



## Association of ABO group types to overweight and obesity: Based on six years of experience in two centers in Sulaimani governorate, Kurdistan Region/Iraq



Hiwa Omer Ahmed<sup>a,\*</sup>, Shwan Ali Tawfiq<sup>b</sup>, Dara Ahmed Mohammed<sup>c</sup>, Sabah Abid Abdulhakim<sup>d</sup>, Rajan Fuad Ezzat<sup>e</sup>, Aram Kakarash<sup>e</sup>, Mohammad Amin Ali Omer<sup>e</sup>, Aree Majid Nuri<sup>e</sup>, Yad Atuf Abdulrahim<sup>f</sup>, Kardo Mohammed Salih<sup>i</sup>, Halkawt Omer Ali<sup>g</sup>, Kalthum Rasul Kider<sup>h</sup>

<sup>a</sup> Professor in Bariatric Surgery, College of Medicine, University of Sulaimani, Sulaimani City, Kurdistan Region, Iraq

<sup>b</sup> Specialist Hematologist, Hiwa Hospital, Sulaimani City, Kurdistan Region, Iraq

<sup>c</sup> General Surgeon, College of Medicine, University of Sulaimani, Sulaimani City, Kurdistan Region, Iraq

<sup>d</sup> Urologist, Sulaimani Teaching Hospital, Sulaimani City, Kurdistan Region, Iraq

<sup>e</sup> General Surgeon, Sulaimani Teaching Hospital, Sulaimani City, Kurdistan Region, Iraq

<sup>f</sup> Trainee of Kurdistan Board of Orthopedic, Sulaimani Teaching Hospital, Sulaimani City, Kurdistan Region, Iraq

<sup>g</sup> Trainee of Iraqi Board of Surgery, Sulaimani Teaching Hospital, Sulaimani City, Kurdistan Region, Iraq

<sup>h</sup> Director of the Central Blood Bank, Sulaimani Teaching Hospital, Sulaimani City, Kurdistan Region, Iraq

<sup>i</sup> Trainee of Arabic Board of Orthopedic, Sulaimani Teaching Hospital, Sulaimani City, Kurdistan Region, Iraq

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### ABSTRACT

**Background:** Many studies have supported a number of associations between ABO blood type and certain diseases, including pancreatic cancer, venous thromboembolism, and myocardial infarction in the presence of coronary atherosclerosis, sexual maturity, breast cancer, cancer, infections, Diabetes mellitus, cardiovascular diseases, hypertension, peptic ulcers, intelligence and socioeconomic class, personality, suicide, BMI and obesity. **Objectives:** To find any relation of the ABO blood groups to overweight and obesity.

**Patients, materials, and methods:** A prospective randomized study including 885 overweight or obese patients from a total of 896 patients, they were consulting for advice, diet and or drugs and various bariatric operations. This was conducted over the period of 6 years from February 1st, 2012 to March 1st, 2018.

The patients were arranged in 2 groups.

1. Group A: 885 overweight or obese patients.

2. Group B: 20011 blood donors.

**Results:** Regarding the frequency of ABO blood groups among the overweight and obese patients, group O was the most common ( $n = 361$ , 40.80%), as it is in the population sample ( $n = 7563$ , 37.80%). Although group A and B were comparable, patients in group AB composes (11.41%) of the overweight and obese patients, while the prevalence of group AB is (07.36%) in the population sample, there is statistically important positive relation between overweight and obesity to ABO group type AB,  $r = 0.98$ , ( $P < 0.001$ ).

**Conclusion:** In the ABO blood group system, group AB was more susceptible to develop overweight and obesity in Kurd race.

### 1. Introduction

Blood groups can be classified according to the presence or absence of certain antigens on the surface of red blood cells: the ABO system on chromosome 9 and the MNS system on chromosome 4 (Cusack, 2013). Their genes and phenotypes are different widely among ethnic groups

and both within and amongst geographical areas, (Chandra and Gupta) within and among ethnic groups, some variations may even occur in different areas within one small country (Jaff, 2010).

