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**Original Research**

# Relation Of Weights Of The Internal Thoracic Organs With Age And Sex – An Autopsy Based Study Done In Medical College Of West Bengal

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**ABSTRACT**

**Background:** Autopsy (necropsy, post mortem examination, thanatopsy) is the examination of a person's body after death. An autopsy is of different types. But among them Medicolegal autopsy is the concern of the forensic pathologist in India. Study of weight of human body organs plays a significant role in almost all the branches of medical sciences including forensic medicine, as any deviation in weight from the normal range suggests some pathological change in the organ. Recording of organ weights is one of regular criteria by the forensic experts during an autopsy. The findings were compared to what is standard or average of a specific organ for a specific age range and particular sex. The determination of weights of abdominal organs in particular has significant clinical value.

**Materials and Methods:** After getting institutional ethical committee clearance, the study done over the body of the 570 deceased came for medicolegal autopsy fulfilling the inclusion and exclusion criteria**.**

**Results:** Total 570 cases were selected after following the inclusion and exclusion criteria out of which 362 were males and 208 were females. Among the studied 570 cases, 362 (63.5 %) were male and 208 (36.5 %) were female. In this study the discussion was mainly on relation of age, sex, body weight, and body length upon the weights of thoracic viscera.

**Conclusion:** A database can be formed from this study regarding normal range of the weight of various organs and their relation with external parameters of the subjects which can be applicable on the population of this region for future reference. In severely mutilated bodies found in mass disasters or in homicidal killing, weights of isolated organs may give an idea about the stature, built and age of the victims helping in identification.

**Keywords: Autopsy; Weight; Thoracic Organ; Age; Sex.**

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## INTRODUCTION

Autopsy (necropsy, post mortem examination, thanatopsy) is the examination of a person's body after death. An autopsy is of different types. But among them usually following two types are most important.

### A] Pathological or Clinical Autopsy

Performed by pathologist or clinicians to diagnose the cause of death where it could not be arrived during treatment, or to confirm a doubtfully diagnosed case or to study the effect/ effectiveness of treatment. Consent from the relatives of the deceased is necessary.

### B] Medicolegal Autopsy

It is performed as part of official investigation of a sudden, suspicious or unnatural death and the information derived from it is to be applied to legal purposes.It is a special type of examination of a dead body to find out the cause of death examining all the body parts, all the organs, opening all the body cavities to corroborate with the evidences of eyewitnesses as per laws of the land towards admission of justice and prosecution of guilty.[1]

Study of weight of human body organs plays a significant role in almost all the branches of medical sciences including forensic medicine, as any deviation in weight from the normal range suggests some pathological change in the organ. Weighing of organs at autopsy not merely an exercise but has great medico-legal importance. Any deviation in weight from the normal range suggests some pathological change in the organ and thus helps in interpreting the opinion regarding the cause of death in various pathological conditions.[2]

Recording of organ weights is one of regular criteria by the forensic experts during an autopsy. The findings were compared to what is standard or average of a specific organ for a specific age range and particular sex. The determination of weights of abdominal organs in particular has significant clinical value. For example, liver volumes are important not only in determining disease states and disease progression but in estimating segmental liver volumes for transplant donors and planning the extent of hepatectomy in cancer patients. The spleen commonly increases in size in response to conditions such as infection and hematologic or metabolic disorders. There is a good correlation between platelet count and spleen volume, and splenic volume detects serious liver disease and correlates with splenic hyper function. Kidney size bears a relation to the degree of renal diseases.[3]

There is a lot of variation in the organ weights due to several factors in different regions of the world. The reason for this is the variation in the dietary habits, climatic conditions, daily water intake, customs, ethnicity and genetic predisposition of different population groups. Hence the normal organ weights of a particular region may not be accurate enough for another.[4]

Human organ weights besides state of nutrition etc. were also reported to be dependent on environmental and socio-economic conditions which are quite different in various parts of India.[5] Hence, the organ weights reported from other parts of India are definitely not applicable directly to the population of West Bengal.[6] As literature available on the internal organ weights for the population of this region, in particular is scanty, hence the present study is an attempt to provide such information. This study was designed to address the issue and to determine a normal weight range for the thoracic visceral organs in population of both sexes and different age groups in this locality and also to correlate the visceral weights with variables such as age, body length and body weight.

