2.06	135.64	34.95	149.01	2079.00
23.	2104.65	1.93	1.31	19.68	1.96	143.8	32.70	151.26	2081.64
24.	2013.77	1.85	1.27	18.63	1.85	141.73	32.05	148.73	1983.30
25.	2106.81	2.19	1.32	22.57	2.22	142.98	37.87	164.84	2246.87
26.	2085.99	1.99	1.23	20.43	2.02	128.75	37.08	156.19	2057.77
27.	1856.74	1.94	1.21	20.20	1.99	121.96	33.78	146.82	2039.48
28.	3321.22	2.33	1.41	23.41	2.39	162.4o	37.10	144.60	2310.04
29.	2089.52	2.03	1.25	20.72	2.06	133.51	33.64	149.37	2084.79
30.	1859.57	1.88	1.18	19.22	1.90	122.46	35.45	163.00	1966.86

See Table A.1 footer

Table A.3 Nutritional analysis for males (No. 27, age: 41–60)

S.No.	Age (Yrs.)	Wt. (Kg)	Prot. (gm)	Fat (gm)	Carb. (gm)	Ca (mg)	Fe (mg)	Mg (mg)	Na (mg)
31.	**55**	**60**	**71.24**	**31.43**	**475.00**	**263.67**	**22.04**	**646.17**	**2744.12**
32.	42	55	70.81	22.07	400.83	282.70	23.34	691.34	2430.91
33.	45	40	60.27	18.49	341.89	258.57	20.64	604.44	2971.12
34.	50	45	64.50	21.35	355.98	275.79	21.53	604.48	2975.78
35.	**50**	**62**	**74.62**	**32.67**	**495.00**	**261.81**	**22.85**	**692.08**	**3059.37**
36.	50	42.	63.33	16.68	404.25	244.43	22.98	724.47	3142.88
37.	50	30	50.71	17.09	331.85	217.34	18.28	556.04	2414.87
38.	47	61	69.03	21.92	400.31	277.35	23.08	691.99	2623.32
39.	**50**	**60**	**73.14**	**30.48**	**488.21**	**287.29**	**24.22**	**738.54**	**2822.39**
40.	50	30	49.38	16.18	317.19	217.90	18.34	553.63	2414.59
41.	50	47	68.30	23.29	369.15	281.47	22.17	628.78	2938.02
42.	50	45	60.79	19.93	384.99	236.90	19.84	566.50	2929.72
43.	55	47	61.84	17.25	397.87	257.19	22.26	685.11	2427.70
44.	55	45	58.78	17.17	374.56	253.20	21.23	640.44	2700.81
45.	55	48	66.93	20.22	363.44	260.50	22.03	648.59	2552.60
46.	52	52	64.68	18.25	414.96	269.80	23.44	719.32	2627.77
47.	51	48	65.77	22.22	356.04	269.26	21.11	605.24	2697.02
48.	55	45	59.62	21.84	324.29	249.46	19.34	546.86	2768.96
49.	51	47	66.43	22.88	355.60	265.20	20.89	602.22	2894.72
50.	52	50	65.52	21.28	359.60	270.52	21.80	639.82	2817.04
51.	55	55	62.19	18.94	397.91	254.03	22.45	686.01	3057.51
52.	54	48	61.98	22.88	335.76	254.14	19.75	566.73	3006.54
53.	51	46	63.95	21.27	356.75	247.88	20.34	606.15	3087.41
54.	55	39	54.74	20.95	330.24	380.35	19.06	552.90	2824.17

(continued)

Table A.3 (continued)

S.No.	Age (Yrs.)	Wt. (Kg)	Prot. (gm)	Fat (gm)	Carb. (gm)	Ca (mg)	Fe (mg)	Mg (mg)	Na (mg)
55.	**55**	**60**	**72.23**	**29.78**	**487.37**	**277.67**	**24.25**	**744.25**	**2670.18**
56.	**60**	**61**	**73.75**	**30.43**	**495.78**	**266.57**	**23.24**	**716.69**	**2508.66**
57.	60	45	54.81	16.42	355.49	228.08	19.77	603.08	2457.68

S.No.	K mg)	Carotene (μg)	Thiamine (mg)	Riboflavin (mg)	Niacin (mg)	Total B6 (mg)	Folic acid (μg)	Vitamin C (mg)	Choline (mg)	Energy (Kcal)
31.	**1168.63**	**2079.72**	**1.87**	**1.18**	**18.72**	**1.84**	**128.85**	**36.93**	**146.30**	**2467.83**
32.	1222.99	2001.58	1.99	1.30	19.88	1.96	149.30	34.40	162.47	2084.53
33.	1027.97	2115.19	1.67	1.10	17.12	1.71	129.76	36.25	151.61	1774.46
34.	1096.82	2308.81	1.76	1.24	17.43	1.73	142.14	36.04	142.97	1873.36
35.	**1205.41**	**1788.66**	**1.95**	**1.12**	**19.84**	**1.97**	**130.36**	**32.39**	**152.6**	**2572.51**
36.	1176.78	1597.63	1.98	1.12	20.61	1.89	121.74	33.10	153.68	2019.81
37.	939.720	1778.76	1.55	1.05	15.92	1.57	101.70	32.16	131.44	1683.43
38.	1135.91	2206.90	1.93	1.29	19.72	1.96	140.97	34.57	150.47	2073.94
39.	**1175.11**	**2217.28**	**2.04**	**1.34**	**20.99**	**2.08**	**146.17**	**35.91**	**153.89**	**2519.72**
40.	936.650	1656.30	1.53	0.95	15.74	1.56	101.02	28.85	126.84	1611.30
41.	1156.61	2246.50	1.82	1.27	18.05	1.80	146.25	34.80	161.90	1958.82
42.	1018.76	1872.49	1.63	1.16	16.31	1.63	125.61	28.84	151.20	1962.21
43.	1171.39	1862.72	1.92	1.20	19.61	1.94	124.32	34.64	160.89	1993.38
44.	1133.28	1860.03	1.81	1.16	18.35	1.81	121.91	35.72	157.73	1887.22
45.	1107.45	1945.69	1.81	1.17	18.44	1.83	140.30	39.17	158.47	1902.94
46.	1226.16	1868.73	2.02	1.24	20.62	2.04	131.09	33.93	157.15	2082.04
47.	1058.55	2244.75	1.72	1.24	17.26	1.72	138.70	34.64	152.30	1886.69
48.	906.290	2359.73	1.53	1.18	15.54	1.55	127.43	34.97	135.11	1731.64
49.	1093.77	2029.11	1.75	1.24	17.31	1.71	141.72	34.10	155.83	1893.42
50.	1072.11	2167.78	1.78	1.17	18.17	1.81	142.15	36.51	153.35	1891.34

(continued)

Table A.3 (continued)

S.No.	K mg)	Carotene (μg)	Thiamine (mg)	Riboflavin (mg)	Niacin (mg)	Total B6 (mg)	Folic acid (μg)	Vitamin C (mg)	Choline (mg)	Energy (Kcal)
51.	1171.14	1863.87	1.94	1.21	19.72	1.95	127.34	33.24	154.74	2010.21
52.	966.570	2235.55	1.59	1.19	16.11	1.61	130.18	34.84	146.71	1796.39
53.	999.180	1999.52	1.72	1.22	17.41	1.71	133.70	32.90	133.76	1873.62
54.	1055.54	2174.20	1.58	1.14	15.85	1.64	110.68	36.07	150.78	1756.83
55.	**1287.87**	**1877.91**	**2.10**	**1.27**	**21.36**	**2.11**	**136.47**	**34.38**	**165.80**	**2506.42**
56.	**1217.11**	**1871.28**	**2.00**	**1.23**	**20.47**	**2.03**	**129.04**	**33.81**	**163.43**	**2551.85**
57.	1001.88	1835.14	1.67	1.10	17.21	1.71	107.36	30.01	139.70	1788.33

See Table A.1 footer

Table A.4 Nutritional analysis for females (No. 15, age: 20–40)

S.No.	Age (Yr.)	weight (Kg)	Protein (gm)	Fat (gm)	Carb. (gm)	Ca (mg)	Fe (mg)	Mg (mg)	Na (mg)
1.	40	44	51.05	18.70	295.11	326.98	17.73	496.51	3152.27
2.	40	49	54.96	15.97	345.27	246.60	20.74	608.08	3210.76
3.	36	40	49.38	17.32	306.73	232.52	18.28	508.36	2613.62
4.	40	45	53.48	17.82	331.03	234.45	19.08	554.67	2694.45
5.	39	40	47.10	17.44	303.32	208.84	17.10	503.43	2765.12
6.	36	40	48.40	17.72	306.23	214.51	17.23	505.35	2806.23
7.	40	43	50.94	15.72	316.57	239.12	19.49	552.11	3090.08
8.	40	40	49.57	15.83	301.63	215.69	17.23	492.63	2415.89
9.	39	43	49.63	16.89	311.37	217.86	17.85	516.06	2453.85
10.	40	48	58.55	21.54	319.34	241.36	18.61	530.42	2494.86
11.	40	50	54.25	15.09	332.06	240.93	20.12	579.68	2542.69
12.	40	40	46.82	16.53	294.79	203.68	16.36	480.97	2568.47
13.	40	46	47.19	17.64	297.36	218.87	17.21	488.70	2689.02
14.	37	46	58.62	18.04	317.97	254.03	19.83	554.90	2774.23
15.	39	35	43.25	15.42	274.01	202.39	15.49	443.61	2958.65

