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Association of ABO blood types and novel obesity markers in healthy adolescents

Nazeem Ishrat Siddiqui, Ajay Soni[1], Sarfaraz Alam Khan[2]

Abstract:

INTRODUCTION: Association of ABO blood type with body mass index (BMI) was explored in the past studies, but literature on association of novel obesity markerssuch as total body fat and lean body mass (LBM) is scarce. The present study aimed to evaluate the relationship of ABO blood types with novel obesity markers in normal adolescents.

MATERIALS AND METHODS: A cross-sectional study was done on 387 medical students. Bio-impedance analysis (BIA)-derived novel obesity markers such as body fat percent (BFP) and lean body mass (LBM) were recorded. Blood typing was done using slide-agglutination method. Mean and SD were calculated; analysis of variance and Chi-square (χ^2) correlation were used to determine the relationship between ABO blood types and obesity markers.

RESULTS: Highest propensity for BFP and LBM was seen in blood groups AB and B (25.09 ± 8.92 and 44.45 ± 6.91) respectively. Highly significant (*P* < 0.001) differences were observed in the values of BFP and LBM in normal and obese participants across ABO blood types. Prevalence of obesity did not show significant relationship (χ^2 = 2.069; *P* = 0.913) with ABO blood types.

CONCLUSIONS: Unlike BMI, novel obesity markers (BFP and LBM) significantly differ across ABO blood groups in normal and obese population. The findings suggest that ABO blood type might have role in determining body composition. This will be helpful in recognition of the participants at the risk of obesity on the basis of their blood groups.

Keywords:

Blood groups, body mass index, body composition parameters, obesity, total body fat

Introduction

Over the past few decades, relationship between ABO blood type and certain disease states gained good attention. Literature suggests that ABO antigens may play a role in pathogenesis of malaria, cancers, cardiovascular, endocrine, and metabolic disorders.[1-4] These findings have devised to presume that obesity might have linkages with ABO blood groups. This is more important in the present scenario because the prevalence of overweight and obesity is on the rise and has now escalated into developing countries like India.[5-7]

Body mass index (BMI), which is widely used marker of obesity, has been studied with ABO system to find out the potential risk of a particular ABO antigen and propensity for increased body fatness.[8-10] However, due to the inferior discriminating abilities of BMI in distinguishing between body fat and muscle mass, the findings of these studies remained diverse and inconclusive.[5,7-13] Moreover, these studies remained unsuccessful in establishing a link between ABO blood groups and the prevalence of obesity.[14-17]

Accumulation of excess visceral fat is an important determinant of metabolic

Department of Physiology, Government Medical College, Khandwa, [1]Department of Physiology, MGM Medical College, Indore, [2]Department of Pharmacology, Government Medical College, Chhindwara, Madhya Pradesh, India

Address for correspondence:
Dr. Ajay Soni, Department of Physiology, MGM Medical College, Indore, Madhya Pradesh, India.
E-mail: drajay.soni141178@gmail.com

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disorders. Therefore, interest is growing to estimate this excess fat directly rather depending on surrogate markers of obesity. Bio-impedance analysis (BIA) is a simple, fast, and inexpensive field technique which provides direct estimation of body fat percent (BFP) and lean body mass (LBM) which are considered as novel screening tools of obesity.

BIA technique has been used in some large-scale population-based studies,[5,7] and its accuracy has been found to be superior to BMI in assessing body fatness.[5,6,12] However, literature on association of these novel screening tools of obesity with ABO blood type is scarce.

Probably, this is the first study which aims to evaluate the relationship of ABO blood type with novel obesity indices in normal adolescents. This will be helpful in early identification of people at the risk of obesity on the basis of their blood groups.

Materials and Methods

This cross-sectional study was conducted on 387 healthy undergraduate medical students of age between 17 to 25 years. After explaining the study protocol to the participants, informed written consent was obtained and anthropometric measurements were done using the standard protocol.[18] Weight was measured to the nearest 0.5 kg in light clothing, without wearing shoes on calibrated weighing machine. Height was measured to the nearest 0.1 cm on wall-mounted stadiometer. BMI was calculated as weight (kg) divided by height (mts^2)

Obesity was defined using the WHO Asia-Pacific Guidelines (BMI $\geq$25 kg/m^2).[19]

Blood samples for ABO typing were collected by finger prick with full aseptic precautions. Slide-agglutination method with antisera (Eryscreen Total Monoclonal ABO Rh-D reagent, Tulip Diagnostic Ltd., Goa, India) was used for blood group determination in each sample.[20]

Body composition parameters such as BFP and LBM were derived from BIA technique as per the NIA standard protocol.[21]

Participants with a history of the current or past chronic illness (n = 13) were excluded from the study. The study was approved from the Institutional Ethical and Research Committee.

