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Research Article

STUDY OF RELATION BETWEEN ORGAN WEIGHTS and BODY WEIGHT IN ADULT POPULATION OF VADODARA REGION, GUJARAT

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ABSTRACT

Knowledge of normal organ weights gives the doctors idea about of whether the organ is normal or not. So, it is very important for autopsy surgeons to know the organ weights. But, Organ weights probably depend on part on body weight of the individual. So, current study was undertaken at Mortuary complex of S.S.G. Hospital, Baroda during 1st July 2013 to 30th June 2015. Total 200 cases based on inclusion and exclusion criteria were selected and subjected to statistical analysis. Results obtained were compared with earlier studies. Right lung weight and Left Lung weight was noted to be 0.89% – 0.68% and 0.86% – 0.65% of body weight respectively, which is lower than the textbooks. This type of variations demands another research.

INTRODUCTION

For Autopsy surgeons, it is very imperative to know whether the organs are normal or not, in all the cases to determine or exclude organ pathology as the cause of death. And the weight of the organ is an indicator of any abnormality of the organ. However, Organ weight in part depends on the weight of individuals, so the organ weight should not be taken into account as how many grams we have noted, but should be taken as percentage of body weight. Body weight of persons and so the organ weights depend on Environmental, dietary, hereditary factors. So, the range of normal organ weight varies according to geographic locations. There is no particular research in Gujarat regarding the range of normal organ weight and its relation to body weight. So, current study was undertaken at Mortuary complex of S.S.G. Hospital, Baroda during 1st July 2014 to 30th June 2015.

MATERIALS AND METHODS

Out of all the cases coming for Post-mortem Examination at Mortuary complex of S.S.G. Hospital, Baroda during the period of one year, i.e., 1st July 2014 to 30th June 2015, cases satisfying inclusion and exclusion criteria were selected.

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Inclusion criteria

- Only cases of Vehicular Accident, Hanging and Poisoning cases were selected, where there is death within 24 hrs of the act and there is no evidence of gross pathology or trauma to the major internal organs.
- The Post-mortem Examination was conducted within 6 hours of death.
- Cases having age between 18-60 years.
- Cases with residence in Central Gujarat area.

Exclusion criteria

- Relatives or Next of Kin available at P.M. room not willing to give written-informed consent were excluded from study.

Method for Removal of Organs (in brief)

- Brain - After opening the skull cap, Dura matter is cut open and then four fingers are slowly inserted below frontal lobe, then frontal lobes are drawn backwards, tentorium is cut open on both sides, and cerebellum is slowly exposed and narrow knife is inserted in foramen magnum as far down as possible to cut cervical cord. Then Brain can be removed (Mukhetjee, ?).

- Heart – It is held from the apex and lifted upwards and pulmonary vessels, superior and inferior vena cava and ascending aorta are cut as far away as possible from the heart (Reddy, ?).
- Lungs – One hand is passed between parietal and visceral pleura. Pleural adhesions, if any, should be cleared. Slip both hands between the lateral portion of one lung and the inner side of the chest wall. The left hand works up to apex and right hand up to base then they meet at the hilum, from where it is cut with a knife as far away as possible (Reddy, ?).
- Liver –is pulled medially and knife is passed behind it to free it from its attachments (Reddy, ?).
- Spleen and Pancreas –Spleen and tail of pancreas are held in the left hand and dissection is carried out behind them up to mid line. The diaphragmatic surface is held in the hand and the vessels in the hilum are cut and spleen and pancreas are separated (Reddy, ?).
- Kidneys – The peritoneum and fat are cut just outside the lateral border of kidney, which is then grasped in the left hand and mobilized by dissection up to midline. The ureter is identified and freed up to bladder and then both the kidneys are cut near its hilum (Reddy, ?).

Note

- If any peritoneal fat or any other attached tissues present with the organ, then it is removed with careful dissection and washing.
- After removal of the organ, if any blood is present on the surface, it is removed by washing and drying.
- In heart, if blood is present in the cavities, it is removed with running tap-water.
- Brain weight is weight without pituitary gland.
- Liver weight is weight without gall-bladder.