S.No.	K (mg)	Carotene (μg)	Thiamine (mg)	Riboflavin (mg)	Niacin (mg)	Total B6 (mg)	Folic Acid (μg)	Vitamin C (mg)	Choline (mg)	Energy (Kcal)
1.	1160.00	1689.42	1.53	1.09	14.51	1.51	115.14	31.48	147.25	1552.09
2.	1095.28	1860.52	1.73	1.03	17.46	1.74	119.44	32.22	143.71	1743.92
3.	966.330	2058.04	1.48	1.04	14.60	1.47	107.24	32.91	136.19	1579.82
4.	1041.47	1850.88	1.59	1.08	15.84	1.59	110.52	32.44	159.16	1697.90
5.	866.690	1821.35	1.42	1.01	14.37	1.43	97.470	31.54	126.18	1558.23
6.	937.400	1739.62	1.44	1.01	14.43	1.43	98.320	31.65	147.29	1577.47
7.	1041.37	1990.58	1.58	0.98	15.85	1.59	114.17	33.81	148.71	1610.89
8.	1011.49	1614.79	1.45	1.00	14.21	1.42	102.65	29.78	160.90	1546.76

(continued)

Table A.4 (continued)

S.No.	K (mg)	Carotene (μg)	Thiamine (mg)	Riboflavin (mg)	Niacin (mg)	Total B6 (mg)	Folic Acid (μg)	Vitamin C (mg)	Choline (mg)	Energy (Kcal)
9.	947.090	1829.79	1.47	1.03	14.76	1.48	101.00	29.21	141.18	1595.45
10	995.420	1970.00	1.53	1.13	15.15	1.51	122.36	32.97	157.37	1704.92
11.	1118.70	1729.27	1.69	1.01	16.73	1.67	119.13	30.38	152.67	1680.34
12.	917.450	1599.42	1.38	0.98	13.80	1.37	94.610	30.30	145.82	1514.73
13.	927.820	1917.17	1.40	1.00	14.01	1.40	100.01	33.34	142.97	1536.49
14.	1040.13	2118.75	1.58	1.06	15.79	1.59	128.64	33.81	161.25	1668.16
15.	849.570	1822.85	1.25	0.95	12.60	1.25	89.980	34.70	151.61	1407.38

See Table A.1 footer

Table A.5 Nutritional analysis for females (No. 28, age: 41–60)

S. No.	Age (Yr.)	Wt (Kg)	Prot. (gm)	Fat (gm)	Carb. (gm)	Ca (mg)	Fe (mg)	Mg (mg)	Na (mg)
16.	42	38	48.49	23.02	289.65	413.53	16.70	464.57	2778.52
17.	42	40	50.47	16.67	309.39	299.67	18.91	535.84	2932.63
18.	42	49	52.28	17.30	329.50	228.03	19.02	549.93	2419.40
19.	42	40	50.89	15.74	306.23	240.79	19.09	531.96	2499.27
20.	43	42	47.64	15.76	305.22	215.16	17.36	504.03	2964.68
21.	45	45	49.37	17.98	314.70	231.09	18.47	525.54	3203.55
22.	45	43	54.29	19.14	298.94	222.56	17.37	493.52	2883.21
23.	43	40	47.01	17.77	271.76	209.30	15.95	439.89	3037.48
24.	43	38	47.40	18.66	263.32	154.58	12.83	418.79	3031.03
25.	45	50	58.77	18.17	366.49	264.10	21.55	623.95	2428.33
26.	45	44	58.62	21.10	338.56	238.10	19.33	573.46	2452.62
27.	45	40	49.27	17.70	306.79	230.22	18.08	510.44	2573.24
28.	42	36	46.68	15.85	297.77	218.99	17.41	490.34	2650.43
29.	**50**	**60**	**71.71**	**29.83**	**487.58**	**240.47**	**17.59**	**471.60**	**2728.71**
30.	50	45	54.50	18.65	287.47	215.93	17.39	495.39	2805.89
31.	**52**	**58**	**70.43**	**32.27**	**503.92**	**230.89**	**18.47**	**523.93**	**2930.90**
32.	50	50	56.84	16.25	355.68	262.58	21.72	630.14	3054.52
33.	50	45	54.32	19.24	282.50	241.18	17.97	485.14	3202.07
34.	**55**	**57**	**72.83**	**30.23**	**495.74**	**233.79**	**18.07**	**486.16**	**2418.45**
35.	50	52	55.71	18.19	345.82	250.74	20.07	576.18	2468.05
36.	50	45	55.62	21.41	297.48	227.43	17.25	488.50	2569.18
37.	50	35	46.09	17.67	290.11	216.82	17.12	475.27	2691.18
38.	**60**	**63**	**73.35**	**31.43**	**483.14**	**209.67**	**16.34**	**461.15**	**2765.73**
39.	50	40	44.15	16.26	277.27	214.90	16.27	449.94	2922.83
40.	50	50	59.50	22.24	322.25	243.30	18.72	538.53	3083.71

(continued)

Table A.5 (continued)

S. No.	Age (Yr.)	Wt (Kg)	Prot. (gm)	Fat (gm)	Carb. (gm)	Ca (mg)	Fe (mg)	Mg (mg)	Na (mg)
41.	50	35	42.24	13.78	260.49	207.06	15.98	443.88	3196.71
42.	**50**	**60**	**75.02**	**29.57**	**490.83**	**211.92**	**15.09**	**400.08**	**2406.08**
43.	50	39	40.66	17.00	255.13	206.06	15.21	406.54	2802.25

	K (mg)	Carotene (μg)	Thiamine (mg)	Riboflavin (mg)	Niacin (mg)	Total B6 (mg)	Folic acid (μg)	Vitamin C (mg)	Choline (mg)	Energy (Kcal)
16.	980.180	2040.34	1.41	1.03	13.82	1.44	98.71	32.21	116.48	1559.20
17.	1007.80	2051.77	1.53	0.97	15.37	1.57	107.01	31.71	134.01	1588.87
18.	1012.29	1829.72	1.61	1.07	15.94	1.58	110.24	29.15	128.44	1682.26
19.	1043.24	1999.92	1.53	0.97	15.16	1.54	113.42	33.72	158.06	1569.60
20.	926.810	1823.83	1.45	1.02	14.53	1.43	101.41	33.24	134.65	1552.72
21.	950.280	2055.48	1.51	1.05	15.12	1.50	108.84	35.31	128.60	1617.58
22.	884.310	1949.48	1.41	1.09	14.11	1.41	114.83	31.47	137.40	1584.76
23.	820.73	2022.90	1.27	1.00	12.61	1.26	101.68	32.73	132.91	1434.57
24.	811.750	578.110	1.25	0.94	12.19	1.13	96.13	27.05	149.31	1410.50
25.	1174.33	2092.33	1.79	1.16	17.92	1.79	125.96	37.38	170.32	1863.89
26.	888.590	2175.52	1.57	1.16	16.23	1.62	117.84	31.82	124.64	1778.15
27.	954.270	2067.30	1.45	1.04	14.52	1.46	105.55	35.41	152.31	1583.06
28.	911.280	2047.16	1.41	1.01	14.12	1.40	101.58	34.36	134.54	1519.89
29.	**910.600**	**2188.04**	**1.39**	**1.09**	**13.57**	**1.35**	**121.66**	**35.67**	**135.49**	**2505.63**
30.	913.970	1667.07	1.43	0.99	14.19	1.42	118.60	27.50	141.61	1535.29
31.	**1057.09**	**1772.67**	**1.52**	**0.95**	**15.02**	**1.51**	**110.90**	**32.94**	**163.96**	**2587.35**
32.	1106.89	2134.90	1.76	1.06	17.92	1.81	121.55	33.13	144.40	1795.66
33.	955.860	2126.49	1.41	1.01	13.87	1.40	124.41	35.33	153.42	1519.95
34.	**974.620**	**2192.75**	**1.44**	**1.03**	**14.07**	**1.41**	**108.76**	**35.35**	**142.60**	**2546.35**

(continued)

Table A.5 (continued)