A scientific study was done on Normal Internal Organ Weight of Thai Adults Correlated to Body Length and Body Weight, analysis with the help of data from 250 autopsies from the Ramathibodi Hospital, Bangkok, Thailand in 2005 by group of scientists led by Thamrong Chirachariyavej. Excluding the decomposed bodies, fire related deaths and cases where medical treatment had not been given rest of the cases were from sudden unnatural death the age ranged from 15 to 88 years and there were 51 females and 199 males. Pearson's correlation coefficient was used to examine the relationship between the internal organ weight with body weight and body length. The mean + standard deviation (SD) were found for males and females respectively as follows:- Brain 1339 + 160/1165 + 184 gm, heart 311+ 66/278 + 160 gm, lung 910 + 347/675 + 255 gm, liver 1439 + 365/1214 + 275 gm, spleen 103 + 46/92.9 + 48 gm, kidney 260 + 68/230 + 42 gm. The relationship between internal organ weight and body weight showed each internal organ significantly correlated with body weight in males at p-value < 0.05, whereas in females it only correlated to liver, kidney and spleen at p-value < 0.05. For the correlation between internal organ weight and body length, it showed only brain, lung, liver and kidney correlated to the body length in males at p-value < 0.05, but not in females [(7)]

In 2006, two scientists Anil Kohli and N.K Aggarwal done extensive study on Normal Organ weights of Indians. In that study organs were collected from dead bodies within the age group of 18 to 75 years brought for autopsy. The organs taken for the studies did not show any gross pathology and the survival time in the hospital (for admitted cases) varied from 1-2 days. Excluding the cases surviving for more than two days omitted for the chances of any alterations in organ weights due to treatment or disease process setting in during treatment. The following organs were considered - brain, liver, lungs, kidneys and spleen. [(8)] The study revealed following results:

| | **Males** | | | **Females** | | |
|---|---|---|---|---|---|---|
| **Organs** | **Weight in grams** | | | **Weight in grams** | | |
| | **Minimum** | **Maximum** | **Average** | **Minimum** | **Maximum** | **Average** |
| Brain | 992.25 | 1615.95 | 1342.86 | 850.5 | 1360.8 | 1085.52 |
| Right Lung | 198.45 | 850.5 | 514.55 | 170.10 | 567.0 | 382.78 |
| Left Lung | 141.75 | 850.5 | 469.65 | 141.75 | 510.3 | 333.12 |
| Heart | 99.225 | 368.55 | 283.5 | 113.4 | 226.8 | 184.28 |
| Stomach | 85.05 | 255.15 | 158.76 | 99.23 | 226.80 | 163.02 |
| Liver | 737.10 | 1,842.75 | 1241.16 | 850.50 | 1417.50 | 1,084.39 |
| Spleen | 70.875 | 311.85 | 170.95 | 56.70 | 269.33 | 145.27 |
| Right Kidney | 70.875 | 170.10 | 103.19 | 56.70 | 113.40 | 87.32 |
| Left Kidney | 42.525 | 170.10 | 102.91 | 56.70 | 113.40 | 83.63 |

In a Study of visceral Organ Weight and Its Correlation to Body Weight in Kumaon Region of Uttarakhand by Chandra Prakash et al done at the department of Forensic Medicine, Govt. Medical College, Haldwani, Uttarakhand from March 2011 to March 2012, Pearson's correlation coefficient was used to see the relationship between the internal organ weights (IOW) with body weight (BW). The mean ± Standard deviation (SD) were represented by males and females respectively: 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, Heart 270.28 ± 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. It was found that weight of different organs was positively correlated to body weight in

both sexes except in male brain, lung and spleen are not correlated and in female spleen is not correlated. Females had a lower organ weight compared to males. In both sexes, weight of organ was lower than the western population. After attaining the peak, all organ weights declined with the advancing age.[9]

Divyesh K. Vadgama et al (2010) conducted an autopsy based study during the period of February 2010 to November 2010. In that study 449 cases (272 Male, 177 Female) were included. Body weight (BW), Body length (BL), Body mass index (BMI) and Body surface area (BSA) was measured for finding correlation with organ weights. The study revealed that in males, except Spleen weights of 5 organs have positive correlation with BW. In females, weights of all organs except spleen were correlated positively with BW. In males, weights of both lungs had positive correlation with BL and weights of the brain, liver, spleen and both kidneys have negative correlation with BL. In females, heart and both lungs had positive correlation with BL.[10]