More recently, an extensive collection of epidemiologic studies have assessed the significance of ABO blood groups in relation to physiologic variations and pathologic processes (Cusack, 2013; Ibraheem, 2016).

\* Corresponding author.

E-mail addresses: [hiwa.omer@univsul.edu.iq](mailto:hiwa.omer@univsul.edu.iq), [hatwan@gmail.com](mailto:hatwan@gmail.com) (H.O. Ahmed).

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Many studies have supported a number of associations between ABO blood type and certain diseases, including pancreatic cancer, venous thromboembolism, and myocardial infarction in the presence of coronary atherosclerosis (Jaff, 2011), sexual maturity (Dai and Liang, 2014), breast cancer (Payandeh et al., 2015), cancer (McMillan, 2006; Franchini et al., 2016; Liumbruno and Franchini, 2013), infections (FalagasMatthew et al., 2006), Diabetes mellitus (Kamil et al., 2010) cardiovascular diseases (Liumbruno and Franchini, 2013) hypertension (Chandra and Gupta; Hercegovac et al., 2017), peptic ulcers (Jaff, 2011), intelligence and socioeconomic class (SmithIsaac Abaidooet al., 2018), personality (SharifiHamza et al., 2015), suicide, (Chandra and Gupta) BMI (SmithIsaac Abaidooet al., 2018; Jafari et al., 2012) and obesity (Chandra and Gupta; Hercegovac et al., 2017; Jafari et al., 2012; Nas and Fişkin, 2017).

There are studies claiming relation of ABO blood groups to overweight and obesity (Chandra and Gupta; Hercegovac et al., 2017; SmithIsaac Abaidooet al., 2018; Jafari et al., 2012; Nas and Fişkin, 2017; Hein et al., 2005; Rai and Sapkota, 2017) while some others denied any association (Kelso et al., 1994; Sukalingam and Ganesan, 2015; Alwasaidi et al., 2017).

The prevalence of overweight and obesity in 2014 in our province was 20.6% and 11.3% respectively (Muhammed Saeed Qadir et al., 2014), and it is rising, and now there is more awareness about this subject and its risks.

The current work aimed in finding of the prevalence of each blood groups in our area, where most of the population are of same the race and ethnic group and to find any relation of the ABO blood groups to overweight and obesity.

## 2. Patients, materials and methods

A prospective randomized study including 885 overweight or obese patients from a total of 896 patients, they were consulting for advice, diet and or drugs and various bariatric operations. This was conducted in the period of 6 years from February 1st, 2012 to March 1st, 2018.

Each patient was evaluated clinically with BMI, Excess body weight (EBW) calculated from ideal body weight (IBW), being measured before and on each visit after operation with a digital skin fold caliper. All patients underwent complete evaluation before the operation (including endoscopy and abdominal ultrasonography). Additional investigations were performed according to the risk profile of each individual patient.

Blood and biochemical work-up were done for each patient. For the collection of the required information, each patient was interviewed face-to-face, by three trainees (from Kurdistan Board for Medical Specialties/surgery) who were working in the following centers: Hatwan private hospital, and Sulaimani Teaching Hospital., An originally –designed questionnaire was filled in English language, translated to Kurdish language by the interviewer. It is composed of demographic, medical and biological data. An informed consent was obtained and a consent form was signed by each patient. The research was confirmed by the Ethics Committee of University of Sulaimani, College of Medicine.

Later sessions were set to label certain patients to be excluded. 11 patients were excluded because either they were lost in supervision, from a different race, not from the area, or not willing to participate in this research.

Then a retrospective registration and collection of data regarding ABO and Rh blood grouping were started from May 2nd, 2017 till April 30<sup>th</sup> 2018 by the surgical trainees who were supervised and guided by the Head of the Central blood bank of Sulaimani Directorate of Health. A total 20132 of blood donors (male and female): 20011 were enrolled to find the real distribution of ABO blood groups in the governorate, Blood grouping done in the blood bank by two methods:

- 1 Taking 3 mL blood from the person, into an EDTA tube. Using fully

automated blood grouping machine, model (IH 1000) from (Bio-Rad) company, Switzerland. This method was used in about 91% of the tests.