	K (mg)	Carotene (μg)	Thiamine (mg)	Riboflavin (mg)	Niacin (mg)	Total B6 (mg)	Folic acid (μg)	Vitamin C (mg)	Choline (mg)	Energy (Kcal)
35.	1219.07	1865.33	1.71	1.10	16.80	1.64	122.22	39.80	197.74	1768.98
36.	913.820	1979.07	1.40	1.09	13.93	1.39	117.19	33.95	156.57	1604.64
37.	935.500	1964.30	1.40	1.00	13.80	1.36	104.59	35.65	143.28	1503.24
38.	**902.910**	**1828.65**	**1.33**	**0.98**	**13.22**	**1.32**	**96.93**	**33.47**	**149.40**	**2508.83**
39.	887.300	2051.24	1.29	0.97	12.87	1.29	96.61	36.95	150.77	1431.48
40.	968.460	1991.71	1.54	1.15	15.35	1.52	125.02	33.96	151.98	1726.64
41.	858.680	1742.49	1.28	0.86	12.68	1.27	96.07	31.57	128.01	1334.52
42.	**769.750**	**2169.83**	**1.16**	**1.00**	**11.44**	**1.14**	**105.69**	**36.24**	**137.59**	**2529.53**
43.	831.930	2038.22	1.19	0.93	11.70	1.17	91.45	35.49	139.38	1335.70

See Table A.1 footer

Table A.6 Anthropometric analysis of male (20–40) (No. of male surveyed = 30)

No.	Height (cm)	Weight (kg)	BMI = Wt (in kg.)/Ht^2 (in m)
1.	158	50	20.02
2.	153	47	20.07
3.	162	49	18.67
4.	163	49	18.44
5.	163	55	20.70
6.	146	42	19.70
7.	140	37	18.87
8.	143	45	21.85
9.	152	55	23.81
10.	168	63	23.71
11.	160	47	18.36
12.	152	44	19.04
13.	160	57	22.27
14.	170	53	18.34
15.	163	65	24.46
16.	157	52	21.10
17.	164	47	17.37
18.	160	56	21.88
19.	166	64	23.23
20.	160	50	19.53
21.	160	50	19.53
22.	168	54	19.13
23.	170	54	18.69
24.	149	35	15.77
25.	160	55	21.27
26.	146	45	19.43
27.	160	43	16.79
28.	158	49	19.63
29.	168	52	18.42
30.	155	40	16.65

See Table A.1 footer

Table A.7 Anthropometric analysis of male (41–60) (No. of male surveyed = 27)

No.	Height (cm)	Weight (kg)	BMI = Wt (in kg.)/ Ht^2 (in m)
31.	**153**	**60**	**25.64**
32.	154	55	23.19
33.	150	40	17.78
34.	**158**	**62**	**24.91**
35.	168	48	16.90
36.	160	42.5	16.60
37.	155	30	12.49
38.	170	61	21.11
39.	170	55	19.03
40.	151	30	13.16
41.	162	47	17.91
42.	160	45	17.58
43.	**154**	**60**	**25.31**
44.	163	45	16.83
45.	156	48.5	19.92
46.	168	52	18.42
47.	150	48	21.33
48.	144	45	21.70
49.	154	47	19.82
50.	152	50	21.64
51.	160.2	55	21.43
52.	147	48	22.21
53.	154	46	19.40
54.	153	39	16.66
55.	162	65	24.76
56.	**152**	**60**	**25.97**
57.	**156**	**61**	**25.10**

See Table A.1 footer

Table A.8 Anthropometric analysis of female (20–40) (No. of female surveyed = 15)

No.	Height (cm)	Weight (kg)	BMI = Wt (in kg.)/Ht^2 (in m)
1.	147	55	25.45
2.	143	45	22.01
3.	139	51	26.40
4.	144	50	24.11
5.	146	48	22.52
6.	155	55	22.89
7.	143	45	22.01
8.	148	51	23.28
9.	152	57	24.67
10.	138	45	23.63
11.	140.6	55	27.82
12.	145.8	48	22.58
13.	148.2	55	25.04
14.	145	50	23.78
15.	137	46	24.51

See Table A.1 footer

Table A.9 Anthropometric analysis of female (41–60) (No. of female surveyed = 28)

No.	Height (cm)	Weight (kg)	BMI = Wt (in kg.)/Ht^2 (in m)
16.	138	38	19.95
17.	150	40	17.78
18.	153	49	20.93
19.	141	40	20.12
20.	**153**	**60**	**25.64**
21.	145	45	21.40
22.	145	43	20.45
23.	**149**	**58**	**26.12**
24.	140	38	19.39
25.	160	45	17.58
26.	157	44	17.85
27.	147	40	18.51
28.	148	36	16.44
29.	144.1	44	21.19
30.	145.8	45	21.17
31.	143.2	45	21.94
32.	153	50	21.36
33.	**154**	**57**	**24.05**
34.	147	35	16.20
35.	154	52	21.93
36.	150	45	20.00
37.	160	35	13.67
38.	**158**	**63**	**25.30**
39.	140	40	20.41
40.	153	45	19.22
41.	143	35	17.12
42.	**154**	**60**	**25.31**
43.	136	39	21.09

See Table A.1 footer

Table A.10 Hematological analysis of males (No. of male surveyed = 57)

No.	Hb (g/dl.)	Blood Gr.	Glucose (mg/l)	S. Urea (mg/dl)	S. Creatinine (mg%)	S. Ca (mg/dl)	S. Cholesterol (mg/dl)	HDL (mg/dl)	LDL (mg/dl)	S. triglyceride (mg/dl)	S.Na (mEq/L)	S. K (mEq/L)	S. Mg (mg/L)
1.	14.0	A+	78	25.5	0.8	9.40	180	40	123	65	137.5	3.67	18.0
2.	14.3	B+	90	34.5	0.8	9.60	215	44	95.0	105	138.5	3.45	18.5
3.	14.0	B+	80	18.4	0.6	9.32	165	38	97.0	54	133.3	3.74	18.0
4.	13.5	B+	82	19.4	0.9	9.65	170	37	109	75	136.9	4.12	21.0
5.	12.9	A+	78	16.5	1.0	9.13	165	40	127	75	136.7	3.87	17.5
6.	13.9	B+	86	38.0	1.4	10.2	175	42	110	88	138.4	4.30	23.0
7.	12.9	A+	82	23.5	1.1	9.12	160	37	80.0	60	137.5	3.55	16.0
8.	12.4	O+	80	24.5	0.6	9.10	165	38	82.0	65	136.4	3.80	20.0
9.	12.5	B+	79	24.5	0.8	10.2	175	36	85.0	89	135.0	3.62	26.0
10.	11.9	A+	80	25.0	0.9	9.12	186	43	120	110	138.2	3.60	24.0
11.	11.9	B+	90	36.0	0.7	9.43	180	37	120	120	137.5	3.56	18.0
12.	13.5	O+	89	26.5	0.6	10.2	175	45	120	110	139.5	3.65	20.0
13.	12.8	B+	78	32.0	0.8	9.50	170	38	130	95	135.9	3.50	17.0
14.	11.9	AB+	73	33.0	0.6	9.65	190	47	133	82	141.0	4.12	19.0
15.	14.2	B+	90	32.0	0.9	10.12	185	38	125	90	137.9	4.12	19.0
16.	13.4	B+	86	25.0	1.2	9.43	170	37	110	80	136.8	3.67	17.0
17.	13.0	B+	90	28.0	1.3	10.2	190	38	90.0	110	138.9	3.60	17.0
18.	13.8	O+	78	28.0	0.8	10.1	184	42	110	120	140.0	4.12	18.0
19.	14.3	B+	95	35.0	1.4	10.3	190	42	110	150	139.0	3.96	23.0
20.	14.0	B+	86	23.0	0.8	9.32	170	39	110	125	137.8	3.97	17.0
21.	11.9	A+	80	27.0	0.8	10.2	198	43	90	130	139.0	3.92	19.0
22.	12.7	A+	75	33.0	0.7	9.96	167	46	99.2	110	147.5	3.98	22.0
23.	10.9	O+	65	35.0	1.0	10.3	183	47	126	103	136.4	3.99	21.9
24.	11.5	A+	72	45.3	0.9	8.83	210	45	113	265	143.5	4.68	23.8
25.	13.7	A+	89	34.0	0.8	10.8	167	41	123	62	139. 7	3.98	22.0

(continued)

Table A.10 (continued)

