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Conclusion:

Abnormal pediatric body weight affect child health, well being, and affect health care cost. These children more liable for complications, mechanical ventilation, longer duration of hospital admission.

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children with low BMI.⁽²⁸⁾

Other correlated results founded in comparison with adult age, in the study of (Association between under- weight and pulmonary function in 282.135 healthy adults)⁽⁹⁾ is a cross- sectional study in Korean population done by dr.Jong Geol Do, et.al, at 2019.

The objective of this study was to determine the effect of being underweight on pulmonary function in a large number of population without certain lung disease. At Number of 282.135 retrospective cohort study done between January 2012 and December 2014 in Korea were included. Using multivariate- adjusted analysis, the relationship between body mass index (BMI) and pulmonary function were assessed. Underweight individuals represented 5.5% of the total study population (n= 282.135), with most (87.9%) of them being females. Compare to normal weight and obese, underweight was associated with decreased pulmonary function. Forced expiratory volume in first second (FEV1), predicted FEV1 (%), forced vital capacity (FVC), predicted FVC (%), and peak expiratory flow (PEF) were lower in the underweight group than those in other groups after adjusting for age, sex, height, status of smoking, frequency of vigorous exercise, diabetes, and high sensitivity, (CRP)(P < 0.001). Lower BMI tended to decrease pulmonary function parameters, This study demonstrated a proportional relationship between pulmonary function and the degree of BMI. We found that underweight status was independently associated with decreased pulmonary function in Korean population.⁽⁹⁾

In our results the need& duration of Mechanical ventilation among obese patients group and overweight group was increased to 12.5% in comparison to 92.9% of healthy weight group who did not need mechanical ventilation (P value= 0.004).

Similar scope was used to relate the weight and its effect on mechanical ventilation in that study done At 2018 (Comparative Analysis of Ideal Body Weight Methods for Pediatric Mechanical Ventilation)⁽⁸⁾ studied by Jeffrey R. Bilharz, et.al it was a universal method for determining ideal body weight (IBW) for the application of appropriate tidal volumes in children on mechanical ventilation is elusive. They sought to compare 3 common IBW methods for subjects between ages 2 and 20Y. Thier used method was depend on a demographic data were recorded, and the IBW by using growth chart data from the Centers for Disease Control and Prevention. The percentage error between each IBW method and the actual body weight were calculated and reported as median. They concluded that The majority of the subjects showed a clinically important error between the actual body weight and the IBW. The error increased in subjects > 25 kg actual body weight. These data underline the importance of obtaining height measurements and calculated IBW in pediatric patients who are mechanically ventilated.⁽⁸⁾

The same results recorded in the Study of (Relationship Between Body Mass Index and Outcomes Among Hospitalized Patients With Community- Acquired Pneumonia)⁽²⁾ by Anna M. Bramley, et.al, at To observe the effect of patient's body mass index (BMI) on community-

acquired pneumonia (CAP) as regard the severity by investigated the effect of BMI and CAP course and prognosis (hospital length of stay [LOS], intensive care unit [ICU] admission, and invasive mechanical ventilation) in hospitalized patients diagnosed as CAP patients from the Centers for Disease Control and Prevention Etiology of Pneumonia in the Community, depending on demographic data including the age, underlying conditions, and smoking status. The study concluded that the overweight or obese children who were, with asthma, had higher risk of ICU admission and mechanical ventilation.⁽²⁾

Our study results revealed that the frequency of complications and percentage among each study group, number of cases& percentage, P value=0.001 which show highest percentages of complications (pneumothorax) among obese patients group (25%)& (pleural effusion) underweight group (22.2%) and the least is the percentage of empyema within average weight group= 0.9%.