Total, 200 cases were selected based on inclusion and exclusion criteria. Then their organs were removed as per standard method as described below, and organ weights were noted on standard electronic weighing machine and measurements taken with wooden organ measuring boards. Data collected from the Postmortem Examination of the cases was subjected to statistical analysis by initially, finding the % of body-weight for each organ and then Maximum, Minimum, Mean were calculated and than Standard Deviation (S.D.) was derived by the formula

Table 1. Range of organ weight in grams and percentage of body weight

Organ	Weight in Grams			Range of % of Body weight
	Max	Min	Range	
Brain	1654	889	1458 – 790	1.96 – 1.45
Heart	452	243	395 – 290	0.60 – 0.42
Rt. Lung	698	258	589 – 405	0.89 – 0.68
Lt. Lung	658	258	526 – 398	0.86 – 0.65
Rt. Kidney	172	95	149 – 99	0.23 – 0.17
Lt. Kidney	190	87	152 – 100	0.26 – 0.18
Liver	1812	785	1622 – 785	3.2 – 1.55
Spleen	185	78	126 – 88	0.20 – 0.10
Pancreas	102	40	81 – 50	0.12 – 0.10

Table 2. Comparison between range of organ weights in males and females

ORGAN	Males		Females	
	Range In Gms	Range of % of B.W.	Range In Gms	Range of % of B.W.
Brain	1392 – 1025	1.98 – 1.72	1198 – 845	1.94 – 1.68
Heart	352 – 260	0.59 – 0.45	325 – 226	0.56 – 0.39
Rt. Lung	560 – 435	0.90 – 0.69	515 – 348	0.89 – 0.68
Lt. Lung	546 – 392	0.88 – 0.69	506 – 324	0.85 – 0.63
Rt. Kidney	136 – 114	0.22 – 0.16	135 – 89	0.23 – 0.17
Lt. Kidney	151 – 116	0.25 – 0.16	140 – 98	0.24 – 0.18
Liver	1812 –895	3.3 – 1.52	1285 – 885	2.58 - 1.56
Spleen	154 – 99	0.23 – 0.14	128 – 89	0.22 – 0.13
Pancreas	86 – 55	0.12 – 0.10	78 – 41	0.12 – 0.09

Table A. Relation between Organ Weights and Body Weight in Adult Population of Bhavnagar Region (Tanna, 2011)

Organ	Weight in Grams			Range of % of Body weight
	Max	Min	Range	
Brain	1532	689	1369 –990	1.98 – 1.76
Heart	399	150	323. – 234	0.51 – 0.39
Rt. Lung	675	238	557 – 413	0.90 – 0.66
Lt. Lung	630	185	517 – 374	0.82 – 0.60
Rt. Kidney	182	90	141 – 104	0.24 – 0.16
Lt. Kidney	189	83	146 – 108	0.25 – 0.17
Liver	1712	734	1444 –995	2.09 – 1.77
Spleen	202	88	157 – 100	0.26 – 0.16
Pancreas	106	39	82 – 52	0.12 – 0.10

$$SD = \sum^{n=200} \sqrt{x - \bar{x}2}/200$$

[Where x=organ weight, X(bar) =Average].

Here the Standard Deviation will signify that, if the Mean ± 2S.D. Value is considered than 95% of the observation will fall in the normal distribution curve. So, the range is established as Mean ± 2S.D.The same Exercise was done for male and female data separately also, where n=72 for Males and n=31 for females.

RESULTS

Total, 200 cases were selected based on inclusion and exclusion criteria. Out of them 153 cases were males, and 47 were females. Results are tabulated as under.

Table B. Organ weights in adults as per Essentials of Forensic Medicine and Toxicology - Dr. K.S.N. Reddy

ORGAN	In Gms	% of BW	ORGAN	In Gms	% of BW
Brain	1400(M) 1275(F)	1.4%	Rt. Kidney	130-160	
Heart	300(M) 250(F)	0.40-0.45%	Lt. Kidney	120-150	
Rt. Lung	360-570	1	Liver	1400-1500	1.8
Lt. Lung	325-480	1	Spleen	150-200	0.16

Table C. Normal organ Weights in Indian Adults. – Medico legal Update (Kohli, ?)

	Male			Female		
	Max	Min	Avg	Max	Min	Avg
Brain	1400gm	1000gm	1219.7gm	1300gm	1000gm	1156.2gm
Liver	1700gm	840gm	1210.9gm	1660gm	800gm	1092.5gm
Heart	400gm	180gm	259.9gm	320gm	160gm	217.7gm
Spleen	220gm	80gm	131.3gm	200gm	60gm	121.8gm
Lung (Rt.)	520gm	300gm	417.6gm	500gm	280gm	369.7gm
Lung (Lt.)	500gm	280gm	376.8gm	480gm	240gm	340.6gm
Kidney (Rt.)	140gm	80gm	108.3gm	120gm	60gm	98.6gm
Kidney (Lt.)	140gm	80gm	104.2gm	120gm	60gm	98.3gm

DISCUSSION

Results were compared with earlier studies and the textbooks showing the range of normal weights. First and foremost thing to notice, is that there were hardly any differences in the results when compare to our previous study in Gujarat in Bhavnagar region (Tanna, 2011).As per table no. A, the only significant differences were found in Spleen weight, which was lower in Vadodara region, now this might point to endemicity of chronic disease like malaria responsible for increase in spleen weight in earlier place of study at Bhavnagar. The other significant difference was in Liver weight.

