Influence of Abdominal obesity on Interleukin-4 and lipid profile in young apparently healthy individuals of western Uttar Pradesh

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Abstract

Background: Abdominal Obesity (AO) has a prevalence of 36% in northern India which is more common as compared to general obesity. As per World Health Organisation (WHO) report published in 2008, Waist Circumference (WC) and Waist to Hip Ratio (WHR) are better indicators of AO as compared to Body Mass Index (BMI) if risks of metabolic disorders like diabetes mellitus, hypertension, cardiovascular disease, etc are considered. Elevation of serum Triglycerides (TG) levels with AO further increases the risk of cardiovascular diseases. Interleukin-4 (IL-4), an inflammatory marker also influences metabolic functions that induces lipolysis, improves insulin sensitivity and thus regulate obesity. Tracking AO and biomarkers (IL-4 & lipid profile) in younger age can help to postulate the risk of above diseases in later phases of life.

Aim: To find the association of AO with IL- 4 and lipid profile in young apparently healthy subjects residing in Western Uttar Pradesh.

Material and Methods: WC and WHR were measured anthropometrically. The serum IL-4 levels were estimated by ELISA method. The serum lipid profiles were analysed using automated analyser.

Results: Interleukin-4 is positively correlating with WC and WHR. Additionally, serum TG is positively associated with AO and IL-4.

Conclusion: There is a positive association of serum IL-4 & TG levels with increase in WC and WHR even in apparently healthy subjects between 18 to 24 years of age. Therefore, an appropriate intervention strategies such as lifestyle and dietary modifications may lower the risk of metabolic disorders by controlling abdominal obesity.

Keywords: Abdominal obesity, nterleukin-4, triglycerides, metabolic disorders

1. Introduction

The accumulation of fat across abdominal region giving a pear-shaped appearance to the body is defined as Abdominal Obesity (AO). Anthropometric measurements were taken, specifically the Waist Circumference (WC) which should be equal to or greater than 90 cm in men and equal to or greater than 80 cm in women. In addition, the corresponding Waist to Hip ratio (WHR) should be equal to or greater than 0.88 for men and equal to or greater than 0.81 for women respectively. If these criteria are met, the individual is classified as having abdominal obesity [1]. It is more prevalent in comparison to general obesity with prevalence of 36% in Northern India [2]. According to WHO, abdominal obesity increases risk of Cardiovascular Diseases (CVD) in comparison to general obesity in addition to Type 2 diabetes mellitus, hypertension, Polycystic Ovarian Syndrome (PCOS), etc [3, 4]. Elevation of serum Triglycerides (TG) levels with AO further increases the risk of cardiovascular diseases [5]. Interleukin-4, an inflammatory marker, has been found to influence metabolic functions. It promotes lipolysis, improves insulin sensitivity, glucose tolerance and can help to reduce fat accumulation [6]. Physical and metabolic changes are induced in the body while transiting from adolescence to adulthood phase of life especially in the age group of 18 to 24 years. The biomarkers related to above changes help to identify health trajectories and predict future diseases risk such as CVD, dyslipidaemia, insulin resistance, etc [7].

2. Materials and Methods

The study was conducted in the Department of Biochemistry, School of Medical Sciences and Research, Sharda University, Greater Noida, UP after approval from Institutional Ethical Committee. This cross-sectional study included sample size of 100 apparently healthy individuals.

Inclusion Criteria: Apparently healthy young adults (18-24 year) of both the sexes.

Exclusion Criteria: Chronic cases such as Thyroid and kidney diseases, history of drug intake (statins) and Pregnancy.

Anthropometry Measurements

WC and WHR were measured anthropometrically using non elastic measuring tape [8].

Biochemical Measurements

The serum samples of apparently healthy individuals were collected and stored in-20 C to be tested for IL-4 by ELISA. The assay ranges from 1.1pg/ml-35 pg/ml for IL-4 [9]. Serum lipid profile levels were measured by dry chemistry automated analyser by spectrophotometry, Vitros 5600.

Statistical Analysis

The acquired data underwent statistical analysis using SPSS version 22, where independent t-test and Pearson correlation were calculated.

3. Result

Individuals were split into two groups based on abdominal obesity as obese and non-obese in age group of 18-24 as per WHO criteria [10].