No.	Hb (g/dl.)	Blood Gr.	Glucose (mg/l)	S. Urea (mg/dl)	S. Creatinine (mg%)	S. Ca (mg/dl)	S. Cholesterol (mg/dl)	HDL (mg/dl)	LDL (mg/dl)	S. triglyceride (mg/dl)	S.Na (mEq/L)	S. K (mEq/L)	S. Mg (mg/L)
26.	9.80	O+	87	34.0	0.8	9.90	216	18	99	42	142.6	4.71	18.5
27.	9.40	B+	79	34.0	0.8	10.5	193	45	113	57	137.4	4.39	22.5
28.	11.0	AB+	78	41.0	0.9	9.80	168	48	109	71	140.6	4.35	22.0
29.	11.4	B+	69	26.8	0.8	9.50	191	36	139	72	136.4	4.24	20.0
30.	12.4	B+	65	26.9	0.7	10.2	201	43	145	82	145.8	4.44	21.5
31.	12.8	B+	92	33.0	0.6	10.2	172	38	112	74	146.9	4.59	22.0
32.	10.2	AB+	92	34.0	0.9	10.4	183	43	112	117	139.9	4.29	23.0
33.	13.0	A+	80	34.0	0.7	10.4	172	39	94	148	139.0	4.40	24.0
34.	12.2	A+	77	22.5	0.7	9.30	190	41	98	100	130.5	3.59	20.8
35.	12.8	A+	67.8	28.6	0.8	8.90	180	39	102	96	129.9	3.50	21.0
36.	12.2	A+	81	18.9	0.7	8.60	170	39	99	76	131.7	3.90	23.2
37.	12.2	O+	93	26.2	0.8	10.4	160	43	106	86	135.2	3.7.0	20.0
38.	14	A+	80	30.4	0.9	9.42	195	43	112	115.5	140.3	4.42	22.4
39.	13.5	O+	70	26.7	0.7	9.20	162	42	106	59	134.8	3.76	23..0
40.	13	B+	80	21.5	0.7	9.50	170	40	116	76	140.2	3.75	20.0
41.	12	A+	76	22.5	0.9	9.13	175	39	85	87	139.5	4.10	21.0
42.	**13.5**	**AB+**	**165**	**32.5**	**1.2**	**10.2**	**180**	**41**	**160**	**157**	**138.5**	**3.90**	**18.0**
43.	11	A+	76	27.0	0.7	9.30	160	36	115	90	136.0	3.65	19.0
44.	12.9	A+	85	21.0	0.8	9.65	167	36	110	130	142.3	3.82	18.0
45.	13.9	B+	82	23.0	0.9	9.50	175	39	113	145	136.8	3.75	22.0
46.	13	B+	75	45.0	0.9	9.95	234	49	163	111	141.6	4.19	22.1
47.	**13**	**O+**	**160**	**35**	**1.1**	**9.40**	**162**	**45**	**162**	**162**	**136.4**	**3.96**	**23.0**
48.	12	O+	78.5	28.0	0.7	9.50	171	46	105	100	136.9	3.65	21.8
49.	10.4	B+	84	30.0	0.7	9.90	172	47	110	76	137.0	3.84	16.3
50.	**9.6**	**A+**	**162**	**44.0**	**1.2**	**9.50**	**162**	**37**	**155**	**148**	**133.0**	**4.12**	**20.0**

(continued)

Table A.10 (continued)

No.	Hb (g/dl.)	Blood Gr.	Glucose (mg/l)	S. Urea (mg/dl)	S. Creatinine (mg%)	S. Ca (mg/dl)	S. Cholesterol (mg/dl)	HDL (mg/dl)	LDL (mg/dl)	S. triglyceride (mg/dl)	S.Na (mEq/L)	S. K (mEq/L)	S. Mg (mg/L)
51.	11.8	A+	69	34.0	0.9	10.3	164	42	113	64	132.7	4.32	16.0
52.	12.4	B+	89	38.5	0.7	10.5	172	48	110	82	136.9	3.69	20.8
53.	12.6	B+	77	23.0	0.7	9.70	199	53	132	153	131.4	3.89	23.2
54.	9.6	B+	112	36.8	0.9	4.79	190	45	131	100	136.9	4.21	19.0
55.	10.1	AB+	86	23.9	0.9	10.3	155	44	133	131	139. 4	3.9.0	22.0
56.	**11.4**	**A+**	**166**	**38.9**	**1.3**	**9.20**	**193**	**38**	**142**	**180**	**138.9**	**4.35**	**23.8**
57.	**10.5**	**B+**	**164**	**33.8**	**1.0**	**8.98**	**174**	**44**	**148**	**172**	**139.9**	**4.49**	**22.9**

See Table A.1 footer

Table A.11 Hematological analysis of female (No. of female surveyed = 43)

No.	Hb (g/dl.)	Gr.	Glucose (mg /l)	S. Urea (mg/dl)	S. Creatinine (mg%)	S. Ca (mg/dl)	S. Cholesterol (mg/dl)	HDL (mg/dl)	LDL (mg/dl)	S. triglyceride (mg/dl)	S.Na (mEq/L)	S. K (mEq/L)	S. Mg (mg/L)
1.	10.5	O+	75.0	32.0	0.6	8.50	193	38	110	86.0	134.4	3.42	17.0
2.	12.0	A+	72.0	24.0	0.7	9.00	175	35	110	54.0	133.0	3.39	22.0
3.	13.0	B+	75.0	37.0	1.2	10.3	185	42	128	70.0	136.3	3.32	24.0
4.	13.9	B+	78.0	27.5	1.3	9.34	190	40	130	90.0	135.5	3.56	19.0
5.	10.2	B+	72.0	17.0	0.8	9.12	175	37	110	95.0	137.5	3.50	19.0
6.	11.2	B+	75.0	16.0	0.7	9.12	160	38	82.0	125	136.5	3.52	18.0
7.	10.9	B+	78.0	32.0	0.8	9.32	185	43	110	120	137.1	3.87	20.0
8.	10.0	B+	78.0	17.0	0.7	9.00	150	38	101	130	136.7	4.67	23.0
9.	11.5	O+	75.0	23.0	0.6	9.32	185	41	104	69.0	137.8	4.21	17.0
10.	10.8	A+	90.0	19.0	0.6	9.67	180	39	125	102	135.9	3.67	22.0
11.	10.5	A+	70.0	15.0	0.6	9.80	165	38	80.0	110	135.5	3.53	19.0
12.	11.5	A+	80..0	22.0	0.7	9.56	180	40	125	110	136.8	3.87	21.0
13.	12.4	B+	68.9	29.0	0.7	10.2	178	46	116	92.0	140.4	3.83	23.4
14.	9.90	O+	67.0	21.0	0.6	8.90	148	45	91.0	58.0	144.4	3.61	18.9
15.	9.00	A+	70.0	30.2	0.8	9.50	188	49	127	62.0	140.6	4.52	22.3
16.	12.1	B+	83.6	23.6	0.8	9.80	179	44	120	67.0	142.9	4.34	16.0
17.	11.2	AB+	80.2	29.0	0.8	10.0	198	40	149	55.0	139.9	3.59	18.2
18.	11.0	O+	80.0	32.6	0.9	10.3	123	49	60.0	82.0	141.8	4.39	21.2
19.	11.9	A+	74.0	32.0	0.7	9.80	179	40	121	55.0	138.4	4.95	17.2
20.	10.2	A+	76.0	34.0	0.7	9.80	196	43	90.0	72.0	138.4	4.59	23.4
21.	10.6	AB+	74.o	16.9	0.7	9.60	212	49	124	187	122.4	4.00	21.9
22.	13.9	O^+	74.0	18.9	0.8	9.40	182	46	99.0	75.0	132.3	3.51	23.0
23.	11.2	A+	75.0	16.0	0.6	9.00	160	38	90.0	70..0	136.5	3.76	19.0
24.	**13.2**	**B+**	**162**	**37.6**	**1.5**	**10.3**	**175**	**39**	**170**	**160**	**136.5**	**3.42**	**16.9**
25.	12.5	O+	86.0	34.0	0.9	10.2	174	40	110	75.0	135.0	3.67	21.0

(continued)

Table A.11 (continued)

No.	Hb (g/dl.)	Gr.	Glucose (mg /l)	S. Urea (mg/dl)	S. Creatinine (mg%)	S. Ca (mg/dl)	S. Cholesterol (mg/dl)	HDL (mg/dl)	LDL (mg/dl)	S. triglyceride (mg/dl)	S.Na (mEq/L)	S. K (mEq/L)	S. Mg (mg/L)
26.	9.50	B+	75.0	17.0	0.8	9.00	155	35	85.0	45.0	136.7	3.49	16.0
27	10.2	A+	80	32	0.7	10.12	190	39	97.0	139	139.2	3.67	17.0
28.	**13.1**	**B+**	**160**	**35.7**	**1.7**	**10.23**	**164**	**44**	**158**	**129**	**142.0**	**3.65**	**24.0**
29.	12.0	O+	85.1	19	0.6	9.12	170	37	90.0	127	136.0	3.57	24.0
30	11.2	A+	78.0	17	0.7	9.0	160	39	110	102	135.5	3.59	21.0
31.	10.9	O+	82.0	15.5	0.5	9.0	155	37	90.0	110	137.0	3.54	24.0
32.	**12.3**	**O+**	**166**	**34.4**	**1.6**	**9.98**	**201**	**39**	**139**	**184**	**139.5**	**3.95**	**23.0**
33	9.8.0	B+	72.0	41	0.7	9.0	162	38	113	74	141.3	4.12	20.0
34.	12.4	A+	77.0	37	0.8	9.2	167	48	100	113	147.9	3.39	20.9
35.	12.4	A+	80.0	32	0.7	8.5	200	45	114	52	143.4	4.15	21.5
36.	11.6	B+	72.0	26.6	0.6	10.3	273	48	209	91	142.0	3.69	24.0
37.	**12.8**	**A+**	**162**	**31.8**	**1.1**	**9.5**	**170**	**42**	**149**	**169**	**136.8**	**3.98**	**23.1**
38.	11.4	B+	72.0	26.8	0.7	9.6	186	42	129	61	132.9	4.37	19.2
39.	10	B+	89.0	21	0.6	10.5	164	50	99.0	79	135.1	3.82	24.0
40.	**9.4**	**O+**	**163**	**39.9**	**1.8**	**9.9**	**165**	**41**	**155**	**146.7**	**142.4**	**3.89**	**18.0**
41.	11.8	O+	76.0	22	0.8	9.5	235	46	92.0	127	140.4	4.69	21.0
42.	12	O+	78.0	34	0.5	10.3	191	50	137	89	142.0	4.36	20.0
43.	9.4	A+	80.0	33.4	1.0	9.7	214	51	185	186	134.7	3.90	24.0

