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The Association between Neutrophil Lymphocyte Ratio and Obesity in Children

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ABSTRACT

Background: Obesity is a multifactorial disease and has been considered as a global problem owing to the increase in its prevalence all over the world in adult subjects as well as in pediatric population, as it is expected that more than 50 per cent of the global population could be obese by 2030 (Abdelmajed et al., 2017). Overweight is considered a common problem in Egypt, and as per the WHO statistics the measured prevalence of overweight is sixty one–seventy per cent of the whole population aged twenty and more, with percentage sixty five per cent of males and seventy six per cent of females aged fifteen and more (Abdelmajed et al., 2017). Overweight was determined among 19.5 per cent of the children in an Egyptian study (Hassan et al., 2016).

Aim: The aim of this work is to detect the role of inflammation in the development of IR and overweight, by studying the association between neutrophil lymphocyte ratio with overweight in children.

Methods: A case control study was conducted on 45 obese children aged from 4 years to 18 years who were following in Mansoura University Children's Hospital out patient clinics with 40 matched control group, during the period from November 2021 till November 2023. Anthropometric measurements assessed and inflammatory markers were withdrawn from each group. Results: A statistically significant difference was detected between the studied groups as regards body mass index (P=0.001). Statistically significant higher mean values fasting glucose, among cases than the control group. A statistically significant positive correlation between Neutrophil/lymphocyte ratio and waist circumference (r=0.455). **Conclusion:** According to our findings, it can be concluded that overweight is an inflammatory state with increasing inflammatory markers in obese children..

Keywords: *Overweight ,neutrophil /lymphocyte ratio, pediatric, inflammation.*

1. INTRODUCTION

Overweight, an essential cause of morbimortality, is gradually rising in young subjects. A lot of health problems which include CVDs, HTN, T2DM, and fatty liver are accompanied by overweight (Pires et al., 2014). Its cause is complicated, comprising interaction between genetic susceptibility and environmental or "obesogenic" factors, which has a main role in stimulating overweight, representing, as a result, the basis for efficient interference (Mărginean et al., 2019)

Pediatric overweight is a determinative factor of adult overweight. One-third of obese children become obese adults(Aydin et al., 2015a). It is suggested that impaired endothelial functions caused by IR, FFAs, NO, and inflammatory cytokines causes CVDs in obese children (Ormazabal et al., 2018).

In addition, overweight is identified to be accompanied by immunological changes (Westheim et al., 2021) Inflammatory infiltrate invade the adipose tissue in obese subjects, and cause a low degree of chronic inflammation by forming cytokines (Maurizi et al., 2018).

Neutrophil infiltration of abdominal fat and their binding to adipocytes could develop before macrophage infiltration comparable to that in other inflammatory situations. In addition, neutrophils are the most essential and abundant form of EBCs. Neutrophils and chronic inflammation appear to be correlated to chronic HTN and overweight with the total neutrophil count being elevated in overweight subjects (Mărginean et al., 2019)

2. MATERIALS AND METHODS

Aim of work

The aim of this work is to detect the role of inflammation in the development of IR and overweight, by studying the association between neutrophil lymphocyte ratio with overweight in children.

Study design and participants

We conducted a case- control study, in MUCH, from November 2021 to November 2023.

Children (aged between 4years and 18 years), with overweight were matched with control group .

Inclusion criteria:

Children aged (4 to 18) years old.

BMI greater than mean +2SD.

Exclusion criteria:

Children below 4 years due to different values of differential leucocyte count.

Children having diseases such as HTN, and diabetes.

Children having acute infection.

Children on ongoing drug regimens such as corticosteroids which can affect CBC or metformin which affects insulin sensitivity.

Syndromic overweight as Prader–Willi syndrome.

Clinical examination:

1-Anthropometric measurements:

-Height: is measured using a wall-mounted Stadiometer

-Weight is measured using a calibrated weight scale.

-Body-mass-index (BMI) [BMI = weight (kg) / height (m)2] .

-Waist circumference (WC): WC was assessed at the midpoint between the distal margin of the last rib and the superior border of the iliac crest on the horizontal plane, using an inextensible tape graduated in mm. When WC value extend beyond the 90th percentile, the subject is considered overweight (Freedman et al., 1999)

2- BP measurement.

Laboratory evaluation:

Neutrophil /lymphocyte ratio.

HOMA- IR

Ethical considerations

The study was approved by IRB of Faculty of Medicine, Mansoura University. Written informed consent was taken from all members. The confidentiality was respected. All participants had the right to leave the study at any time.

Statistical analysis

Data analysis was conducted by SPSS software, version 26. Qualitative data were described using number and percent. Quantitative data were defined using mean±SD for normally distributed data following testing normality using Kolmogrov-Smirnov test. Significance was set at the (0.05) level.

MCT were used to compare qualitative data between groups as appropriate as correction for Chi-Square

Student t test was used to compare 2 independent groups for non-normally distributed data.

One Way ANOVA test was used to compare at least three independent groups.