The data analysis revealed that there is a significant difference in the mean levels of serum IL-4, TG and anthropometric measures WC and WHR (p<0.05) between abdominal obese and non- obese groups. Sixty percentage of obese individuals were found to have hypertriglyceridemia, with mean value of 191 mg/dl. The other lipid parameters (Total Cholesterol (TC), High-Density Lipoprotein Cholesterol (HDLC), Low-Density Lipoprotein Cholesterol (LDLC), and Very Low-Density Lipoprotein Cholesterol (VLDLC)) did not show any abnormalities in either group. The serum IL-4 levels are more than twice in obese individuals (5 pg/ml) compared to non-obese (2 pg/ml). Similar results have been reported in individual with hypertriglyceridemia compared to others (Table no. 1). By applying Karl Pearson's correlation on the data, a positive association has been observed between WC and WHR with serum IL-4 (correlation coefficients (r) of 0.537 and 0.424, respectively) and similar results between WC and WHR with serum TG with r = 0.203 and 0.285 respectively. Additionally Serum TG and IL-4 are positively correlated with r= 0.330 (Table no. 2).

Table 1: Group statistics on basis of abdominal obesity (including range, mean, Standard mean of error, Standard Deviation and p value using independent t test)

Parameters	Group Statistics on basis of Abdominal obesity							
	Groups	n (no. of samples)	Range		Mean	Standard. Error of Mean	Standard Deviation	Significance One-Sided p
			Minimum	Maximum				
TC (mg/dl)	Non-obese	65.00	116.35	186.44	151.39	4.35	35.04	0.14
	Obese	35.00	116.68	211.00	163.84	7.97	47.16	
HDLC (mg/dl)	Non-obese	65.00	27.43	85.23	56.33	3.58	28.90	0.21
	Obese	35.00	38.48	88.85	63.67	4.26	25.19	
TG (mg/dl)	Non-obese	65.00	67.36	188.41	127.88	7.51	60.52	0.04
	Obese	35.00	113.20	190.59	151.90	6.54	38.69	
VLDLC (mg/dl)	Non-obese	65.00	11.36	35.87	23.61	1.52	12.25	0.17
	Obese	35.00	17.44	36.31	26.88	1.59	9.43	

LDLC (mg/dl)	Non-obese	65.00	33.42	109.48	71.45	4.72	38.03	0.85
	Obese	35.00	16.96	129.63	73.29	9.52	56.34	
WC (cm)	Non-obese	65.00	64.89	82.83	73.86	1.11	8.97	<.001
	Obese	35.00	83.55	91.77	87.66	0.69	4.11	
WHR	Non-obese	65.00	0.74	0.85	0.80	0.01	0.05	<.001
	Obese	35.00	0.83	0.93	0.88	0.01	0.05	
IL-4 (pg/ml)	Non-obese	65.00	1.97	2.31	2.14	0.17	0.17	<.001
	Obese	35.00	4.28	5.19	4.74	0.45	0.45	

Since the range of IL-4 is wide we have used standard error of mean in place of standard deviation.

Table 2: Correlations between variables

Parameters	**Correlations**								
		IL-4 (pg/ml)	**TC (mg/dl)**	**HDLC (mg/dl)**	**TG (mg/dl)**	**VLDLC (mg/dl)**	**LDLC (mg/dl)**	**WC (cm)**	**WHR**
IL-4 (pg/ml)	Pearson Correlation (r)	1	0.091	0.004	0.330	0.129	0.045	.537	.424
	Sig. (2-tailed)		0.37	0.97	0.001**	0.201	0.655	0**	0**
TC (mg/dl)	Pearson Correlation	0.091	1	.198	0.038	0.06	.749	0.129	0.173
	Sig. (2-tailed)	0.37		0.048*	0.71	0.554	0**	0.202	0.085
HDLC (mg/dl)	Pearson Correlation	0.004	.198	1	-0.004	0.041	-.451	0.11	0.021
	Sig. (2-tailed)	0.97	0.048*		0.97	0.682	0**	0.275	0.837
TG (mg/dl)	Pearson Correlation	0.330	0.038	-0.004	1	.825	-0.173	.203	.285
	Sig. (2-tailed)	0.001**	0.71	0.97		0**	0.084	0.043*	0.004**
VLDLC (mg/dl)	Pearson Correlation	0.129	0.06	0.041	.825	1	-.226	0.172	0.193
	Sig. (2-tailed)	0.201	0.554	0.682	0**		0.024*	0.086	0.054
LDLC (mg/dl)	Pearson Correlation	0.045	.749	-.451	-0.173	-.226	1	0.003	0.092
	Sig. (2-tailed)	0.655	0**	0**	0.084	0.024*		0.98	0.363
WC (cm)	Pearson Correlation	.537	0.129	0.11	.203	0.172	0.003	1	.746
	Sig. (2-tailed)	0**	0.202	0.275	0.043*	0.086	0.98		0**
WHR	Pearson Correlation	.424	0.173	0.021	.285	0.193	0.092	.746	1
	Sig. (2-tailed)	0**	0.085	0.837	0.004**	0.054	0.363	0**	
** Highly significant Correlation at the 0.01 level (2-tailed).									
* Correlation is significant at the 0.05 level (2-tailed).									