As regard complications, (What Are the Complications of Pneumonia)⁽²⁹⁾ was a review done by Minesh Khatri, et.al, on September 22, 2020 revealed that the most frequent comlications of pneumonia was Bacteremia and Septic Shock: bacteremia can lead to septic shock. It's a reaction to the infection in the blood, and it can cause drop in blood pressure level. The second complication was the lung abscesses which is usually occurs in association with, gum disease, bacteremia and poor immunity. Also, Pleural Effusions, Empyema, and Pleurisy were common complications.⁽²⁹⁾

A study done at 2013 to demonstrate (Acute Pneumonia and Its Complications).⁽⁵⁾ By Chitra S. Mani et.al, their collected data revealed that Multiple microbes, both viruses and bacteria, cause lower respiratory tract infection in children. Pneumonia in immunocompetent children, specific etiologic agents were confirmed in only. Pathogens vary according to age, underlying medical condition, and efficacy of the immune system. Multiple pathogens, particularly respiratory syncytial virus, rhinoviruses, influenza viruses, and Mycoplasma, are seasonal. In neonates and Infants. Aspiration is the cause of most early- onset infections. Group B streptococcus is the most frequent cause of early- onset pneumonia, , and other gram- negative bacilli can cause respiratory distress similar to hyaline membrane disease, Chlamydia trachomatis pneumonia can occur in 10% of neonates born to mothers colonized with the organism in genital tract. Bordetella pertussis infection, viruses are a less common cause compared with older infants. Congenital or perinatal infection with cytomegalovirus (CMV), herpes simplex virus (HSV), or Treponema pallidum can cause pneumonia. In Infants, Children, and Adolescents, viruses have been considered to be the most common cause of pneumonia in children 1 to 36 months of age. In a study published in 2004 of acute pneumonia in hospitalized, immunocompetent children 2 months to 17 years of age, bacteria were identified in 60%, viruses in 45%, Mycoplasma species in 14%, Chlamydia pneumoniae in 9%, and mixed bacterial- viral infections in 23%.⁽⁵⁾

Calculation of Body Mass Index (BMI) of each child and determination of the centile which child fall in, and Interpretation of Child's BMI, Detailed chest examination for all signs of lower respiratory tract infections including inspection, palpation, percussion and auscultation, Chest X-ray for diagnosis of lower respiratory tract infections, Laboratory tests at initial diagnosis and follow up including: CBC, ESR, CRP and blood culture, Close follow up and determination of patients who are at risk for development of complications or need of mechanical ventilation.

Our study revealed that (among our study sample) highest percentage of infection was in underweight females= 66.7% and the least percentage was among underweight males= 33.3% (P value= 0.3). Obese patients was more liable for respiratory distress, as, 50% of them was presented at grade 2 respiratory distress at time of admission, while the percentage was 8.8% within average weight group (P value=0.01).

Grades of respiratory distress in clinical practice (5- 8):

1. Grade 1 (Mild distress): Rapid respiratory rate& working ala nasi.
2. Grade 11 (Moderate distress): Grade 1+intercostals& subcostal retraction.
3. Grade 111 (severe distress): Grade 1+ Grade 11+expiratory grunting.
4. Grade IV (advanced distress): Grade 1+ Grade 11+ Grade 111+central cyanosis and disturbed consciousness.

Obese and overweight group showed increase in the need& duration of Mechanical ventilation (12.5%), while healthy weight group did not need mechanical ventilation by 92.9%. (P value=0.004). Also, there is double increase in complications and underweight (44.4%)& obese patients (50%) in comparison to (10.6%) complicated cases within average weight group (P value=0.002). Pneumothorax was the most frequent complication among obese patients group (25%), while pleural effusion was the most frequent complication underweight group(22.2%), In comparison to 0.9% from average weight group developed empyema (P value=0.001).

Duration of hospital admission among underweight patients was the longest duration (5 days) by 44.4% (P value=0.005), Also, paternal work absenteeism was increased in parents of underweight and obese patient (P value= 0.02).

So, our results revealed that the obese child was more liable for respiratory distress, disease complications as pneumothorax, had a higher risk for need of mechanical ventilation& increased its duration.

Overweight child were also had increased risk for mechanical ventilation.

As regard underweight child they were more liable for complications as pleural effusion, longer duration of hospital admission.

So, an abnormal pediatric body weight and abnormal BMI had a direct impact on child health, well being, affect pediatric mortality and morbidity and have a negative effect on health care cost and an increased economic burden on family and community.

