Original Article

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A Study of Weights of Vital Intracranial, Thoracic and Abdominal Viscera and Correlation of it with Bodyweight in Different Age-Group of Deceased in Fatal Medico Legal Cases at a Medical Institute of Central India

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Abstract: This study is a prospective examination of total 303 (201 males, 102 females) autopsy cases ranging from one day to 90 years during the period from 1st July 2009 to 31st June 2011 in the Department of Forensic Medicine and Toxicology of a Medical Institute of central India. Measurements are taken of organs (in gram unit) of Brain, Heart, Lungs, Liver, Spleen, Kidneys, and body weight taken (in kilogram unit) of the dead bodies. All fire related death, cases of decomposition and those who showed any macroscopic evidence of disease on gross autopsy are excluded. In this study, weight of the organs at all age groups is lower when compared with Western and North Indian population because they are hefty and taller than the central Indian population. Weight of organs in females is less than males at all ages except lungs at age group 61- 70 years (654.3 in female & 539.9 in males), liver at age group 21-30 years (1289.4 in females &1268.3 in males) & spleen at age group 21-30 (118.3 in male & 122.9 in females) and 41-50 years (112.3 in male & 128.7 in females). In this study the weight of all internal organs has been seen categorically increased in the age group of 61-70 years but shows a decline immediately after 70 years of age due to catabolic activity and old debilitating changes at this age.

Keywords: Vital organ weights; Prostate weight; Medico legal autopsy.

Introduction

Growth and development are the fundamental property of life, being the normal function of every individual, the growth of viscera of body proceeds along with the physical development of human being. Growth of different parts of the body follows a predictable schedule during normal development and maturation. The development not only is influenced & controlled by many genetic, environmental factors but it is also dependent on race, body weight, length, age, sex, habitat, habits, climatic conditions, diet, nutrition, environment and socioeconomic status of an individual. As India being a vast country, there are multiple factors like climate, nutrition and tropical diseases which vary from South to North and from East to West, which play an important role for gaining organ weight as compared to Foreign Countries.

From the previous studies, it was found that there is marked variation in weight of organs and body weight and stature in different races. Hence, present study will be carried out to see such variations in Central Indian people and their comparison with other races. Not only application of such anatomical knowledge will explore different types of influences like- age, sex, nutrition, race, on human body that may again help in formation of concept of such variations in different countries or at different states or areas of a single country.

Materials and Method

This study is a prospective examination of total 303 (201 males, 102 females) autopsy

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cases ranging from one day to 90 years during the period from 1st July 2009 to 31st June 2011 in the Department of Forensic Medicine and Toxicology of a Medical Institute of central India. Measurements of organs (in gram unit) of Brain, Heart, Lungs, Liver, Spleen, Kidneys, Uterus, Prostate, and body weight taken (in kilogram unit) of the dead bodies. The Body length (or height) was measured from the head to the heel by standard foldable measuring metal caliper. All the bodies were weighed naked with the same weighing machine by a standard Electronic machine. All autopsies were performed within 24-36 hours after death to avoid altered organ weights. Besides the age is spread into nine groups. All fire related death, cases of decomposition and those who showed any macroscopic evidence of disease on gross autopsy are excluded. Organs are removed by Virchow's method and weighed on standard Electronic machine. The data of organ weight were statistically analyzed.

Table No 1: Organs weight at different ages of life in Male

Age Groups	Brain			R.Lung			L. Lung			Heart		
	No. of cases	Mean	Range	No. of cases	Mean	Range	No. of cases	Mean	Range	No. of cases	Mean	Range
0-10	10	766.4	240-1153	9	156	56-314	9	132.78	34-304	10	78	10-159
11-20	12	1209	900-1426	12	439.917	300-540	12	420.750	260-493	12	196.667	90-300
21-30	44	1254.318	875-1496	44	458.500	211-768	44	422.182	208-710	45	217.511	175-303
31-40	42	1268.143	925-1600	38	462.711	265-850	38	425.533	223-750	42	210.714	169-300
41-50	24	1238.542	996-1575	25	451.920	300-816	25	414.240	250-594	22	223.636	187-300
51-60	29	1262.276	971-1450	24	444.458	280-800	24	412.125	241-700	21	224.667	182-270
61-70	22	1246.500	972-1450	20	539.900	340-780	22	516.591	236-750	16	231.625	194-281
71-80	12	1208.083	1000-1480	10	405	189-591	10	374.800	191-582	9	238.444	192-370
81-90	04	1198	1096-1480	04	465.250	371-550	04	405.750	288-496	02	236.500	181-292
Total cases	**199**			**186**			**188**			**179**		