## MATERIALS & METHODS

After getting the clearance from the institutional ethical committee, examination and weight measurements of the thoracic viscera of the bodies were done during the process of medicolegal autopsies in Burdwan Police Morgue of Burdwan Medical College over 12 months. This cross-sectional study included following criteria-

**Inclusion Criteria**

All the bodies came for postmortem examination following complete enumeration method

**Exclusion Criteria**

I. Decomposed body
II. Evidence of gross pathology and trauma to internal organs,
III. Apparently Malnourished (BMI < 18)
IV. Dead-bodies whose exact age is not documented.

Total 570 cases were included in the study.

## RESULTS

Total 570 cases were selected after following the inclusion and exclusion criteria out of which 362 were males and 208 were females. Analysis and tabulation were done by standard statistical methods using appropriate software.

**Table 1: Distribution of subjects according to their sex**

| Sex | Frequency | Percent |
|---|---|---|
| Male | 362 | 63.5 |
| Female | 208 | 36.5 |
| Total | 570 | 100.0 |

**Table 2: Distribution of subjects according to their ages**

| Age (Years) | Frequency | Percent |
|---|---|---|
| 0-10 | 8 | 1.4 |
| 11-20 | 100 | 17.5 |
| 21-30 | 148 | 26.0 |
| 31-40 | 101 | 17.7 |

| | | |
|---|---|---|
| 41-50 | 92 | 16.1 |
| 51-60 | 60 | 10.5 |
| 61-70 | 39 | 6.8 |
| 71-80 | 18 | 3.2 |
| 81-90 | 4 | .7 |
| Total | 570 | 100.0 |

**Table 3: Age group-wise distribution of sex of subjects**

| | | Age groups | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0-10 years | 11-20 years | 21-30 years | 31-40 years | 41-50 years | 51-60 years | 61-70 years | 71-80 years | 81-90 years | |
| Sex | Male | 6 | 46 | 84 | 67 | 70 | 47 | 28 | 10 | 4 | 362 |
| | Female | 2 | 54 | 64 | 34 | 22 | 13 | 11 | 8 | 0 | 208 |
| Total | | 8 | 100 | 148 | 101 | 92 | 60 | 39 | 18 | 4 | 570 |

Among the studied 570 cases, 362 (63.5 %) were male and 208 (36.5 %) were female. (Table 1). In this study the discussion was mainly on relation of age, sex, body weight, and body length upon the weights of thoracic viscera.

**Table 4: One way ANOVA test between different Age groups and weight of Heart (n = 569)**

| ANOVA | | | | | |
|---|---|---|---|---|---|
| HEART | | | | | |
| | Sum of Squares | df | Mean Square | F | Sig. |
| Between Groups | 1496306.185 | 8 | 187038.273 | 78.663 | .000 |
| Within Groups | 1333904.708 | 561 | 2377.727 | | |
| Total | 2830210.893 | 569 | | | |

**Table 5: Independent sample t-test between Sex and weight of Heart (n= 570)**

| Group Statistics | | | | | |
|---|---|---|---|---|---|
| | Sex | N | Mean | Std. Deviation | Std. Error Mean |
| Heart | Male | 362 | 296.130 | 76.0155 | 3.9953 |
| | Female | 208 | 260.962 | 52.9717 | 3.6729 |

| Independent Samples Test | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | | | | |
| | | F | Sig. | t | df | Sig. (2-tailed) | Mean Difference | Std. Error Difference | 95% Confidence Interval of the Difference | |
| | | | | | | | | | Lower | Upper |
| HEART | Equal variances assumed | 13.168 | .000 | 5.899 | 568 | .000 | 35.1683 | 5.9618 | 23.4585 | 46.8781 |
| | Equal variances not assumed | | | 6.480 | 547.299 | .000 | 35.1683 | 5.4270 | 24.5079 | 45.8287 |