- 2 Taking 3 mL blood from the person, into a yellow gel tube, by gel card method, used in 9% of the tests when fully automated blood grouping machine was not ready. One hundred twenty one persons were excluded because they were either repeated donors, overweight or obese, or not willing to participate, or not from the same race.

The patients were arranged in 2 groups.

1. Group A: 885 overweight or obese patients
2. Group B: 20011 blood donors

All the collected data were collected, organized and analyzed by Statistical Package for the Social Sciences (SPSS); version 21.

## 3. Results

Informed consent were signed at the interview on filling the questionnaire. The work was approved by University of Sulaimani-College of Medicine-Ethics Committee on//2018, number ( ... ), The Most of the patients were female (n = 668), with gender ratio (female to male = 3:1). The mean age of (30 ± 9.4 years); (31 ± 9 years) for female, and male patients, respectively. Mean BMI 37 ± 9 kg/m<sup>2</sup>s in (n = 668 female) and 43 ± 8 kg/m<sup>2</sup>s in (n = 217 male) patients, (Table 1).

Retrospective registration of ABO blood groups in Sulaimani Governorate revealed that (Group O) is the most common blood group (37.80% of the blood donors), while the least common ABO blood group was (group AB = 07.36%). Regarding D blood group, was positive in (17974) blood donors and negative in (2037) blood donors as shown in Table 2.

Comparing prevalence of ABO blood groups in the current work (in Sulaimani governorate) to a study registered ABO blood groups in the Kurdistan Region (Jaff, 2010): frequency and percentage of ABO blood groups were slightly different Group O (0.64%), group A (0.53%), B (0.94%) and AB (0.83%); look to (Table 3).

While in comparing prevalence of ABO blood groups of Kurds to other nations in the region and neighboring countries, a large difference noticed. Especially in the two most common blood groups (O and A). The differences were (8.05%, 2.97%, 1.8%, 4.8%) in group O with Iranian, Turks, non-Kurd Iraqi and Caucasian) respectively. Regarding the second common ABO blood group A, the differences were (10.44%, 10.48%, 1.94%, 11.26%) in group A with Iranian, Turks, non-Kurd Iraqi and Caucasian) respectively.

The differences were (11.94%, 8.01%, 5.10%, 11.70%) in group B with (Iranian, Turks, non-Kurd Iraqi and Caucasian) respectively, as seen in Table 4.

Near half of the overweight and obese patients were from group O (n = 361, 40.80%), other patients were distributed on the other ABO blood groups as group (A: n = 262, 29.60%), (B: n = 161, 18.19%), (AB: n = 101, 11.41%) respectively.

Regarding the frequency of ABO blood groups among the overweight and obese patients, group O was the most common (n = 361, 40.80%), as it is in the population sample (n = 7563, 37.80%). Although group A and B were comparable, but patients in group AB

**Table 1**  
Frequency, mean age, mean BMI of the overweight and obese patients.

Gender	Number (n = 885)	Mean age (years)	Mean BMI (Kg/m <sup>2</sup> s)
Female	668	30 ± 9.4	37 ± 9
Male	217	31 ± 9	43 ± 8

**Table 2**  
Frequency of blood group types in the Sulaimani governorate.

Blood group	Total number (20011) & %	Blood group & Rh	Number (subgroups)	Frequency
<b>O</b>	7563	<b>O+</b>	6709	<b>33.53%</b>
	<b>37.80%</b>	<b>O-</b>	854	<b>04.27%</b>
<b>A</b>	6393	<b>A+</b>	5805	<b>29.00%</b>
	<b>31.94%</b>	<b>A-</b>	591	<b>02.95%</b>
<b>B</b>	4583	<b>B+</b>	4142	<b>20.70%</b>
	<b>22.90%</b>	<b>B-</b>	440	<b>02.20%</b>
<b>AB</b>	1472	<b>AB+</b>	1318	<b>06.58%</b>
	<b>07.36%</b>	<b>AB-</b>	154	<b>00.78%</b>

**Table 3**  
Frequency and percentage of the blood group types in the Sulaimani governorate and Kurdistan region.

Blood Groups	Sulaimani Governorate	Kurdistan region	P value	correlation coefficient
O	7563 37.80%	19783 37.16%	0.540963	r = 0.29
A	6393 31.94%	17283 32.47%		
B	4583 22.90%	12693 23.84%		
AB	1472 07.36%	3475 06.53%		

**Table 4**  
Comparison of the prevalence of blood group types of Iranian to the sample of general population from the Sulaimani governorate.