Continued....Table 1 : Organs weight at different ages of life in Male

Age Groups	R. Kidney			L. Kidney			Liver			Spleen		
	No. of cases	Mean	Range	No. of cases	Mean	Range	No. of cases	Mean	Range	No. of cases	Mean	Range
0-10	10	50.6	23-72	10	44.6	23-64	10	456.9	71-884	10	54.5	5-112
11-20	12	109.333	75-160	12	104.417	74-160	12	1286.917	1000-1526	12	94.250	40-180
21-30	45	123.978	90-160	45	116.311	80-150	44	1268.363	1026-1566	44	118.364	80-300
31-40	42	126.286	78-180	42	121.095	73-180	42	1255.214	726-1692	42	133.143	80-253
41-50	25	124.560	90-200	25	121.200	80-200	25	1286.400	1100-1442	25	112.320	80-210
51-60	29	121.138	73-163	29	117.448	72-200	29	1280.655	850-1450	29	128.448	35-250
61-70	22	130.591	98-170	22	122.682	88-160	22	1288.318	800-1400	22	133.364	55-234
71-80	12	116.917	68-190	12	118.250	81-200	12	1202.333	725-1475	12	119.167	38-210
81-90	04	114	96-120	04	104.750	83-116	04	1255.750	979-1425	04	105.500	88-151
Total cases	**201**			**201**			**200**			**200**		

Table 2: Organs weight at different ages of life in Female

Age Groups	Brain			R.Lung			L. Lung			Heart		
	No. of cases	Mean	Range	No. of cases	Mean	Range	No. of cases	Mean	Range	No. of cases	Mean	Range
0-10	10	542.8	250-1129	11	134.09	24-246	11	127.09	24-248	11	71.636	10-148
11-20	23	1181.261	912-1430	22	413.591	175-789	22	397.182	160-756	24	195.250	90-300
21-30	20	1233.650	900-1456	18	443.500	190-669	18	426.778	160-658	18	211.833	180-293
31-40	14	1135.857	830-1450	13	447.231	250-685	13	414.692	220-670	14	209.071	144-250
41-50	17	1212.529	900-1450	17	418.235	200-793	17	403.176	200-691	15	215.600	150-300
51-60	08	1224.625	1080-1375	09	435.778	295-684	09	372.111	215-650	08	220	204-250
61-70	04	1218.500	1060-1325	03	654.333	523-790	03	627	521-730	03	230.333	210-260
71-80	03	908	759-1029	03	415.333	369-475	03	352.667	277-405	03	234.667	216-256
81-90	0	542.8	250-1129	-	134.09	24-246		–	–		–	–
Total cases	**99**			**96**			**96**			**96**		

Continued....Table No 2: Organs weight at different ages of life in Female

Age Groups	R. Kidney			L. Kidney			Liver			Spleen		
	No. of cases	Mean	Range	No. of cases	Mean	Range	No. of cases	Mean	Range	No. of cases	Mean	Range
0-10	11	47.273	8-92	11	44	8-85	11	401	80-1000	11	43.27	6-112
11-20	24	106.792	40-140	24	103.167	40-150	24	1191.875	864-1456	24	93.708	40-150
21-30	20	120.900	55-150	20	115.200	54-147	20	1289.450	900-1668	20	122.900	50-206
31-40	14	119.143	74-200	14	114.643	71-230	14	1225.571	980-1480	13	120.00	82-220
41-50	17	123.882	86-140	17	117.647	71-136	17	1272.647	900-1600	17	128.765	60-300
51-60	09	106.000	60-135	09	109.556	50-210	09	1272.556	926-1500	09	117.444	62-210
61-70	04	122.750	109-150	04	119.500	90-142	04	1250.000	1060-1329	04	135.250	92-195
71-80	03	98.000	81-130	03	92.333	76-122	03	991.667	754-1125	03	77.000	51-99
81-90	-	--	–		--	--		–	–	-	–	–
Total cases	**102**			**102**			**102**			**101**		

Observation

Discussion

The organ wise weights at different age groups are compared and discussed below with various authors.