Statistical analysis was carried out on MedCalc statistical software (V.18.10.2), Belgium. Categorical variables were reported as number and percentages, whereas continuous variables as mean and standard deviations. Analysis of variance test was used to compare difference between the mean. Pearson Chi-square (χ^2) correlation was used to determine association between ABO blood groups and the prevalence of obesity. Level of significance for all the tests was fixed at $P < 0.05$.

Results

Baseline characteristics of the study variables and distribution of ABO blood groups have been depicted in Table 1. Blood group B was the most prevalent (n = 116; 29.9%) in our study population, followed by blood group A (n = 104; 26.8%) [Figure 1].

The tendency for highest BFP was seen in blood group AB (25.09 ± 8.92); similarly, LBM was highest in group B (44.45 ± 6.91). However, no significant differences in the mean values of BMI were noted across the ABO groups [Table 2].

Highly significant differences were observed in the mean values of BFP in normal (f = 6.645; $P \leq 0.0001$) and obese (f = 4.756; $P \leq 0.001$) participants. Similarly, LBM also differed significantly in both normal (f = 2.8229; $P \leq 0.05$) and obese (f = 5.912; $P < 0.001$) participants [Table 3].

However, BMI did not show statistically significant differences across the ABO blood groups.

In the present study, the prevalence of obesity (BMI $\geq$25 kg/m^2) was 18.60%. The observed differences

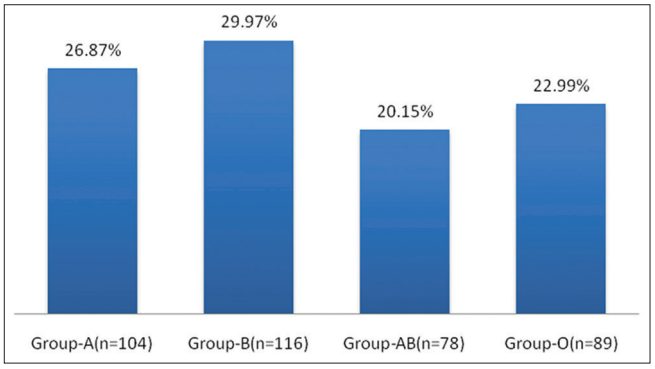

Figure 1: Distribution of the study population in different blood types

Table 1: Baseline characteristics of the study population

Study variables	Minimum	Maximum	Mean±SD	95% CI
Age (year)	17.00	24.00	18.78±1.08	18.65-18.90
Weight (kg)	32.50	100.00	57.22±13.22	55.72-58.72
Height (cm)	144.00	192.00	164.15±9.48	163.07-165.22
BMI (kg/m^2)	14.25	35.17	21.17±4.13	20.70-21.64
BFP	8.78	43.94	22.30±7.70	21.42-23.17
LBM (%)	27.59	63.99	44.19±7.12	43.38-45.00

SD=Standard deviation, 95% CI=95% Confidence interval, BMI=Body mass index, BFP=Body fat percent, LBM=Lean body mass

in the prevalence rates in different blood groups did not show a statistically significant relationship (χ^2 = 2.069; $P \geq 0.05$) [Table 4].

Discussion

After the advent of BIA-derived novel screening tools of obesity such as body fat percent (BFP) and LBM, the concept of obesity has changed. More emphasis has now been given on the direct estimation of body fat rather than depending on the surrogate markers of obesity like BMI. It is the visceral fat which determines the health condition of the individual, but due to the inferior discriminating abilities of BMI in distinguishing between body fat and muscle mass, it often does not provide correct estimation of visceral fat.[5-7,12,14]

Various past studies have attempted to explore links between ABO blood type and obesity, but their findings were diverse.[10,11,13-16] In some of the studies, blood group O was found to be associated with increased risk of obesity and high blood pressure.[22,23] However, in other studies, increased tendencies for obesity and high leptin levels were observed in blood type B.[24,25] Furthermore, in one of the past study, increased prevalence of obesity was noted in blood type A.[9] On the contrary, no statistically significant association among overweight, obesity, and blood type have been observed in the population of Saudi Arabia.[8] Apart from a recent study from India, the relationship of ABO blood groups and novel screening tools of obesity such as BFP and LBM remained unexplored.[14,13]