The same results was recorded at 2017 Yusuke Okubo et.al, study The (Impact of pediatric obesity on hospitalized children with lower

respiratory tract.

infections in the United States).⁽³¹⁾ They conducted a retrospective cohort study of bronchitis and pneumonia among children aged 2- 20 years using hospital discharge records. The data were obtained from the Kid's Inpatient Database in 2003, 2006, 2009, and 2012, and were weighted to estimate the number of hospitalizations in the United States. they used the International Classification of Diseases, Ninth Revision, to classify whether the patient was obese or not. investigated the associations between pediatric obesity and use of mechanical ventilation using multivariable logistic regression model. They concluded that the Pediatric obesity is an independent risk factor for severity and morbidity among pediatric patients with lower respiratory tract infections. These findings suggest the importance of obesity prevention for pediatric populations.⁽³¹⁾

Also, similar results recorded in study of (Obesity and risk of respiratory tract infections: results of an infection- diary based cohort study)⁽¹³⁾ was studied at 2018 by Livia Maccioni, et.al, depending on the fact of: Respiratory tract infections (RTIs) are a major morbidity factor contributing to health care costs and patient quality of life. The aim of their study was to test if the obesity ($BMI \geq 30 \text{ kg/ m}^2$) is one of the risk factors underlying frequent RTIs in the German adult population. They recruited 1455 individuals between 18 to 70 years from a cross- sectional survey on respiratory tract infections in Germany and invited the patients to self- report in brief or accidental RTIs experienced during three consecutive winter/spring seasons. And the summery of these 18 months is reported. In the results in comparison with individuals with normal weight, obese individuals reported a consistently higher frequency of upper and lower RTIs and predominantly fell in the upper 10% group of a diary sum score adding- up 10 different RTI symptoms over time. Obesity was associated both with lower RTIs. They conclude that there is a combination between the obesity and infection burden and present evidence for the rule and interaction with sports activity and dietary habits.⁽¹³⁾

Other supportive results was founded in the study of (Predisposition to acute respiratory infections among overweight preadolescent children).⁽²⁸⁾ was took place at 1998 by W Jedrychowski, et.al, It was a cross- sectional field survey applied on 1129 preadolescent children lived in Krakow. By a trained health workers interviewed the parents at schools or at homes in order to get standardized information regarding the families' social backgroundand children's respiratory state and attacks of respiratory infections. Predisposition to respiratory infections in children according to frequency of spells of acute respiratory infections experienced by a given child over the 12 months before meeting. Clinical examination of children in the form of anthropometric measurements and spirometric testing. Anthropometric measurements were used for calculation of the body mass index (kg/ m^2). A child whose BMI was 20 or higher was defined as overweight (90th percentile). Susceptibility to acute respiratory infections was related significantly to body mass index. The children with $BMI > \text{or} = 20$ experienced twice as high a risk for acute respiratory infections than

Results:

Table (1) Demographic And Anthropometric Measurements Of Study Groups As Regard Clinical Presentation:

Clinical Presentation	Type	N0	%
Diagnosis	Lobar Pneumonia	83	60.1
	Broncho Pneumonia	47	34.1
	Imterstitial Pneumonia	8	5.8
Causative Organism	Haemophilus Influanza	38	27.5
	Viral	30	21.7
	Pneumococca	27	19.6
	Strept	23	16.7
	Klepsiela	8	5.8
	Staph	7	5.1
	Niesseria	5	3.6
Respiratory Distress	Not Distressed	53	38.4
	Grade (1)	58	42
	Grade (2)	18	13
	Grade (3)	9	6.5

Type of pneumonia, causative organism and presence of respiratory distress and it's degree. Diagnosis (type of pneumonia), Chi square=4, P value= 0.67, Causative organism, Chi square= 55, P value= 0.001, Respiratory distress, Chi square=4, P value= 0.67.

Table (2) Presence& degree of respiratory distress among each study group

Resp Distress		Under Wt	Average Weight	Over Wt	Obese
Not Distressed	n	0	8	1	0
	%	0.0%	7.1%	12.5%	0.0%
Grade1	n	1	48	2	2
	%	11.1%	42.5%	25.0%	25.0%
Grade2	n	4	47	3	4
	%	44.4%	41.6%	37.5%	50.0%
Grade3	n	4	10	2	2
	%	44.4%	8.8%	25.0%	25.0%

Presence& degree of respiratory distress among each study group, Chi square= 14.8.