**Table 6: Correlation coefficient test between weight of Heart and Body Weight (n= 570)**

| Descriptive Statistics | | | |
|---|---|---|---|
| | **Mean** | **Std. Deviation** | **N** |
| **Heart** | 283.296 | 70.5267 | 570 |
| **Weight** | 61.999 | 12.2795 | 570 |

| Correlations | | | |
|---|---|---|---|
| | | **HEART** | **WEIGHT** |
| **HEART** | Pearson Correlation | 1 | .676** |
| | Sig. (2-tailed) | | .000 |
| | N | 570 | 570 |
| **WEIGHT** | Pearson Correlation | .676** | 1 |
| | Sig. (2-tailed) | .000 | |
| | N | 570 | 570 |
| **. Correlation is significant at the 0.01 level (2-tailed). | | | |

**Table 7: Correlation coefficient test between weight of Heart and Body Length (n= 570)**

| Descriptive Statistics | | | |
|---|---|---|---|
| | **Mean** | **Std. Deviation** | **N** |
| **LENGTH** | 160.328 | 9.9484 | 570 |
| **HEART** | 283.296 | 70.5267 | 570 |

| Correlations | | | |
|---|---|---|---|
| | | LENGTH | HEART |
| LENGTH | Pearson Correlation | 1 | .509** |
| | Sig. (2-tailed) | | .000 |

| | | | |
|---|---|---|---|
| | N | 570 | 570 |
| HEART | Pearson Correlation | .509** | 1 |
| | Sig. (2-tailed) | .000 | |
| | N | 570 | 570 |
| **. Correlation is significant at the 0.01 level (2-tailed). | | | |

In this study there is a statistically significant differences of weight of heart between groups as demonstrated by one-way ANOVA F (8,561) = 78.6, p =.000. The Bonferroni post hoc test showed that except between few age groups (i.e. 81-90 age group with that of 61-70 and 71-80 age group; 71-80 age group with that of 61-70age group; 61-70 age group with that of 51-60 age group; 51-60 age group with that of 41-50 age group) there is significant differences between weight of the heart and different age groups. (Table 4) Independent sample t test between sex and weight of the heart showed that the mean weight of the heart among the male is 296.130 gm and that of female is 260.962gm. 2-tailed p value (0.0) also showed that the differences between weight of heart between male and female is also significant. Levene's Test also showed that the there is significant Variances between two samples (p= 0.000, <0.05) (table 5)

Correlation coefficient i.e Pearson's r is 0.676 that means moderately positive correlation – the persons having more the body length likely to have greater weight of the heart and the 2-tailed significance value (0.00) also proofs that this correlation is very powerful and (it has enough statistical power to identify even the slightest change) (table 6)  Correlation coefficient i.e Pearson's r is 0.509 that means moderately positive correlation – the persons having more the body length likely to have greater weight of the heart and the 2-tailed significance value (0.00) also proofs that this correlation is very powerful and (it has enough statistical power to identify even the slightest change) (table 7).

**Table 8: One way ANOVA test between different Age groups and weight of Left Lung (n = 569)**

| **ANOVA** | | | | | |
|---|---|---|---|---|---|
| **LEFT LUNG** | | | | | |
| | **Sum of Squares** | **df** | **Mean Square** | **F** | **Sig.** |
| **Between Groups** | 2312595.522 | 8 | 289074.440 | 23.743 | .000 |
| **Within Groups** | 6830313.103 | 561 | 12175.246 | | |
| **Total** | 9142908.625 | 569 | | | |

**Table 9: Independent sample t-test between Sex and weight of Left Lung (n= 570)**

| **Group Statistics** | | | | | |
|---|---|---|---|---|---|
| | **SEX** | **N** | **Mean** | **Std. Deviation** | **Std. Error Mean** |
| **LEFT LUNG** | Male | 362 | 449.105 | 118.7329 | 6.2405 |
| | Female | 208 | 447.125 | 139.9309 | 9.7025 |

| Independent Samples Test | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | | | | |
| | | F | Sig. | t | df | Sig. (2-tailed) | Mean Difference | Std. Error Difference | 95% Confidence Interval of the Difference | |
| | | | | | | | | | Lower | Upper |
| Left Lung | Equal variances assumed | 5.792 | .016 | .179 | 568 | .858 | 1.9800 | 11.0384 | -19.7011 | 23.6611 |
| | Equal variances not assumed | | | .172 | 376.723 | .864 | 1.9800 | 11.5361 | -20.7032 | 24.6631 |

