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Impact of Overweight and Obesity in children and adolescents on complete blood picture parameters

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ABSTRACT

Obesity is a rising health problem in children and adolescents leads to serious metabolic and cardiac complications. Assessment of the effect of obesity on complete blood count in children and adolescents. This study was conducted on 40 overweight and obese children attending children outpatient obesity clinic in Minia University children hospital aged 6-18 years and 40 apparently healthy control age and sex matched; complete blood count (CBC) was done to all enrolled subjects then platelet lymphocyte ratio and neutrophil lymphocyte ratio were calculated. This study showed significant higher Platelet count, total leucocytic count and platelet lymphocyte ratio in overweight and obese than the control, while there was insignificant difference between overweight and obese as regard these parameters. Overweight and Obese children had an increase in platelet count, total leucocytic count and platelet lymphocyte ratio which may be due to a low grade of chronic inflammation.

1. INTRODUCTION

Obesity causes chronic hypoxia, which leads to inflammation, insulin resistance, and dysfunctional adipose tissue 1].

The World Health Organization defines overweight and obesity as excessive or abnormal fat buildup that is harmful to one's health. A body mass index (BMI) of ≥25 kg/m^2 is generally considered overweight, and a BMI of ≥30 kg/m^2 is considered obese [2].

The malnutrition condition known as obesity is typified by an excessive accumulation of depot fat that impedes normal functioning. A complex network of interconnected factors contributes to childhood obesity rather than a single cause [3]. Tumor necrosis factor-alpha (TNF-α) and interleukin-6 (IL-6) are two examples of the inflammatory cytokines that are released in significant quantities from adipose tissue and induce chronic inflammation [4]. The aim of our study was to assess changes in CBC parameters, platelet lymphocyte ratio & neutrophils lymphocyte ratio in overweight and obese children.

2. Subjects and methods

This study included 40 cases (obese and overweight) with ages ranging from 6 to 18 years and 40 apparently healthy controls who were age and sex matched. All included children were subjected to: BMI measurement by conventional equation weight in kilograms (kg) divided by the square of height in meters (m^2) with plotting on the suitable chart for age and sex, Two ml of blood samples were withdrawn to all children and were collected on sterile vacutainers containing EDTA solutions tube for CBC assay.,

Total leucocytic count with differential, and the following ratios were calculated: Neutrophil- lymphocyte ratio and Platelet-lymphocyte ratio,

3. Results

The study included 20 males versus 19 of the control group, and 20 females versus 21 of the control with insignificant difference between them (where P value was 0.8)

Table (1) shows, significantly higher platelet count in overweight and obese children group than the control group where (P value was 0.03). Also, overweight and obese children had significantly higher TLC, lymphocytic and segmented neutrophilic count and platelet lymphocyte ratio than the control where (P value was 0.001). On the other hand, there was insignificant differences between the two groups regarding neutrophil lymphocyte ratio for all where (P value = 0.83).

Table (2) shows significantly higher levels of TLC, segmented Neutrophilic & Lymphocytic Count in overweight and obese groups than control group, where (P value <0.001 for all), while there were insignificant differences between overweight and obese children and adolescents as regard these parameters where (P value >0.05)

Table (1) Comparison between the obese and the control groups as regard complete blood count

		Group 1 (overweight and obese) (n=40) Mean ±SD	Group 2 (control) (n=40) Mean ±SD	P value
CBC	**Hb (gm/dl)**	11.2±1.2	11.4±1.1	0.56
	RDW(%)	16±1.8	16.5±1.7	0.68
	Platelets (x10^9/L)	278.2±71.6	244.5±69.6	0.03*
	TLC (×10^3/µL)	9.9±1.5	6.7±1.35	<0.001*
	Segmented neutrophils count (×10^3/µL)	4.2±1.01	3.1±0.73	<0.001*
	Lymphocytic count (×10^3/µL)	3.92±1.34	2.04±0.54	<0.001*
	N/L ratio	1.25±0.5	1.45±0.54	0.83
	Platelet/lymphocyte ratio	77.3±28.2	126.7±46.3	<0.001*

* significant

Hb (hemoglobin), RDW (red cell distribution width), TLC (total leucocytic count), N/L (neutrophil/ lymphocyte ratio).

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Table (2) Comparison between overweight and obese children with the control as regard CBC parameters and different grades of obesity (BMI)

CBC parameter	Overweight (n=16) Mean ±SD	Obese (n=24) Mean ±SD	Control (n=40) Mean ±SD	P value	Post hoc analysis		
					P1	P2	P3
Hb (gm/dl)	11.03±1.19	11.3±1.26	11.4±1.1	0.63	0.61	0.99	0.72
RDW (%)	16.2±2.1	15.8±1.7	16.5±1.7	0.79	0.99	0.8	0.85
Platelets ($x10^9$/L)	279±74.3	277.6±71,4	244.5±69.6	0.11	0.23	0.17	0.99
TLC ($\times10^3$/µL)	10.3±1,4	9.6±1.67	6.7±1.35	<0.001*	<0.001*	0.001*	0.37
Segmented neutrophilic count ($\times10^3$/µL)	4.49±1.09	4.1±0.94	3.13±3.70	<0.001*	<0.001*	<0.001*	0.39
Lymphocytic count ($\times10^3$/µL)	4.2±0.83	3.71±1.5	2.04±0.54	<0.001*	<0.001*	<0.001*	0.29
N/L ratio	1.04±0.39	1.39±0.54	1.45±0.54	0.11	0.44	0.43	0.09
Platelet/lymphocyte ratio	126.7±46.3	67.1±18.1	84.1±31.9	<0.001*	<0.001*	<0.001*	0.36

_* significant

P1= p value between control and overweight; P2= p value between control and obese,

P3= p value between overweight and obese

Hb (hemoglobin), RDW (red cell distribution width), MPV (mean platelet volume), PDW (platlet distribution width), PCT (platelet crit ratio), N/L (neutrophil/ lymphocyte ratio)

4. Discussion

Although it is not a problem unique to any one country, childhood obesity is one of the most significant public health issues [5]. Multiple research studies conducted on both adults and children demonstrate a correlation between the release of inflammatory cytokines and body mass index (BMI); nevertheless, there are differing reports about their use in relation to childhood obesity [6]. This study revealed significant increase in platelet, leucocytic count, segmented neutrophilic, lymphocytic count and platelet lymphocyte ratio in obese & overweight children when compared to normal weight children. This could be explained by the presence of low grade of inflammation in obese children which is brought on by adipose tissue releasing a lot of inflammatory cytokines, including tumor necrosis factor-alpha (TNF-α) and interleukin-6 (IL-6) [4]. This finding is consistent with previous study conducted by [4] On the other hand, there was no insignificant differences as regard haemoglobin levels between the two groups, which may be secondary to suffering of obese patients from prolonged hypoxia resulting in more production of red blood cells and white blood cells. This finding agreed with another study [7] while contradicts with another one who stated a lower haemoglobin levels in obese children [2].

5. Conclusion: Overweight and obesity leads to increase in platelet, leucocytic, lymphocytic, neutrophilic count and platelet lymphocyte ratio.

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