Here in Vadodara the liver weight range was found to be large. Range is pretty high between the upper limit and lower limit. This might be due to problems with alcoholism in the area affecting the liver weight. When compared the results with weights as given in table - B, Essentials of Forensic Medicine – Reddy, ?, Brain weight is given as 1.4% of body weight, but in our study we found it 1.96% to 1.45% of body weight, that is on higher side than the book. Heart weight is also on higher side 0.60% to 0.42% of body weight in comparison to 0.40-0.45% of body weight. Both lung weights bit lower, but not significantly lower than the textbooks.

No significant difference in the Kidney and spleen weights. Liver weight range is bigger 3.20-1.55% compared to textbook 1.8%. When compared with study of Kohli A. and Aggrawal NK, Only significant differences were found in Liver and Spleen weight.

Liver weight is higher in Vadodara, which is 1812 –895gms for males and1285 – 888gms for females, than in study population of Delhi which is 1210gms for males and 1092gms for females. Whereas Spleen weight is found to be lower in study population of Vadodara, which is 154 – 99gms for males and128 – 89gms for females than in Delhi, which is 131gms for males and 121 gms for females (Kohli and Aggrawal, ?).

Observations of study by Singh *et al*. (2004) at PGI, Chandigarh noted that Mean organ weights as observed in the present study in general were more than those reported from other parts of India.

They are more in concordance with the western population, possibly because the population of this zone in general is taller and heavier than rest of the population of the country and is more akin to western population so are their organ weights. So, our findings in comparison to this study were lower on an average in all the organs. Probably due to the difference in dietary habit of Gujarati who are vegetarians and Punjabis who are mix-vegetarians. When compared with the study of Chandra-prakash *et al* at Uttarakhand, Only significant differences were found in Spleen, Kidneys and Liver.

Observation of their study in grams are Brain 1115.51±156.42/1016.09+141.01, Rt Lung 446.57±201.06/ 334±143.76, Lt Lung 477.85±201.22/344.37+140, Spleen 149.17±105.61/153.09±116.98,Heart270.28±54.41/204.35±57. 35, Liver 1419.80±395.27/1204.52±365.71, Rt Kidney 136.65±62.24/ 111.91±32.29, Lt Kidney 132.42±42.67/ 104.24±33.79 (Cahndra Prakash, 2013). Spleen weight in our study is found to be 154-99gms for males and 128-89gms for females, which is lower than 149.17±105.61/153.09±116.980 for males and females respectively. Liver weight in our study is found to be 1812-895gms for males and 1285-885gms for females which is higher than1419.80±395.27/1204.52±365.71 for males and females respectively. Right Kidney weight in our study is found to be 136 – 114gms for males and 135 – 89gms for females which is higher than 136.65±62.24/ 111.91±32.29 for males and females respectively. Left Kidney weight in our

study is found to be 151 – 116gms for males and 140 – 98gms for females which is higher than 132.42±42.67/ 104.24±33.79.for males and females respectively. However, their range is pretty high. Since we have chosen Mean +_2SD - our ranges are narrower and more in line with the normals.

REFERENCES

Cahndra Prakash *et al*. 2013. Study of Internal Organ Weight and Its Correlation to Body Weight in Kumaon Region of Uttarakhand. JIAFM; 35(1): 29-32.

Dr. Reddy, K.S.N. The Essentials of Forensic Medicine and Toxicology - 33rd Edition - chapter -5 - pg no. 108-113.

Kohli, A. and Aggrawal, N.K. 2006. Normal organ Weights in Indian Adults. – Medico legal Update; 6(2) 03- -06.

Mukherjee, J.B. Forensic Medicine and Toxicology - - 4th Edition - Edited by - R.N. Karmakar - Chapter- 5 - Pg no. 191-192.

Singh, D., Bansal, Y.S., Sreenivas, M., Pandey, A.N. and Tyagi, S. 2004. Weights of human organs at autopsy in Chandigarh Zone of North-West India. – JIAFM. 26(3): 97-99.

Tanna J. *et al*. 2011. Relation between Organ Weights and Body Weight in Adult Population of Bhavnagar Region- A Post-Mortem Study. - JIAFM 33(1); 57-59.

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