See Table A.1 footer

Appendix B
Standard Methodologies Followed

Nutritional Survey and Analysis

Dietary habits of a population is determined mainly by the availability of food. For sustaining the healthy and active life, diet should be planned on sound nutritional principles. Human needs a wide range of nutrients to lead a healthy and active life, and these are derived from the diet. The amount of each nutrient that is required by man depends upon his age, energy requirement and physiological status. Adults need nutrients for maintaining constant body weight and ensuring proper body function. A little disturbance in the food habit and diet may alter the body response causing fatal diseases like obesity, hyperlipidemia, heart ailments, diabetes, and so therefore it was essential to gather information about the dietary pattern and nutritional status of the selected population.

The following standard methods (Thimmayamma et al. 2003) are applied for quantitative and qualitative evaluation of diet and nutritional status:

Diet Analysis

- *Diet History*: This method is useful for obtaining qualitative details of diet and studying patterns of food consumption at household. This procedure includes assessment of the frequency of consumption of different food—daily or number of times in a week or fortnight or occasionally. This method is used to study:
  a. Meal patterns
  b. Dietary habits
  c. Peoples food preferences and avoidances

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Oral Questionnaire

This is used for quantitative estimation of nutrition. In this (24 h) recall method of oral questionnaire diet survey (Standard questionnaire given below), a set of 'standardized cups' suited to local conditions are used. The steps involved are: (1) The housewife or the member of the household who invariably cooks and serves food to the family members is asked about the types of food preparations made at breakfast, lunch, afternoon tea time and dinner. (2) An account of the raw ingredients used for each of the preparations is obtained. (3) Information on the total cooked amount of each preparation is noted in terms of standardized cup(s). (4) The intake of each food item (preparation) by the specific individual in the family is assessed by using the cups. The cups are used mainly to aid the respondent recall the quantities prepared and fed to the individual members.

Nutritional assessment

1. Which type of fuel is used in cooking? Wood/Coal/Gas/Stove/Heater/Non-smoking stove/ Other/Kanda

2. Whether Vegetarian? Yes/No

If not—which type of non-vegetarian food?

Meat type	**Daily**	**Once a week**	**Twice a week**	**Once in two weeks**	**Once a month**	**Occasional**

3. Which type of vessels or pots are used for cooking: Steel/Iron/Aluminum

4. Type of Cooking medium:

Oil	**Quantity/day**	**Quantity per month**

5. Type of meal: Plain/Spicy

6. Use of butter/ghee in diet? Yes/No
   If yes ,in what quantity: One teaspoon/Two/Three

7. Type of milk utilized: Cow milk/Buffalo/Goa/Other **Quantity**

8. Use of curd/whey/matha: Yes/No
   If yes: Type used: Curd/Whey/Matha **Quantity**

9. (a) Beverages taken? Tea/Milk/Other
   (b) How many times? Once/Twice/Many times

10. (a) Quantity of sugar in day: Once/Twice/Many times
    (b) Quantity of jaggery in day (½ piece/full)

Nutritional assessment

11. Pulse taken with meal: Yes/No, if yes:

Type	**Quantity (pot wise)**

12. Rice taken with meal: Yes/No, if yes:

Variety	**Quantity (pot wise)**

13. Chapattis of which flour is used: Wheat/Bajra/Sorghum/Other

Type of cereal	**Total Quantity**

14. Use of green vegetables: Yes/No

If yes

Varieties	**Quantity/day**

15. Use of Sugar/Beet/Other sugar-rich plant parts in diet:

16. Number of meals? Once/Twice/Thrice

17. Water intake?

18. Pot wise details of the diet:

No. of diet	**First Day Food items with quantity**	**Second Day Food items with quantity**	**Third Day Food items with quantity**
Breakfast			
Lunch			
Evening teatime			
Dinner			
Before sleep			
In between Breakfast/Lunch/Evening tea time/ Dinner			

Specific Habit

1. Smoking Yes/No Cigarettes /Bidi/Cigar/ Other with quantity
2. Alcohol consumption Yes/No Pouch/Beer/Rum/Local with quantity
3. Tobacco / Ghutka chewing Yes/No Quantity
4. Tea/ Coffee with no. of cups and sugar

Medical History

1. Medical history of a person and his family.
2. Is suffering from any disease; especially diabetes?
3. Under treatment for diabetes?

Nutritional Analysis

After tabulating the qualitative and quantitative amount of food consumed by the population in the study, the nutrients derived from the food are also calculated. An average amount of daily intake of different food types is assessed and verified by repetitive and participatory observations. Again it is crosschecked by applying Weighment Method (Thimmayamma et al. 2003) applying the following formula.

$$\frac{Intake\,per\,person}{per\,day\,(g/ml)} = \frac{\text{Raw } amount\,of\,each\,food\,(\text{g})}{No.\,of\,persons \times No.\,of\,days\,of\,survey}$$

Thus, the accuracy is obtained to a large extent in determining the exact amount of food items consumed by the individuals on daily basis. Then, the nutritious value of these are calculated as per recommendations of **ICMR** Advisory **Committee (1989**) (Swaminathan et al. 2001); and standard method prescribed by the National Institute of Nutrition **(ICMR) (**Gopalan et al. 2003) using the Food Composition Table for calculation of different amount of nutrients and their energy value.

Anthropometric Analysis

Anthropometric data (height and weight) is obtained from the adult persons of the households following the method suggested by Weiner and Lourie. According to this method, the body weight (in kg.) is taken on a spring weighing machine, asking the subject to stand on it with an erect posture with light apparel. Height is measured by the vertical distance from the floor to the vertex by the anthropometer which is placed at the back and between the heels of the subject, taking care that it is kept absolutely vertical. Reading in centimeter and its fraction is then recorded.

The weight and height ratio is expressed in terms of body mass index which is directly associated with the dietary intake and nutritional status of an adult individual. BMI is used for assessment of chronic energy deficiency (CED) as proposed by James, Ferro-Luzzi and Waterlow, (Ferro-Luzzi et al. 1992; Naidu and Rao 1994; WHO 2000). The body mass index is most widely used because its investigation is inexpensive, noninvasive, and suitable for large scale surveys Bose et al. 2005; Khongsdier 2001; Ulijaszek et al. 1999. Thus, BMI is the most established anthropometric indication used for assessment of adult nutritional status (Moy et al. 2003). BMI is defined as the individual's body weight divided by

the square of the height, and is almost always expressed in the unit kg/m^2. Hence, using the units in parentheses the BMI value can be calculated as:

$$\text{BMI} = \frac{\text{weight (kg)}}{\text{height} \times \text{height (m} \times \text{m)}}$$

As per WHO (WHO 2000) the corresponding BMI and status of health is expressed as under:

BMI under 18.5 (underweight); 18.5–24.9 (normal weight); 25.0–29.9 (overweight); 30.0–34.9 (obese-Class I); 35.0–39.9 (obese-Class II); 40 or greater (obese-Class III). The index is calculated for those aged 18 and over excluding pregnant women and persons less than 3 feet (0.914 m) tall or greater than 6 feet 11 inches (2.108 m). Thus, the adults are categorized on the basis of their BMI into different stages.

Hematological Analysis

A direct manifestation of nutrition is ascertained by examining the blood sample of an individual. Since blood flows throughout the body, acting as a medium for providing oxygen and other nutrients and drawing waste products back to the excretory systems for disposal, the state of the blood stream affects, or is affected by, many medical conditions. Therefore, exact physiological status is assessed through the hematological analysis; the following parameters are described:

Determination of Calcium

Principle: Calcium reacts directly with cresolphthalein complexon (CPC) reagent containing dimethyl sulfoxide and 8 hydroxyquinoline. Since magnesium also reacts with CPC, the addition of eight hydroxyquinoline virtually eliminates the interference from magnesium (Gitleman et al. 1967; Young et al. 1975; Baginski et al. 1973; Tietz et al. 1986).