**Table 10: Correlation coefficient test between weight of Left Lung and Body weight (n= 570)**

| Descriptive Statistics | | | |
|---|---|---|---|
| | Mean | Std. Deviation | N |
| LEFT LUNG | 448.382 | 126.7611 | 570 |
| WEIGHT | 61.999 | 12.2795 | 570 |

| Correlations | | | |
|---|---|---|---|
| | | LEFT LUNG | WEIGHT |
| LEFT LUNG | Pearson Correlation | 1 | .446** |
| | Sig. (2-tailed) | | .000 |
| | N | 570 | 570 |
| WEIGHT | Pearson Correlation | .446** | 1 |
| | Sig. (2-tailed) | .000 | |
| | N | 570 | 570 |

**Table 11: Correlation coefficient test between weight of Left Lung and Body Length.**

| Descriptive Statistics | | | |
|---|---|---|---|
| | Mean | Std. Deviation | N |
| LEFT LUNG | 448.382 | 126.7611 | 570 |
| LENGTH | 160.328 | 9.9484 | 570 |

| Correlations | | | |
|---|---|---|---|
| | | LEFT LUNG | LENGTH |
| LEFT LUNG | Pearson Correlation | 1 | .299** |
| | Sig. (2-tailed) | | .000 |
| | N | 570 | 570 |
| LENGTH | Pearson Correlation | .299** | 1 |

| | | | |
|---|---|---|---|
| | Sig. (2-tailed) | .000 | |
| | N | 570 | 570 |
| **. Correlation is significant at the 0.01 level (2-tailed). | | | |

In this study There is a statistically significant differences of weight of Left Lung between groups as demonstrated by one-way ANOVA F(8,561) = 23.743, p=.000. The Bonferroni post hoc test showed that EXCEPT between few age groups (i.e. 81-90 age group with that of 21-30, 31-40, 41-50, 51-60, 61-70 and 71-80 age group;71-80 age group with that of 21-30, 31-40, 41-50, 51-60 and 61-70 age group; 61-70age group with that of 31-40, 41-50 and 51-60 age group; 51-60 age group with31-40 and 41-50 age group; 31-40 age group with that of 21-30 age group) there is significant differences between weight of the Left Lung and different age groups. (Table 8)

Independent sample t test between sex and weight of the left lung showed that the mean weight of the left lung among the male is 449.105 gm and that of femaleis447.125 gm. 2-tailed p value (0.858 & 0.864) also showed that the differences between weight of left lung between male and female is not significant. Levene's Test also showed that the there is significant Variances between two samples (p=0.016, <0.05) (table 9)

Correlation coefficient i.e Pearson's r is 0.446 that means weak positive correlation–the persons having more the body weight likely to have greater weight of the Left Lung and the 2-tailed significance value (0.00) also proofs that this correlation is very powerful and (it has enough statistical power to identify even the slightest change) (table 10)

Correlation coefficient i.e Pearson's r is 0.299 that means weak positive correlation–the persons having more the body length likely to have greater weight of the Left Lung and the 2-tailed significance value (0.00) also proofs that this correlation is very powerful and (it has enough statistical power to identify even the slightest change) (table 11).

**Table 12: One way ANOVA test between different Age groups and weight of Right Lung (n = 569)**

| ANOVA | | | | | |
|---|---|---|---|---|---|
| **RIGHT LUNG** | | | | | |
| | **Sum of Squares** | **df** | **Mean Square** | **F** | **Sig.** |
| Between Groups | 2636140.556 | 8 | 329517.569 | 26.900 | .000 |
| Within Groups | 6872133.928 | 561 | 12249.793 | | |
| Total | 9508274.484 | 569 | | | |