Brain

Batra A. K. *et al* (1995) and Singh Dalbir *et al* (2004) mentioned that mean brain's weight in 0-10 years is 856 gm, 1098.24 gm in male which becomes 1240 gm, 1315.13 at age group 11-20 years which is 10.46%, 30.21% and 2.5%, 8.06% more than present study respectively. The maximum brain's weight is seen in age group of 31-40 in males mean brain's weight is 1254, 1336.85 gm in Batra A K and Singh Dalbir study and in the present study it is 1268.14 gm. In the female, maximum brain's weight seen at age group 11-20 years (mean brain's weight -1132gm) in Batra A.K. and 1210.21 gm, in Singh Dalbir *et al*. at the age group of 21-30 years. In the present study maximum mean brain's weight is 1268.14gm which is also same as Singh Dalbir study. Piyanun M. *et al* (2009) observed that mean brain's weights 1358.8 gm which is 12.3% more than present study at age group 11-20

yrs. After that it remains almost constant till age group 41-50 yrs where mean brain's weight is 1311.04 which are again 6.3% more than present study. At the old age there is decreased in the mean brain's weight in all the three studies in both sexes.

Lungs

Batra A. K. *et al* (2002) mentioned in male that mean Right lung's weight in 0-10 years is 101 gm, which becomes 266 gm, at age group 11-20 years which is 54.45% and 65.38% less than present study. Singh Dalbir *et al* (2004) observed 149.32 gm which become 444.92gm which is 4.33 and 1.12% more than present study. Batra A. K. *et al* (2002) mentioned that mean Left lung's weight 0-10 years is 96 gm in male and 95 in female, which becomes 254-220 gm, at age group 11-20 years which is 38.31%, 33.77%, 65.65% and 80.53% less than present study respectively. Singh Dalbir *et al* (2004) observed left lung's mean weight as 143.42 gm, 137.96 becomes 411.51 gm which is 370.04 gm in male and female respectively which is 7.41%, 7.8% more and 2.24% and 7.37% less than the present study.

Piyanun M. *et al* (2009) observed that lung's mean weight is 791.5 gm which are significantly higher than present study of both lung means 454.1 and 423.5 respectively at age group 21-30 yrs. At older age group 61-89 yrs of Piyanun, lung mean weight 766.6 gm is decreased which is similar with present study of both right lung and left lung mean lung's weight 407.3 and 369.6 respectively at age group 71-80 yrs.

Heart

Batra A. K. *et al* (2002) study is 256gm, 224 gm which is 45.28 % and 14.92% more than the present study in male and female (31-40 years) respectively. Singh Dalbir *et al* study is 301.68gm , 251.98 gm which is 30.15%%, 17.02% more in male and female respectively than the present study (31-40 years). Piyanun M. *et al*(2009) observed that mean heart weight is 267.95 gm which are 26.95% higher than present study of at age group 11-20 yrs. Heart weight increased exponentially till old age in both sexes due to deposition of epicardial fact and cardio myopathy.

Kidneys

Batra A. K. *et al* (2002) mentioned in male that mean Right kidney's weight 0-10 years is 30 gm and in female 25 gm which becomes 113 gm, and 86 gm at age group 11-20 years which is 68.66% and 89.9%, 10.97%,34.9% less than present study. Singh Dalbir *et al* (2004) study shows right kidney's weight as 52.92 gm in males and 58.66 gm in female which becomes 114.20gm. in male , 114.99 gm in female and which is 4.38%, 19.4% 4.26, 7.12% more than present study. Right kidney's weight increased exponentially till the age group of 31-40 years in both sexes except in female it is still 21-30 years in female and present study. Maximum right kidney mean is seen at age 31-40 years age group in Singh Dalbir, above 40 years in Batra AK study and at 61-70 age groups in present study. Piyanun M. *et al* (2009) observed that mean kidney weight is 236.5 gm which are significantly higher than present study of both kidney means 107.6 and 103.0 respectively at age group 11-20 yrs.

Liver

Piyanun M. *et al*(2009) observed that mean liver's weights 1297.5 gm which is 5.7% more than present study at age group 11-20 years. At age group 41-50 years mean liver's weight is 1489.0 which are again 13.92% more than present study (1281.6 gm). At old age group 61-89 years in Piyanun study, liver's mean weight is decreased which is similar with present study. At age group 71-80 yrs. Batra A. K. *et al* (2002) mentioned mean liver's weight 497, & 405 gm in males and female at age 0-10 years which becomes 1258 gm, & 1087 gm at age group 11-20 years which is 8.06%, 0.98%, 0.22% more and 12.74% less than present study respectively. Singh Dalbir *et al* (2004) mentioned mean liver's weight 619.73 gm in males and in female 498 gm at age 0-10 years which becomes 1420.62 gm, 1282.86 gm

at age group 11-20 years which is 26.27%, 19.47%, 9.41% more and 2.09% more than present study respectively. Internal organ weight decreased at the age group at more than 60 years in Singh Dalbir study and more than 40 years in Batra A K and more than 71-80 years in present study.