Normal Value: 9–11 mg/dl

Method: OCPC method

Requirements: Test tubes, 100-ml graduated cylinder, 100-ml beaker, 10-ml graduated pipette, push button pipette (0.05 ml), stop watch, photometer.

Reagents:

(a) *Calcium Reagent* 1: It is prepared by mixing 40 mg of cresolpthalein complexon in 1.0 ml of conc. HCl, followed by 2.5 g of 8-hydroxyquinoline, 100 ml of dimethyl sulfoxide and final quantity is made up to 1 l by using glass distilled water.
(b) *Calcium Reagent* 2: It is prepared by mixing 500 mg of potassium cyanide and 40 ml of diethyl amine in 960 ml of glass distilled water.

(c) *Calcium Standard:* 10 mg/dl (5.0 mEq/l): It contains 25 mg of $CaCO_3$ in 50% of (v/v) HCl acid.
(d) *EDTA:* 4.0 g/dl

Stability: Reagent 1 and 2 are stable at room temperature for 3 months. Reagent 3 is stable at 2–8 °C and reagent 4 is stable at room temperature for several months. *Procedure:* Fresh working reagent is prepared by mixing equal quantities of regent 1 and reagent 2.

Pipette in the tubes labeled as follows:

	Test	Standard	Blank
Working reagent (ml)	6	6	6
Serum (ml)	0.05	–	–
Standard 10 mg/dl	–	0.05	–
Distilled water (ml)	–	–	0.05

Thoroughly mixed and kept at room temperature for exactly 10 min to read intensities of test and standard against blank at 575 nm (yellow filter).

Calculation:

$$Serum\ Calcium\,\mathrm{mg/dl} = \frac{O.D.\ Test}{O.D.\ Standard} \times 10$$

Procedure: Pipette in the tubes, labeled as follows

	Test	Standard	Blank
Working calcium (ml)	1	1	1
Serum(ml)	0.01	–	–
Ca Standard 10 mg/dl	–	0.01	–
Distilled water(ml)	–	–	0.01

Mixed and keep at room temperature (25 ± 5 °C) for 10 min. Read absorbance of test and standard against blank.

Calculation:

$$Serum\ Calcium\,\mathrm{mg/dl} = \frac{O.D.\ Test}{O.D.\ Standard} \times 10$$

Clinical Significance: Decreased serum calcium values are found in hypoparathyroidism, rickets, osteomalacia, and steatorrhea. A fall in serum calcium can occur in acute pancreatitis and in those form of renal diseases in which excessive proteinuria is observed. Increased serum calcium values are observed in hyperparathyroidism, hypervitaminosis D and multiple myeloma. The level of calcium depends on the parathyroid hormone.

Determination of Serum Sodium and Potassium

Principle: The solution under test is passed carefully, under controlled conditions as a very fine spray in the air supply to nonluminous flame. In the flame the solution evaporates and the salt dissociates to give neutral ions, which emit light of the characteristic wave length. The flame is simultaneously monitored by both the channels. Each channel consists of a detector, which views the flame through a narrow band optical filter. The photo detector out put are connected to two independent digital display, which are calibrated for direct concentration readouts. Initial calibration is done by using at least three standards of different concentrations (Young et al. 1975).

Normal Range: Na: 135–145 mEq/L; K: 3.5–5.0 mEq/L

Method: Flame photometry method

Requirements: Test tubes, dispenser or 10-ml volumetric pipette, 10 ml beaker or bulbs, 50- or 100-µl push button pipette, flame photometer, and specimen (Serum or heparinized plasma)

Standards: Mix standards are prepared by using following two stock standards:

a. *Stock standard for sodium*: 1,000 mEq/L: It is prepared by dissolving 5.85 g of analar grade sodium chloride in glass distilled water and diluted to 100 ml by using a volumetric flask.
b. *Stock standard for potassium*: 100 mEq/L: It is prepared by dissolving 0.740 g of potassium chloride in glass distilled water and diluted to 100 ml by using a volumetric flask.

Mixed working standards are prepared as follows:

(a) Sodium/Potassium: 120/2.0 mEq/L: It contains 120 mEq of sodium and 2 mEq/L of potassium per liter of distilled water. It is prepared by mixing 12 ml of stock standard 1 and 2 ml of stock standard 2 in 86 ml of glass distilled water.
(b) Sodium/Potassium: 140/4.0 mEq/L: It is prepared by mixing 14 ml of stock standard of 1 and 4 ml of stock standard 2, in 82 ml of glass distilled water.
(c) Sodium/Potassium: 160/6.0 mEq/L: It is prepared by mixing 16 ml of stock standard of 1 and 6 ml of stock standard 2, in 78 ml of glass distilled water.

Flame Photometer: A dual channel instrument capable of quick simultaneous estimation of sodium and potassium is preferred for clinical chemistry purpose. Most of the equipment are equipped with the facilities incorporated to select Ca in place of Na and lithium in place of K Simultaneous determination of two elements minimizes sample quantity, cost of operation, and operation time.

Procedure: Pipette in the tubes, labeled as follows

	Test	Standard 1	Standard 2	Standard 3
Glass distilled water (ml)	10	10	10	10
Serum plasma (ml)	0. 1	–	–	–
Std. 120/2.0 (ml)	–	0.1	–	–
Std. 140/4.0 (ml)	–	–	0. 1	
Std. 160/6.0 (ml)	–	–	–	0.1

Mixed and transferred to beakers or bulbs for the flame photometric determination.

Clinical Significance:

a. *Hyponatremia*: Low serum sodium are observed in the condition such as: severe prolonged diarrhea and vomiting, salt losing nephritis and Addison's disease.
b. *Hyperatremia:* Increased serum sodium values are observed in the conditions such as: severe dehydration, diabetes insipidus, salt poisoning, Cushing's syndrome and in certain post renal conditions leading to obstruction to the flow of urine.
c. *Hypokalemia*: It is observed in conditions such as Cushing's syndrome, renal tubular damage, metabolic alkalosis and malnutrition.
d. *Hyperkalemia*: High potassium values are observed in the conditions such as Addison's disease, renal glomerular disease, anuria and oliguria.

Determination of Hemoglobin

Principle: In solution the ferrous ions (Fe^{2+}) of the hemoglobin are oxidized to the ferric state (Fe^{3+}) by potassium ferric cyanide to form methemoglobin. In turn methemoglobin reacts with the cyanide ions (CN^{-}) provided by potassium cyanide to form cyanmethemoglobin, which has the absorbance at 540 nm (Raghuramulu et al. 2003).

Normal Range: 12–14.5 (Female),
12–15.5 (Male) g/dl
Method: Cyanmethemoglobin method
Reagent:

(a) *Cyanmethemoglobin Solution* (*Drabkin's solution*): 0.05 gm potassium cyanide, 0.200 g potassium ferric cyanide and 0.140 gm dihydrogen potassium phosphate is dissolved in 1 L of distilled water. 1 ml of Triton X-100 is added and mixed. Stable for at least 6 months.
(b) *Hemoglobin Standard*: Lyophilized human methemoglobin (supplied by Sigma USA). Each vial is equivalent to hemoglobin concentration of 18

g/dl whole blood when reconstituted in 50 ml of Drabkin's solution, Stable for 6 months when refrigerated at 2–6 °C.

Procedure: 0.02 ml of blood using a calibrated hemoglobin pipette is transferred into a tube containing 5.0 ml of Drabkin's reagent. The pipette is rinsed several times with the reagent; diluted hemoglobin solution is allowed to stand for at least 5 min to achieve full colour development. The absorbance is measured at 530–550 nm of the unknown sample (Aunk) and that of a standard of known hemoglobin content (Astd.) against a reagent blank.

Calculation:

$$Hemoglobin\ Unknown\ (\mathrm{g/dl}) = \frac{Aunk\ \times Conc.\ of\ Hemoglobin\ standard(\mathrm{g/dl})}{\mathrm{Astd.}}$$

Estimation of Blood Sugar

Principle: Glucose is oxidized to gluconic acid by glucose oxidase. The hydrogen peroxide liberated is reduced by peroxidaes and the oxygen transferred to an acceptor, which is colourless in the reduced form but coloured in the oxidized form (Raghuramulu et al. 2003; Hawh's 1965; Strehler et al. 1957; Trinder et al. 1969).

Normal Range: 60–100 F (mg/l)
Method: Glucose oxidase method

Reagents:

(a) *Protein Precipitant*

- Sodium Tungstate $Na_2WO_42H_2O$: 10 g
- Disodium Phosphate Na_2HPO_4: 10 g
- Sodium Chloride: 9 g

The above is dissolved in about 800 ml water and approximately 125 ml of HCl is added to adjust to pH 3.0. 1 g phenol is added to makeup to 1 L with water. Stable for 1 year at 25 °C.