3. Discussion

The study shows that abdominal obesity raises the risk of Diabetes Mellitus (DM), hypertension, CVD and other metabolic disorders as reported by WHO in 2008 [3]. Even the chances of PCOS in females are higher when they have AO leading to increased morbidity according to the health care system [4]. The prevalence of AO is 36% in Northern India among age group of 26 -52 years shown by Pradeepa R *et al.*, in 2015 [2]. It is understood that during transition from adolescence to adulthood,

significant physical and metabolic changes occur even among individual who are physically active [7]. Therefore, the subjects in this study belong to age group of 18-24 years. It is surprising to observe that 35% of young apparently healthy individuals are associated with abdominal obesity. It creates a concern of AO even in young generation of the society.

The biomarkers used in this study to assess the likelihood of metabolic complications are the lipid profile and IL-4, which are correlated with anthropometric measures WC and WHR for abdominal obesity. This study has shown a positive correlation of WC and WHR with serum TG levels which aligns with the results by Srinivasan SR *et al*., in 2020 [5]. Further 60% of obese individuals did have hypertriglyceridemia, which is consistent with the findings reported by Feingold who stated that 70% of individuals with dyslipidaemia are obese [11]. The other lipid parameters (TC, HDLC, LDLC & VLDLC) were not deranged and within their desirable limit. The literature says the inflammatory marker IL-4, has also been found to influence metabolic functions such as lipolysis by increasing the activity and translocation of Hormone Sensitive Lipase (HSL), improves insulin sensitivity and glucose tolerance and reduce fat deposition. However, the influence of IL-4 is limited when insulin resistance is developed [6]. This study also suggests a positive association between IL-4 and AO, indicating that individuals with higher WC and WHR are likely to have elevated serum IL-4 similar to observations made by Binisor ID *et al*., in 2016 [12]. The serum IL-4 level is positively correlated with TG, exhibiting more than twice the level in individuals with hypertriglyceridemia (5 pg/ml) compared to others (2 pg/ml). Similar observations have been reported between obese and non-obese individuals. Hence, the current study supports the hypothesis that Interleukin-4 has a substantial function in onset of obesity-related complications. This study has significant implications which may help healthcare professionals in identifying the risk factors at an early stage. Since WC and WHR can be measured anthropometrically, screening can be conducted without the need for expensive analysers, making this approach feasible and accessible even in remote areas. An individual can use a non- elastic measuring tape at home, similar to a pregnancy test, glucometer, blood pressure monitor, etc to suspect AO and further consult with a doctor for evaluation and guidance in order to identify any underlying health condition.

4. Conclusion

Interleukin-4 & TG are positively correlated with abdominal obesity. TG among lipid profile and IL-4 may serve as an important tool for identifying individuals at a higher risk of developing metabolic complications when associated with abdominal obesity. The anthropometric screening, even in remote areas can be done without the need for expensive analysers, makes this approach feasible and accessible. This information can help to undertake appropriate intervention strategies such as lifestyle and dietary modifications during the transition from adolescence to adulthood by measuring the waist circumference.

5. Limitations of study

A longitudinal research may be carried out across a wider geographic region among larger population.

6. References

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