**Table 13: Independent sample t-test between Sex and weight of Right Lung (n= 570)**

| Group Statistics | | | | | |
|---|---|---|---|---|---|
| | **SEX** | **N** | **Mean** | **Std. Deviation** | **Std. Error Mean** |
| **RIGHT LUNG** | male | 362 | 498.983 | 123.5348 | 6.4928 |
| | female | 208 | 492.163 | 138.8874 | 9.6301 |

| Independent Samples Test | | |
|---|---|---|
| | Levene's Test for Equality of Variances | t-test for Equality of Means |

| | | F | Sig. | t | df | Sig. (2-tailed) | Mean Difference | Std. Error Difference | 95% Confidence Interval of the Difference | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Lower | Upper |
| RIGHT LUNG | Equal variances assumed | 2.826 | .093 | .606 | 568 | .545 | 6.8200 | 11.2535 | -15.2836 | 28.9235 |
| | Equal variances not assumed | | | .587 | 391.572 | .557 | 6.8200 | 11.6145 | -16.0146 | 29.6545 |

**Table 14: Correlation coefficient test between weight of Right Lung and Body weight (n= 570)**

| **Descriptive Statistics** | | | |
|---|---|---|---|
| | **Mean** | **Std. Deviation** | **N** |
| **RIGHT LUNG** | 496.495 | 129.2691 | 570 |
| **WEIGHT** | 61.999 | 12.2795 | 570 |

| **Correlations** | | | |
|---|---|---|---|
| | | **RIGHT LUNG** | **WEIGHT** |
| **RIGHT LUNG** | Pearson Correlation | 1 | .468** |
| | Sig. (2-tailed) | | .000 |
| | N | 570 | 570 |
| **WEIGHT** | Pearson Correlation | .468** | 1 |
| | Sig. (2-tailed) | .000 | |
| | N | 570 | 570 |
| **. Correlation is significant at the 0.01 level (2-tailed). | | | |

**Table 15: Correlation coefficient test between weight of Right Lung and Body Length.**

| **Descriptive Statistics** | | | |
|---|---|---|---|
| | Mean | Std. Deviation | N |
| RIGHT LUNG | 496.495 | 129.2691 | 570 |
| LENGTH | 160.328 | 9.9484 | 570 |

| **Correlations** | | | |
|---|---|---|---|
| | | RIGHT LUNG | LENGTH |
| RIGHT LUNG | Pearson Correlation | 1 | .355** |
| | Sig. (2-tailed) | | .000 |
| | N | 570 | 570 |
| LENGTH | Pearson Correlation | .355** | 1 |
| | Sig. (2-tailed) | .000 | |
| | N | 570 | 570 |
| **. Correlation is significant at the 0.01 level (2-tailed). | | | |

In this study There is a statistically significant differences of weight of Right Lung between groups as demonstrated by one-way ANOVA F(8,561) = 26.900, p=.000. The Bonferroni post hoc test showed that EXCEPT between few age groups (i.e. 81-90 age group with that of 21-30, 31-40, 41-50, 51-60, 61-70 and 71-80 age group; 71-80 age group with that of 21-30, 31-40, 41-50, 51-60 and 61-70 age group; 61-70age group with that of 31-40, 41-50 and 51-60 age group; 51-60 age group with that of 31-40 and 41-50 age group; 41-50 age group with that of 31-40 age group; 31-40age group with that of 21-30 age group) there is significant differences between weight of the Right Lung and different age groups. (Table 12)

Independent sample t test between sex and weight of the right lung showed that the mean weight of the right lung among the male is 498.983 gm and that of femaleis492.163 gm. 2-tailed p value (0.545 & 0.557) also showed that the differences between weight of right lung between male and female is not significant. Levene's Test also showed that the there is no significant Variances between two samples (p=0.093, >0.05) (table 13)

Correlation coefficient i.e Pearson's r is 0.468 that means weak positive correlation–the persons having more the body weight likely to have greater weight of the Right Lung and the 2-tailed significance value (0.00) also proofs that this correlationis very powerful and (it has enough statistical power to identify even the slightest change) (table 14)

Correlation coefficient i.e Pearson's r is 0.355 that means weak positive correlation–the persons having more the body length likely to have greater weight of the Right Lung and the 2-tailed significance value (0.00) also proofs that this correlation is very powerful and (it has enough statistical power to identify even the slightest change) (table 15).

## DISCUSSION

### Weight of Heart

The values are almost similar to those observed by Dr. Reddy and Dr. Mukherjee in their text books. (300 gm in male, 250 gm in females and 0.40-0.50%of BW in both sexes. (table 5).