P value= 0.01 with highest percentage is grade 2 resp distress within obese patients= 50% and the least percentage is grade3 resp distress within average weight group= 8.8%.

Table (3) Need& Duration Of Mechanical Ventilation Among Each Study Group.

Mechanical Vent		Under Wt	Average Weight	Over Wt	Obese
No	n	6	105	7	7
	%	66.7%	92.9%	87.5%	87. %
1day	n	1	0	0	0
	%	11.1%	0.0%	0.0%	0.0%
2days	n	1	7	0	1
	%	11.1%	6.2%	0.0%	12. %
3days	n	1	1	1	0
	%	11.1%	0.9%	12.5%	0.0%

Need& duration of Mechanical ventilation among each study group, Chi square= 24.5, P value=0.004 which show highest percentage of healthy weight group did not need mechanical ventilation= 92.9% and increased percentage of mechanical ventilation within obese patients group and overweight group which was needed mechanical ventilation for 2& 3 days respectively= 12.5%.

Table (4) types and frequency of complications and percentage among each study group.

Type Of Complication		Under Wt	Average	Over Wt	Obese
No	n	6	109	6	4
	%	66.7%	96.5%	75.0%	50.0%
Pleuraeffusion	n	2	2	1	1
	%	22.2%	1.8%	12.5%	12.5%
Pneumothorax	n	0	1	0	2
	%	0.0%	0.9%	0.0%	25.0%
Empyema	n	0	1	1	0
	%	0.0%	0.9%	12.5%	0.0%
Septicemia	n	1	0	0	1
	%	11.1%	0.0%	0.0%	12.5%

Types and frequency of complications and percentage among each study group, number of cases& percentage Chi square= 55.4, P value= 0.001 which show highest percentages of pneumothorax among obese patients group= 25%, pleural effusion among underweight group= 22.2% and the least is the percentage of empyema within average weight group= 0.9%.

Discussion:

Multiple studies were applied to find the relation between body weight and BMI and their impact on pediatric and adult health and health care cost to minimizing the undesirable problems on patients and community. In Our present study, our scope was to detect the difference in course, prognosis and outcome of pediatric pneumonia between four groups of patients through detailed comparative study and to detect the effect of an abnormal body weight on the child health, disease prognosis and its impact on family and community. Also, we aimed to increase the awareness about over weight, obesity and underweight as a growing health problems affect child's life. SO, correction of child weight and healthy life style including proper nutrition& adequate physical activities is an important factor for reducing child's morbidities and mortalities in addition to reducing health care cost and economic burden on families and communities.

The study was conducted on 138 pediatric patients diagnosed with pediatric pneumonia all are recruited from inpatient units, Children's hospital, Faculty of Medicine, Ain Shams University with age range from 2 up to 14 yrs with a mean age of 7.8 years classified to four groups:

- ☒ Healthy weight group: including patients with healthy or average BMI (from 5th to below 85th percentile).
- ☒ Underweight group: including patients with below average BMI (below 5th percentile).
- ☒ Over weight group: including patients with high average BMI (from 85th to below 95th percentile).
- ☒ Obese group: including patients with above average BMI (Above 95th percentile).

All children undergone a detailed history taking stressed on dietetic history, daily life style and physical activities, Careful physical examination including complete anthropometric measures including weight, height, mid- arm circumference and skin fold thickness,

Introduction:

Abnormal pediatric body weight is a common public health problem among children within the community in which the healthcare costs are gradually rising.⁽²⁵⁾ Pediatric overweight or underweight are considered as a global epidemic that requires attention due to the burden placed on the healthcare system for children and adults.⁽²⁵⁾ Obesity is considered a top public health concern due to the high level of morbidity⁽²²⁾ As regard underweight, malnutrition, anemia, insufficient food intake, poverty and ignorance are the main causes of underweight.⁽²⁵⁾ The prevalence of childhood obesity increased from 1990 to 2007, and then leveled off.⁽²⁵⁾ Medical costs for obesity care are higher in obese children versus children with a normal body weight,^(25,30) Pediatric obesity affects all the organs in the body and has an increasing prevalence in young diabetic children.^(25,30) Pediatric obesity is connected with an increased risk of various diseases such as diabetes, cardiovascular, stroke, certain types of cancer later in life, social problems and depression among youth.⁽²⁵⁾ Other hand, among children aged 6- 10 years, the rate of underweight children has increased from 7% in 1980 to 18% in 2010.^(25,22,18) As an increasing number of children are becoming overweight or underweight, health professionals need to search for effective methods for the prevention and treatment. Malnutrition, which encompasses under- and over nutrition,⁽¹⁸⁾ is responsible for an enormous morbidity and mortality burden globally.⁽²⁵⁾ Malnutrition results from disordered nutrient assimilation but is also characterized by recurrent infections and chronic inflammation, implying an underlying immune defect.⁽²²⁾ Several studies reported the effect of obesity on respiratory tract infections. Obesity was associated with higher hospital admission rates, greater need of supportive therapies, longer length of hospital stays, and worse outcomes among patients with bronchitis and pneumonia.⁽³⁾ Thus, obesity is a clinically complicating risk factor for hospitalized patients with lower respiratory tract infections. However, these reports are limited because some of them were conducted with relatively small sample sizes in small areas.^(3,18) Some studies included only adults, and these results are not generalizable to pediatric populations (3- 17). In addition, previous studies in pediatric population focused on hospitalized children due to influenza or respiratory syncytial infections. Thus, the potential effects of obesity on the severity of lower respiratory tract infections among hospitalized children remain unclear.^(3,17,18) Various studies investigated the burden of pediatric obesity on lower respiratory tract infections. which suggested the potential associations between abnormal body weight and morbidity including acute respiratory distress and bacteremia.⁽²⁶⁾ we hypothesized that children with abnormal body weight who were hospitalized due to lower respiratory tract infections were more likely to require noninvasive or invasive mechanical ventilation, develop bacteremia or septicemia, and needs greater healthcare costs and longer length of hospital stay, compared with children without obesity. Malnutrition, which encompasses both under- and over- nutrition, is responsible for an enormous health burden globally.^(19,20) Although broadly defined as impaired nutrient assimilation,

malnutrition does not simply arise from inadequate food intake. Obesity can develop independently of poor diet and persist despite switching to a healthy diet,^(7,11,14) and stunting prevalence is only modestly reduced by intensive feeding interventions.⁽²²⁾ Despite manifesting as distinct physical defects, several observations implicate shared etiological pathways in under- and over nutrition: early- life under nutrition increases the risk of obesity in later life^(12,13,15) altered metabolism^(10,20,23) chronic inflammation^(1,31,13) and gut dysfunction (enteropathy)^(1,15,16) are features of both conditions; and excess energy and macronutrient intake is often coincident with micronutrient deficiencies in overweight individuals⁽¹⁾ There is a growing appreciation that malnutrition is complex, reflecting a suite of overlapping co morbidities that are poorly understood (10- 16),. Characterizing pathogenesis across the spectrum of malnutrition is essential to underpin novel therapeutic approaches to support international goals to improve nutrition, health, and well- being.^(1,15) Under- nutrition remains one of the most common causes of morbidity and mortality among children under five years of age in developing countries.⁽²²⁾ In 2011, 16% of children under five were underweight (low weight- for- age) in developing countries and 45% of under- five deaths were directly or indirectly linked to under- nutrition.⁽¹⁶⁾ Despite global improvements, the prevalence of underweight children under five is still a major public health problem in sub- Saharan Africa.⁽¹⁾ and many countries have failed to achieve the first Millennium Development Goal (MDG 1) that called for the eradication of extreme hunger and the reduction of the prevalence of underweight children by 50% from 1990 to 2015.^(1,16)

Subjects& Methods:

It was a prospective and comparative study included patients aged from 2 to 14 years whom diagnosed as pediatric pneumonia recruited from inpatient units in Children hospital, Faculty of Medicine, Ain shams university, through the period from February 2019 to February 2020 enrolled in the study and will be divided into four groups: healthy weight group, underweight group, over weight group and obese group.

Each patient in the study will undergo detailed history taking especially dietetic history, complete physical examination, general examination and Complete anthropometric measures: weight, height, mid- arm circumference and skin fold thickness.

- ✧ Calculation of Body Mass Index (BMI) of each child and determination of the centile which child fall in through WHO growth charts: Weight for age, height for age.
- ✧ Detailed general and local examination, chest X ray and laboratory tests.
- ✧ Close follow up and determination of patients who are at risk for complications.