(b) *Colour Reagent:*

- Sodium azide 0.3 g
- 4 Aminophenazone 0.1 g
- Disodium phosphate 3 g

These are dissolved in 295 ml water, then 5 ml of glucose oxidase-peroxidase mixture is added. The mixture should have at least 1.5 μU and 3.0 μU/ml of glucose oxidase and peroxidase stable for 8 week's at 4 °C.

(c) *Standard:* The stock standard contains exactly 1 g of pure glucose in 100-ml benzoic acid solution. The working standard is made by diluting 1 ml of stock standard with 49-ml benzoic acid solution. This solution is stable at 25 °C for 1 year.

Procedure: 0.1 ml of blood is pipetted into 2.9 ml or protein precipitant; mixed well and centrifuged for about 5 min. A standard curve is set up for each batch of determination. 0.1, 0.2 and 0.3 ml of the working glucose standards equivalent to 60, 120 and 180 mg/100 ml is pipetted into clean tubes. In each case, volume is made to 1 ml with protein precipitant reagent.

Similarly, 1 ml of clear supernatant is taken from the test and placed in clean tubes. For the reagent blank, 1 ml of protein precipitant is used. To all tubes, 3 ml of colour reagent is added and incubated at 37 °C for 10 min. Then the tubes are placed in cold water for 1 min and the absorbance is read at 505 nm against the reagent blank without further delay.

The absorbance of the standard is plotted graphically and glucose values of the tests is read from this. If the glucose concentration of the test is greater than 180 mg/100 ml, the colour development stage is repeated using a smaller aliquot of the supernatant, e.g. 0.2 or 0.6 ml.

Determination of Serum Urea

Principle: Urea reacts with diacetyl—monoxime in hot acidic medium and in the presence of thiosemicarbazide and ferric ions to form a pink colored compound which can be measured on a green filter (Fearon et. al. 1939; Marsh etal. 1965; Wybenga 1970, 1071).

Normal Range (Reference range):

- Birth to one year: 4–16 mg/dl (SI: 1.4–5.7 m mol/L)
- One to forty year: 7–21 mg/dl (SI: 2.5–7.5 m mol/L)
- Gradual slight increases occur over 40 years of age.
- Possible panic range: BUN > 100 mg/dl (SI: >35.7 m mol/L)

Method: Diacetyl monoxime method

Requirements: Test tubes (15 × 25 mm), 10 ml pipette, dispenser or burette, push button pipette or 0.1-ml serological pipette, measuring cylinder of 100 ml, water bath, stop watch, and photometer.

Sample Material: Serum, heparinized plasma or fluoride plasma.

Preparation of Reagents:

(a) *Reagent 1 (DMR):* It contains 0.2 g/dl diacetyl-monoxime in distilled water. The reagent is stable at room temperature (25 ± 5 °C) for 1 year.
(b) *Reagent 2 (TSC):* It contains 40 mg/dl thiosemicarbazide in distilled water. The reagent is stable at room temperature (25 ± 5 °C) for 6 months.

(c) *Reagent 3 (Acid):* It contains 60 ml of conc. sulphuric acid. 10 ml of orthophosphoric acid and 10 ml of 1 gm /dl ferric chloride in 1 l of the reagent prepared in distilled water. This reagent is stable at room temperature for one year.
(d) *Urea Nitrogen Standard:* 20 mg/dl: It contains 42.8 mg of urea in 100 ml of saturated benzoic acid. This standard is stable for one year when refrigerated.

Preparation of Working Reagent: It is prepared fresh by mixing one part of reagent 1, one part of reagent 2, and two part of reagent 3. This reagent should be prepared fresh for each batch of the determination.

Procedure: Pipetted in the tubes labeled as follows

	Test	Standard 1	Blank
Working reagent	5.0	5.0	5.0
Serum plasma (ml)	0.05	–	–
Standard 20 mg/dl	–	0.05	–
Distilled water	–	–	0. 05

The contents of the tubes is mixed thoroughly and placed in boiling water for exactly 15 min. Cooled immediately by using tap water and after 5 min the intensities of the test and standard is measured against blank at 520 nm (green filter).

Calculation:

$$Plasma\ or\ (Serum)\ Urea\ Nitrogen, \mathrm{mg/dl} = \frac{O.D.\ Test}{O.D.\ Standard} \times 20$$

Clinical Significance: Elevated levels of urea are observed in pre-renal, renal and post renal conditions.

a. *Pre-renal conditions:* Diabetes mellitus, dehydration, cardiac failure, hematemesis, severe burns, high fever, etc.
b. *Renal conditions:* Diseases of kidneys
c. *Post-renal conditions:* Enlargement of prostate, stones in the urinary tract, tumor of the bladder. Decreased values have been reported in severe liver disease, protein malnutrition and pregnancy.

Determination of Cholesterol

Principle: Cholesterol reacts with hot solution of ferric perchlorate, ethyl acetate and sulphuric acid (Cholesterol reagent) and gives a lavender colour complex which is measured at 560 nm. High density of lipoproteins is obtained in the supernatant after centrifugation. The cholesterol in the HDL fraction is also estimated by this method Dimacher et al. (1977, 1980) and Warnick et al. (1985).

Normal Value: Normal values vary with diet and age.
Total Cholesterol:

- Adult: 134–230 mg/dl
- Children: Lower values are found

HDL Cholesterol:

- Male: 35–55 mg/dl
- Female: 35–75 mg/dl

Method: One step method of Wybenga and Pileggi
Sample: Serum or Plasma
Reagent:

(a) Reagent 1: Cholesterol Reagent
(b) Reagent 2: Working Cholesterol Standard
(c) Reagent 3: Precipitating Reagent

Auxillary: Normal Saline

a. **Total Cholesterol**

Procedure: 3 ml of cholesterol reagent is added to 0.2 ml of working cholesterol Standard and 0.2 ml of specimen; pipetted into 3 test tubes labeled as Blank, Standard and Test.

	Blank	Standard	Test
Reagent 1: Cholesterol reagent (ml)	3	3	3
Reagent 2: Working cholesterol standard (ml)	–	0.2	–
Serum (ml)	–	–	0.2

Mixed well and kept immediately in the boiling water bath exactly for 90 s. Then immediately cooled to room temperature under running tap water. The optical density of standard and test against blank is measured on colorimeter with a yellow green filter at 560 nm.

b. **HDL Cholesterol**

Step I
HDL Cholesterol Separation (Supernatant)

Pipette into centrifuge tube	Quantity
Sample	0.2 ml
Precipitating reagent	0.2 ml

Mixed well and kept at room temperature for 10 min. and then centrifuged at 2000 round/min for 15 min to a clear supernatant. Then to step—II.

Step II

HDL Cholesterol Estimation: 3 ml of cholesterol reagent is added to 0.2 ml of working cholesterol standard and 0.12 ml of supernatant. Pipetted into three test tubes labeled as Blank, Standard and Test.

	Blank	Standard	Test
Reagent 1: Cholesterol reagent (ml)	3	3	3
Reagent 2: Working cholesterol standard (200 mg per) (ml)	–	0.2	–
Supernatant from step 1 (ml)	–	–	0.12

Mixed well and kept immediately in the boiling water bath exactly for 90 s. Then immediately cooled to room temperature under running tap water. The optical density of standard and test is measured against blank on a colorimeter with a yellow green filter at 560 nm.

Calculation:

1.

$$Total\ Cholesterol\ (serum/plasma)\ \mathrm{mg/dl} = \frac{OD\ Test}{OD\ Standard} \times 200$$

2.

$$HDL\ Cholesterol\ (serum/plasma)\ \mathrm{mg/dl} = \frac{T}{S} \times 200$$

Where $50 = \frac{200}{8} \times 2$

Clinical Significance: High value may be found in diabetes mellitus, hypothyroidism, obstructive jaundice, nephritic syndrome, biliary cirrhosis, athertoscelerosis, etc. Low value may be found in hyperthyroidism, malnutrition, Gaucher's disease and acute hepatitis. Decrease level of HDL cholesterol leads to increased chance of coronary heart disease while increased levels of HDL cholesterol reduce these chances. Lower values HDL cholesterol and increased ratio of total cholesterol to HDL cholesterol are taken as risk for coronary heart disease.