In the present study, mean values of BFP and LBM significantly vary across the ABO system in both normal and obese participants. It suggests that significant physiological differences exist between individuals of ABO blood types and blood groups may play a biological role;[22,23] however, BMI did not show such relationship [Tables 2 and 3]. These findings suggest that ABO system might have a role in determining TBF and LBM in normal population. In this context, despite of our best efforts, we did not find literature to compare our findings. However, in one of the Indian studies,[14]

Table 2: Distribution of obesity indices in ABO blood groups

Entire series	ABO blood groups Mean±SD				Test of significance		
	Group A (*n*=104)	Group B (*n*=116)	Group AB (*n*=78)	Group O (*n*=89)	df	f-statistic	*P*
BFP	22.47±8.02	21.87±7.05	25.09±8.92	23.05±8.31	3	2.6190	0.0460
LBM %	43.22±6.91	44.45±6.91	41.25±7.06	43.84±7.45		3.3858	0.0182
BMI	21.50±4.51	21.21±4.21	21.70±3.94	21.58.±4.40		0.2385	0.8695*

*Nonsignificant, level of significance *P*<0.05. SD=Standard deviation, df=Degree of freedom, LBM=Lean body mass, BMI=Body mass index, BFP=Body fat percent

Table 3: Comparison of the study variables in normal and obese groups

Adiposity indices	ABO blood groups (mean±SD)				Test of significance		
	Group A	Group B	Group AB	Group O	df	*F*	*P*
Normal weight (BMI <25)							
BFP	19.28±7.24	19.53±7.16	24.69±10.07	20.46±8.28	03	6.645	0.0002
LBM %	42.91±6.72	43.98±6.57	40.84±6.70	43.13±7.09		2.822	0.0390
BMI	19.32±3.44	19.87±2.69	20.25±2.61	19.82.±2.33		1.343	0.260*
Obese (BMI >25)							
BFP	33.69±7.45	35.48±6.66	26.75±9.43	34.02±3.78		4.756	0.004
LBM (%)	47.47±7.76	47.89±8.30	41.12±8.36	52.71±6.68		5.912	0.002
BMI	28.18±3.00	29.01±2.79	27.79±2.47	29.06±3.01		0.806	0.494*

*Nonsignificant, level of significance *P*<0.05. LBM=Lean body mass, BMI=Body mass index, BFP=Body fat percent, SD=Standard deviation, df=Degree of freedom

Table 4: Distribution of normal and obese population across ABO blood type

BMI category*	Number (*n*) and percentages (%)	Blood group (*n*=387)					
		Group A (*n*=104)	Group B (*n*=116)	Group AB (*n*=78)	Group O (*n*=89)	χ^2	*P*
Normal (BMI <25 kg/m^2)	*n*	81	99	63	72	2.06	0.913†
	Percentage within ABO groups	77.88	85.34	80.76	80.89		
	Percentage of all groups	20.93	25.58	16.27	18.60		
Obese (BMI >25 kg/m^2)	*n*	23	17	15	17		
	Percentage within ABO groups	22.11	14.60	19.23	19.10		
	Percentage of all groups	5.94	4.39	3.87	4.39		
Entire study population	Total	104	116	78	89		
	Percentage within all ABO	26.87	29.97	20.15	22.99		

*Based on body mass index refrence values for Asian Indians; †Nonsignificant. χ^2=Chi-square statistic, BMI=Body mass index

highest values of BFP were reported in AB blood group, this is in agreement to the findings of the present study.

Prevalence of obesity observed in this study was 18.60%, this is in accordance with the prevalence rate reported in a recent cross-sectional study.[7]

In the present study, blood group A has the highest number of obese participants (22.11%); however, the present study remains unsuccessful in establishing relationship between the prevalence of obesity with ABO phenotype [Table 4]. These findings are in agreement with the past studies.[9,12,22,26,27] On the contrary, significant correlation between ABO blood group and obesity was noted in the other previous studies.[10,14,15] The reported differences might be due to the confounding effect of population-specific ethnic and racial variations.[6,12,26,27]

Moreover, obesity was defined using BMI classification which has poor sensitivity for visceral fat.[5-7,13] Thus, it did not reflect adiposity accurately especially in the Asian population which has significantly more visceral adipose tissue as compared to other races.[6,12,27]

Conclusions

The observed differences in the mean values of BFP and LBM in different ABO blood groups in healthy and obese population might suggest a role of ABO system in determining body composition parameters in healthy adults. Further studies on a larger population must be needed to confirm the observations of this study. This will be helpful in early recognition of the population at the risk of obesity.

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Conflicts of interest

There are no conflicts of interest.

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