Statistical Analysis:

Data are collected and analyzed on PC using SPSS version 12 (2004), numerical and nominal data presented in the form of number& percentage inform of number, name and slandered deviation, proper significant test used in old analysis with P value< 0.05.

Impact of variation in pediatric body weight on course and prognosis of Pneumonia

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Summary

Background: Obesity is a common pediatric health problem and has a direct impact on child health, his family and community. Drawing attention to potential association between body weight with course and prognosis of pediatric disease.

Objective: To find the relation between abnormal pediatric body weight and course& prognosis of pediatric pneumonia.

Subjects& Methods: It was a case control comparative study included 138 patients aged from (2 to 14) years diagnosed with pediatric pneumonia. They had been admitted at inpatient units in Children hospital, Faculty of Medicine, Ain shams university, Egypt. through the period from February 2019 to February 2020; One hundred eighteen child were of average weight patients, 8 are overweight, 8 were obese patients and nine of them were under weight All children undergone a detailed history taking, Careful physical examination including complete anthropometric measures, calculation of Body Mass Index (BMI) of each child, Chest X- ray, Laboratory tests and determination of patients who are at risk for development of complications or need of mechanical ventilation.

Results: A total of 138 children with pediatric pneumonia aged between 2 to 14 years were studied. They were 84 males and 39 females. The mean of age was 7.8, Our study revealed that. Obese patients was more liable for respiratory distress more than average weight group (P value=0.01). Obese and overweight group showed increase in the need& duration of Mechanical ventilation (P value=0.004). Also, there is double increase in complications and underweight& obese patients 50% in comparison to average weight group (P value=0.002). More frequent complication among obese patients& underweight group, In comparison average weight group (P value=0.001).

Conclusion: An abnormal pediatric body weight and abnormal BMI had a direct negative impact on child health, well being, affect pediatric mortality and morbidity and have a negative effect on health care cost and an increased economic burden on family and community.

تأثير اختلاف الوزن على مسار ونتيجة التهاب الرئوى فى الأطفال .

مقدمة: السمنة والنحافة مشاكل شائعة لدى الأطفال فى المجتمع والتكلفة الناتجة عن المشكلات الصحية الناتجة عن السمنة فى إزدیاد مما يتطلب الإهتمام والانتباه. مع تصاحب الإصابة بالسمنة والنحافة وإلتهابات الجهاز التنفسى السفلى مثل إلتهاب الشعب الهوائيه وتزداد معدلات العلاج السريرى ومدة الإقامة فى المستشفى بالإضافة الى زيادة الفرصة لحدوث مضاعفات مثل تسمم الدم وضيق التنفس الحاد وكذلك زيادة تكلفة العلاج الواقع على كاهل المريض والمؤسسات الصحية. جميع هذه المخاطر تكون أكثر حدوثا لدى الأطفال المصابين بالسمنة او النحافة عن أقرانهم من أصحاب الوزن الطبيعى.

الأهمية: الدراسة تهدف الى الإشارة الى أهمية المشكلة وضرورة إيجاد البات فعالة للوقاية والعلاج المعدلات الغير طبيعى لمعدل كتلة الجسم فى الأطفال.

الحالات والأساليب: دراسة مقارنة فى الأقسام الداخلية والرعايه المركزه بمستشفى الأطفال جامعة عين شمس تشمل المرضى الذين يعانون من التهابات الجهاز التنفسى السفلى.

النتائج: بناء على ناتج معدل كتلة الجسم تم تقسيم الاطفال المصابين بحدوى الجهاز التنفسى السفلى الى اربع مجموعات: من هم دون المعدل الطبيعى، الاطفال ضمن المعدل الطبيعى، الاطفال أصحاب المعدل المرتفع والاطفال المصابين بالسمنة. ومن حيث المقارنه فقد كان الاطفال المصابين بالسمنة هم الاكثر عرضه للاصابه بمضاعفات الالتهاب الرئوى والاكثر عرضه للاصابه بازمه تنفسيه حاده من الدرجه الثانيه، والاكثر احتياجا للتنفس الصناعى والمكوث لمده اطول فى المستشفى.