Determination of Triglycerides

Principle: Lipoprotein lipase hydrolyses triglycerides to glycerol and free fatty acids. The glycerol formed with ATP in the presence of glycerol kinase forms glycerol 3 phosphates, which is oxidized by enzyme glycerol phosphate oxidase to

form hydrogen peroxide. The hydrogen peroxide further reacts with phenolic compound and 4 aminoantipyrine by the catalytic action of peroxidase to form a red coloured quinoneimine dye complex. Intensity of coloured formed is directly proportional to the amount of present in the sample (Bucolo et al. 1973; Dimacher et al. 1977; Trinder et al. 1969).

$$\text{Triglycerides} \xrightarrow{\text{Lipoprotein}} \text{Lipase Glycerol} + \text{free fatty acids}$$

$$\text{Glycerol} + \text{ATP} \xrightarrow{\text{Glycerolkinase}} \text{Glycerol 3 phosphate} + \text{ADP}$$

$$\text{Glycerol 3 phosphate} + \text{O}_2 \xrightarrow{\text{G3POxidase}} \text{Dihydroxyacetone phosphate} + \text{H}_2\text{O}_2$$

$$\text{H}_2\text{O}_2 + \text{4 aminoantipyrine} \xrightarrow{\text{Perxidase}} \text{Red quinoneimine dye} + \text{H}_2\text{O} + \text{phenol}$$

Normal Range:
Triglyceride: 50–190 mg/dl
150 mg/dl and above (suspicious)
200 mg/dl and above (Elevated)
LDL: 75–150 mg/dl
Method: PAP method
Content:

	25ml	2x75ml
L1 enzyme reagent 1	25	2 × 60
L2 enzyme reagent 2	5	2 × 15
S. tri. standard (200 mg/dl)	5	5

Reagent Preparation:

Working Reagent: The content of 1 bottle of L_2 is poured into 1 bottle of L_1. This working reagent is stable for at least 6 week when stored at 2–8 °C. Upon storage the working reagent may develop a slight pink colour however this does not affect the performance of the reagent. Alternatively for flexibility as much of working reagent may be made as and when desired by mixing together 4 parts of L_1 and 1 parts L_2. Alternatively 0.8 ml of L_1 and 0.2 ml of L_2 may also be used instead of 1 ml of the working reagent directly during the assay.

Triglycerdies is reported to be stable in the sample for 5 days when stored at 2–8 °C.

Procedure: Wave length/filter: 505 nm/ green; Temp.: 37 °C /RT; Line path: 1 cm.

1 ml of working reagent mixed with 0.01 ml of distilled water is added to the triglycerides standard 0.01 ml and then 0.01 ml sample is added.

Pipetted into three test tubes labeled as Blank, Standard and Test.

	Blank (ml)	Standard (ml)	Test (ml)
Working reagent	1	1	1
Distilled water	0.01	–	–
Triglycerides standard	–	0.01	–
Sample	–	–	0.01

Mixed well and incubated at 37 °C for 5 min or at room temperature (25 °C) for 15 min. The absorbance of the standard and test sample against the blank is measured within the 60 min.

Calculation:

$$\text{Triglycerides in mg/dl} = \frac{Abs.T}{Abs.S} \times 200$$

For LDL: Total cholesterol − VLDL + HDL

Where $\text{VLDL} = \frac{\text{Triglycerides test}}{5}$

Clinical Significance: Increased levels are found in hyperlipidemias, diabetes, nephritic syndrome and hypothyroidism. Increased levels are risk factor for arteriosclerotic coronary diseases and peripheral vascular diseases. Decreased levels are found in malnutrition and hyperthyroidism.

Estimation of Creatinine

Method: Jaffe method

Normal Range: 0.5–1.5 mg%

Procedure:

2 ml of plasma is mixed with 2 ml of distilled water and the protein is precipitated by adding 2 ml of 5 % sodium tungstate and 2 ml of 2/3 N sulphuric acid. 3 ml of the filtrate is mixed with 1 ml of picric acid (0.04 M solution that is 9.16 g/l) and 1 ml of NaOH (0.75 N solution). The mixture is allowed to for about 15 min. A standard is also setup with 1.5 ml of standard creatinine solution (containing 0.01 mg/ml) and 1.5 ml distilled water.

Calculation:

$$\textit{Creatinine}\,\text{mg}\,(\%) = \frac{\text{Reading of Unknown}}{\text{Reading of Standard}} \times 2.0$$

For the determination of creatinine 1 ml of 0.04 M solution of picric acid is added to 3 ml of protein free filtrate as previously prepared, heated in a boiling water bath for 45 min, and the volume is made up to 4 ml. With distilled water and cooled. Then 1 ml of 0.75 N sodium hydroxide is added and the creatinine is estimated as before. The results include the amount of creatinine originally present together with that formed from the creatinine. The differences of the figure

obtained before and after heating the sample are multiplied by the factor 1.16. This gives the value of creatinine.

Estimation of Magnesium

Principle: Magnesium combines with Calmagite in an alkaline medium to form a red coloured complex. Interference of calcium and proteins is eliminated by the addition of specific chelating agents and detergents. Intensity of the colour formed is directly proportional to the amount of magnesium present in the sample (Fossati et al. 1982).

$$\text{Magnesium} + \text{Calmagite} \xrightarrow[\text{Medium}]{\text{Alkaline}} \text{Red coloured complex}$$

Normal Range: 6–25 mg/L
Method: Calmagite method
Reagent:
Content:

	25 ml
L1 Buffer reagent	12.5
L2 Color reagent	12.5
Magnesium standard (2.05 mEq/L)	2 ml

Reagent Preparation:

For larger assay series a working reagent may be prepared by mixing volumes of L1 (Buffer reagent) and (L2 Colour reagent). The working reagent is stable at 2–8 °C for at least one month. Keep tightly closed.

Procedure:

Wave length/filter: 546 nm/ green; Temp.: 37 °C /RT; Line path: 1 cm.

Pipette into clean dry test tubes labeled as Blank, Standard and Test.

	Blank (ml)	Standard (ml)	Test (ml)
L_1 (Buffer reagent)	0.5	0.5	0.5
L_2 (Color reagent)	0.5	0.5	0.5
Distilled water	0.01	–	–
Magnesium standard	–	0.01	–
Sample	–	–	0.01

Mixed well and incubated at room temperature (25 °C) for 5 min. The absorbance of the Standard and Test sample against Blank is measured within 30 min.

Calculation:

$$Serum\ Magnesium, \mathrm{mg/L} \frac{Abs.\ Test}{Abs.\ Standard} \times 2$$

ABO Blood Grouping

Human red blood cell antigens can be divided into four groups A, B, AB and O depending on the presence or absence of the corresponding antigens on the red blood cells. Human red blood cells possessing A and /or B antigen will agglutinate in the presence of antibody directed toward the antigen. Agglutination of red blood cells with Anti-A, Anti-B, Anti-A, B reagents is a positive test result and indicates the presence of the corresponding antigen.

Absence of agglutination of red cells with Anti-A, Anti-B, Anti-A, B reagents is a negative test result and indicates the absence of the corresponding antigen.

Reagents: Anti-A, Anti-B, Anti-A, B (of Tulip Diagnostics P Ltd., Plot Nos. 92/96, Phase II C, Verna Ind. Est., Verna, Goa-403722, India) are ready to use reagents prepared from supernatants of mouse hybridoma cell cultures. These antibodies of immunoglobulin class IgM are a mixture of several monoclonal antibodies of the same specificity but having the capability of recognizing different epitopes of the human red blood cell antigens A and B. Each batch of reagent undergoes quality control at various stages of manufacture for its specificity, avidity and performance.

Reagent Storage and Stability:

1. The reagent is stored at 2–8 °C.
2. The shelf life of reagent is as per the expiry date mentioned on the reagent vial label.

   Sample Collection: No special preparation of the patient is required prior to sample collection by approved techniques (Daniels et al. 1995; HMSO 1994; Kohler et al. 1975; Lee et al. 1983).

Additional Material Reqiured for Slide Tests: Glass Slides (50 × 75 mm), Pasteur Pipettes, Timer, Mixing Sticks.

Slide Test Procedure:

1. One drop of reagent Anti-A or Anti-B or Anti-A, B is placed on a clean glass slide.
2. To each reagent drop, one small drop of whole blood is added.
3. Mixed well with a mixing stick uniformly over an area of approximately 2.5 cm^2.
4. The slide is rocked gently, back and forth.

5. Observation is done for agglutination macroscopically at 2 min.

Interpretation of Result:

Agglutination is a positive test result indicating the presence of A and /or B antigen. Peripheral drying or fibrin strands should not be mistaken as agglutination. No agglutination is a negative test result indicating the absence of A and /or B antigen.

About the Book

Health of the people is the most important indicator of the development of a nation. Health is a state of complete physical, mental, and social wellbeing and not merely the absence of disease or infirmity (as defined by WHO). The state of health of an individual or population depends upon complex interaction of the physical, biological, political and social domains. The environment affects the human health in a big way. People tend to be most susceptible to illness when physically or mentally stressed. Stress, energy, and immunity form a closely knit network.

Through his experimental findings, the author has brought out this intricate concept of interdependence of biotic (living) and abiotic (nonliving) factors in an ecosystem, resulting in an impact on human health, in an explicitly marvelous manner. As a result, a new word "Biogeogens" has been coined, "bio" for living (biotic), "geo" for nonliving (abiotic/geographical/climatic/environment) and "gens" for the interactive proceeds of the two. The content included herein is directly concerned with the societal health and gives a clue to many socio-psycho health problems presently not handled with care. It also defines a multidimensional approach for dealing with many psychosomatic and health problems.

N. Kumar, *Biogeogens and Human Health*, SpringerBriefs in Public Health,
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