In the present study, mean ±SD, range 296.13 gm ±76.01 gm in males and 260.96gm± 52.97 gm in females.

Mean ±SD 311 ± 66 in males and Mean ± SD 278 ± 60 in females have been observed by Chirachariyavej T et al **(7)**. Values are higher in both males and females than those observed in the present study.

Mean ±SD - 270.28 gm ± 54.41gm and Mean ± SD - 204.35gm± 57.35gmareobserved in males and females respectively in the study by Chandra Prakashet al.[9] Both the values are lower than those observed in the present study.

Figure shows trend of increasing heart weight with increasing age.

Chandra Prakash et al[9] observed significant correlation between heart wt. and body wt in both sexes ('r'0.418, p<0.001 in males and 'r' 0.847, p<0.001 in females)

Divyesh K. Vadgama et al[10] also observed significant correlation in between heart wt. and BW ('r' 0.549, p<0.001 in males and 0.634, p<0.001in female)

### Weight of lungs

### Right lung

Table 13 shows average weight of right Lung among the male is 498.983 gm and that of female is 492.163 gm in this study is observed to be similar to that mentioned in Dr. Reddy' text book (360-570 gm in both sexes)

Kohli Anil et al[8] observed average lung wt (rt.) to be 514.5 gm in males and382.7gm in females. The values are higher than in males and less than in females that observed in the present study.

Observed values in the present study in both sexes are higher than those observed in the study by Gharpure PV et al[11] in Nagpur (365.3 gm in males, 309.6gm in females).
Observation in Uttar Pradesh by Divyesh K. Vadgama et al **(10)** has similar values (514.55 gm in males and 382.78 gm in females) compared to the present study.
Table 17 shows mean ± SD in males is 498.98 ± 123.53 gm and that of in femalesis492 ± 138.88 gm.
Chandra Prakash et al[9] observed Rt. Lung 446.57± 201.06 gm(males) and334±143.76 gm (females).
Chandra Prakash et al[9] in their study at Kumaon district in Uttarakhand observed lung wt.(rt.)—BW correlation coefficient 'r' 0.0744, p >0.1in males which is statistically insignificant and 'r' 0.595, p<0.05 in females which is statistically significant.
Divyesh K. Vadgama et al[10] observed significant correlation between lung wt.(rt.)and BW in their study at Jamnagar region in both sexes ('r'0.184 in males, 'r'0.354 in females). They also observed significant correlation in between lung wt (rt.) and BL in that study ('r'0.229 in males and 'r' 0.431in females).

**Left Lung**

Table 13 shows average weight of left Lung among the male is 449.105 gm and that of female is 447.125 gm in this study is observed to be similar to that mentioned in Dr. Reddy' text book (325-480 gm in both sexes).
Kohli Anil et al[8] observed average left lung wt to be 376.8 gmin males and340.6gm in females. The values are less than that observed in the present study.
Observed values in the present study in both sexes are higher than those observed in the study by Gharpure PV et al **(11)** in Nagpur (346.6 gm in males, 297.0gminfemales).
Table 13 shows mean ± SD in males is 449.10 ± 118.73 gm and that in Femalesis447.12 ± 139.93 gm.
Chandra Prakash et al[9] observed lt. Lung 477.85+201.22gm(males) and344.37+140 gm (females).
Chandra Prakash et al[9] in their study at Kumaon district in Uttarakhand observed lung wt.(lt.)-BW correlation coefficient 'r' 0.0342, p >0.1in males which is statistically insignificant and 'r' 0.595, p<0.01 in females which is statistically significant.
Divyesh K. Vadgama et al[10] observed significant correlation between lung wt.(lt.)and BW in their study at Jamnagar region in both sexes ( 'r'0.171 , p<0.01inmales, 'r'0.330 , p<0.01in females). They also observed significant correlation in between lung wt (rt.) and BL in that study ('r'0.229 in males and 'r' 0.431in females).

## CONCLUSION

A database can be formed from this study regarding normal range of the weight of various organs and their relation with external parameters of the subjects which can be applicable on the population of this region for future reference. In severely mutilated bodies found in mass disasters or in homicidal killing, weights of isolated organs may give an idea about the stature, built and age of the victims helping in identification.

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