Spleen

Batra A. K. *et al* (2002) mentioned mean spleen's weight 59 gm in males and in female 60 gm at age 0-10 years which becomes 113 gm, 100 gm at age group 11-20 years which is 7.62%, 27.88%, 16.59% and 6.29% more than present study respectively. Singh Dalbir *et al* (2004) study shows mean spleen's weight 57.97 gm in males and in female 51.75 gm at age 0-10 years which becomes 130.05 gm, 129.35 gm at age group 11-20 years which is 5.98%, 47.07%, 27.62% and 27.35% more than present study respectively. Internal organ weight is more in female at age group 41-50 years in present study. However female heart is heavier at age group 0-10 and 11-20 years. Internal organ weight decreased at the age group at 71-80 years in present study and above 60 in Singh Dalbir study and more than 40 years in Batra A K study. Piyanun M. *et al*(2009) observed that mean spleen's weights 104 gm which are almost similar with present study mean 93.8 gm at age group 11-20 years. At age group 21-40 years mean spleen's weight is 199.2 which are again 39.8% more than present study (mean weight 1197 gm). At old age group 61-89 years in study of Piyanun, liver mean weight is decreased which is similar with present study at age group 71-80 yrs.

Conclusion

Weight of the organs at all age groups is lower when compared with Western and North Indian population because they are hefty and taller than the central Indian population. Hence studies of European and Western authors can not be taken as standard by forensic pathologist of this region. Weight of organs in females is less than males at all ages except lungs at age group 61- 70 years, liver at age group 21-30 years and spleen at age group 21-30 and 41-50 years. In this study the weight of all internal organs has been seen categorically increased in the age group of 61-70 years but shows a decline immediately after 70 years of age due to catabolic activity and old debilitating changes at this age, being heavier than females and males have more body weight and length than females.

The different results for the same are because of the nutritional status in females is different as compared to males due to typical dietary habits, cultural habits, and customs. They sacrifice more by eating less after completion of meals of male and children in his family. Also low socioeconomic status of this region together with higher incidence of maternal mortality rate because of poor dietary intake (mostly vegetarian at this region). Less birth spacing due to higher illiteracy rate in this region. These are all compounding factors that are responsible for low internal organ weight of this study.

References

1. Batra AK, Dongree AP, Mohanty AC. A Study of organ weights from Persons who died in accidents in Nagpur Dist. Of Maharashtra State. *JFMT*. 2002; 19(1): 21-24.
2. Chourasia's B D, 5th Edition. 2010; 2: 403-405.
3. Chrzanowska G, Krechowiecki A, Does the weight of the brain depend on the body height? *Gegenbaurs Morphol Jahrb*. 1975; 121(2): 192-208.
4. Daisy Sahni, Indar Jit, Lavina Sodhi. Weight and measurements of kidneys in northwest Indian adults. *American Journal of Human Biology*. 1982; 13(6): 726–732.
5. Daniel Ferreira da Cunha, Selma Freire de Carvalho da Cunha, Marlene Antônia dos Reis, Vicente de Paula Antunes Teixeira, Arquivos Brasileiros de Cardiologia, Arq Bras. Weight and Heart Weight/Body Weight Coefficient in Malnourished. *Adults Cardiol*. 2002; 78(4): São Paulo Apr.
6. Gradwohl RBH. Clinical and Laboratory methods and diagnosis. VoL II edition 4. Mod

by St Louis; 1948.

7. Gray. In Grays Anatomy 27th edition. Edited by Williams P L Roger W, M Dyson. New York-254, 260: Churchill Livingstone; 1989, 1440-1442.
8. Gur RC, Mozley PD *et al*. Gender differences in age effect on brain atrophy measured by MRI. *Proc Nat Acad Sci USA*. 1991; 88(7): 2845-49.
9. Jain SC, Mehta SC, Dogra TD, Chandrashakher N, Reddy AR, Naagaratnam A. Organ Weighs in Autopsy Cases from an Urban Apex Hospital. *Indian Journal of Medical Research*. 1992; 96: 37-44.
10. Michael T Sheaff, Deborah J Hopstar. Post mortem Technique Handbook. 2nd Edition. 2004; 80: 97-105.
11. Piyanun Mathuramon, Thamrong Chirachariyavej, AVM Vichan Peonim, Mana Rochanawutanon. Correlation of Internal Organ Weight with Body Weight and Length in Normal Thai Adults. *J Med Assoc Thai*. 2009; 92(2): 250-8.
12. Singh Dalbir, Bansal Sreenivas, Avadh Naresh Pandey, Seema Tyagi. Weights of Human Organs at autopsy in Chandigarh Zone of North West India. *JIAFM*. 2004; 26(3).