The Spearman's correlation is used to detect the direction of a linear association between two non-normally distributed continuous variables and/or ordinal variables.

ROC curve measured validity of continuous variables with calculation of best cut off point. Predictive values and accuracy are assessed using cross tabulation.

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3. RESULTS

The present study was case control study that is carried out on 45 obese cases age and sex matched with 40 non obese as control group to detect the role of inflammation in the development of IR in overweight, by studying the association between neutrophil lymphocyte ratio with IR in obese children.

It illustrates cross matched cases and control groups as regards age and sex between studied groups (p=0.205). Mean age of cases is 11.04±3.27 years versus 10.20±2.75 years for control group. A statistically significant difference was detected between the studied groups regarding body mass index, systolic and diastolic BP (p=0.001 each). Cases have higher mean body mass index and BP than the control group. (table 1)

Also, it illustrates statistically significant higher mean values for fasting glucose and Neutrophil/ Lymphocyte ratio among cases than control group (table2)

Table (1): comparison of demographic characteristics and clinical data between cases and control groups

	Cases **N=45**	**Control** **N=40**	**Test of significance**
Age / years	11.04±3.27	10.20±2.75	t=1.28 p=0.205
Sex **Male** **Female**	 18(40) 27(60)	 10(25) 30(75)	 P=0.142
BMI (kg/m^2)	32.40±4.46	20.87±1.59	t=15.47 p=0.001*
SBP(mm/Hg)	112.89±11.0	103.25±6.56	t=4.82 p=0.001*
DBP(mm/Hg)	73.33±8.26	65.62±5.45	t=5.01 p=0.001*

t:Student t test , *statistically significant

Table (2): comparison of laboratory findings between cases and control groups

	Cases **N=45**	**Control** **N=40**	**Test of significance**
Neutrophil Lymphocyte Ratio	1.55±0.36	1.35±0.16	t=3.28 p=0.002*
Fasting glucose	94.11±8.84	80.02±5.86	t=8.54 p=0.001*

t: Student t test, *statistically significant (p<0.05)

Table (3): correlation Neutrophil/lymphocyte ratio in with demographic , clinical and laboratory findings among cases with metabolic syndrome.

		N/L ratio
HOMA IR	r	-.007
	p	.976
Age / years	r	.386

	p	.084
BMI	r	.152
	p	.510
waist circumference	r	.455*
	p	.038
SBP	r	.108
	p	.643
DBP	r	.123
	p	.594
LDL Cholesterol	r	.207
	p	.368
SGPT	r	.081
	p	.726
Fasting glucose	r	-.049
	p	.834

4. DISCUSSION

Overweight is predominant in Egypt, and based on WHO data, the meausred prevalence of overweight is sixty one–seventy per cent of the whole population aged twenty and above, with percentage sixty five per cent of males and seventy six per cent of females aged fifteen and more (Abdelmajed et al., 2017). Overweight was detected among 19.5 per cent of the children in an Egyptian study(Hassan et al., 2016)

Overweight-mediated inflammation is demonstrated in various researches using various biomarkers. For instance, overweight is demonstrated to be positively accompanied by increased values of CRP, an increased WBC count, and an increased number of WBCs subtypes (Oguntibeju and pharmacology, 2019) .

Pediatric overweight is a foundational factor of adult overweight. In addition, 1/3 of obese children develops also obesity in their adulthood life (Aydin et al., 2015a)

It is suggested that impaired endothelial functions mediated by IR, FFAs, NO, and inflammatory cytokines causes CVDs in obese children (Ormazabal et al., 2018)

In our study, the studied cases were divided into two groups: 45 obese children and 40 match age and sex apparently normal children (control group).

Excess weight has been considered a common cause a of HTN (El Sehmawy et al., 2022) .We reported a significant increase in BP in obese children of the studied children. Increase in BP in obese children was formely recorded by Rosaneli et al. (Rosaneli et al., 2014) .

The present study illustrates statistically significant higher mean values for the Neutrophil/ Lymphocyte ratio among cases than in the control group. This is in concordance with the Turkish study that showed that Neutrophil/ Lymphocyte ratio was significantly higher in the obese group (Aydin et al., 2015b).

Also, in agreement with an Egyptian study which showed a positive correlation between BMI and NLR, PLR, IL6, and hs-CRP in obese and overweight children.(Fayed et al., 2024)

Our study also showed statistically significant positive correlation between Neutrophil/lymphocyte ratio and waist circumference (r=0.455) among cases with metabolic syndrome.

5. CONCLUSION:

In brief, it could be concluded that overweight is an inflammatory process accompanied by increased markers of inflammation, as the neutrophil lymphocyte ratio, which is a marker used in studying many inflammatory conditions.

Fund: None

Conflict of interest: None

LIST OF ABBREVIATIONS

DBP: Diastolic BP

HOMA IR: Homeostatic model assessment for IR

MUCH: Mansoura University Children's Hospital

N/L: neutrophil lymphocyte ratio.

SBP: Systolic BP.

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