Blood groups	Sulaimani (n = 20011)	Iranian (n = 23320) (Chandra and Gupta)	Turks (n = 55524) (Nas and Fişkin, 2017)	Iraq non Kurds (Jaff, 2010)	Caucasian (Bruno et al., 2014)
<b>O</b>	7563 <b>37.80%</b>	6938 29.75%	19339 34.83%	36.00%	137 (42.6)%
<b>A</b>	6393 <b>31.94%</b>	5014 21.50%	23552 42.42%	30.00%	139 (43.2)%
<b>B</b>	4583 <b>22.90%</b>	8123 34.84%	8267 14.89%	28.00%	36 (11.2)%
<b>AB</b>	1472 <b>07.36%</b>	3243 13.91%	4366 7.86%	08.00%	10 (3.1)%

composes (11.41%) of the overweight and obese patients, while the prevalence of group AB is (07.36%) in the population sample, there is statistically important positive relation between overweight and obesity to ABO group type AB, r = 0.98), (P < 0.001) as shown in Table 5.

In the literature there are smaller groups of patients recruited for similar study, 401 (Aboel-Fetoh NM1 et al.) and 412 (Samuel Smith et al.) patients in comparison to 885 patients in the current work. The prevalence of group AB is ranging from (03.10%) to (27.30%) as shown

**Table 5**  
Prevalence of the ABO and Rhesus blood group types in the overweight and obese patients.

Groups	O (n = 361)		A (n = 262)		B (n = 161)		AB (n = 101)	
	+	-	+	-	+	-	+	-
Female	258 29.15%	21 02.37%	174 19.66%	21 02.37%	108 12.20%	17 1.92%	63 07.11%	6 00.67%
Male	73 08.25%	9 01.01%	65 07.34%	2 00.22%	33 032.70	3 00.33%	32 03.61	0 00.00%
Total subgroups	331 37.41%	30 3.39%	239 27.00%	23 02.60%	141 15.93%	20 02.26%	95 10.74	6 00.67%
Total groups	361 40.80%		262 29.60%		161 18.19%		101 11.41%	

**Table 6**  
Comparison of the frequency of blood group types of the overweight and obese patients to the sample of general population from the Sulaimani governorate.

Blood group	Total number of the sample (n = 20011) & %	Total number of the patients (n = 885) & %	P value	Correlation coefficient
<b>O</b>	7563 37.80%	361 40.80%	0.4613	0.95
<b>A</b>	6393 31.94%	262 29.60%		
<b>B</b>	4583 22.90%	161 18.19%	0.4613	0.98
<b>AB</b>	1472 07.36%	101 11.41%		

in Table 5.

#### 4. Discussion

There is great genetic diversity within all human populations (AAA (American Anthropological Association), 1996), simple example is ABO group system.

In the ABO system, the most common phenotype in Kurdistan, was O (37%), followed by A (32.6%), B (22.8%) and AB (7.6%) (Jaff, 2010; Hennerbichler, 2012), this is intermediate between the European and Asian countries with some specificity to the Kurds population reflecting the distinct geographical area and preserved ethnic background of the Kurds in the region (Hennerbichler, 2012).

To avoid bias, the frequency of ABO group types in an area in Sulemani Governorate which is pure Kurds was evaluated for comparison to an assay done in South Kurdistan, as it is inhabited also by non-Kurds like Arabic, Assyrian Neo-Aramaic, Chaldean Neo-Aramaic, Turkmen and Armenian (Michael, 2013), different results were found, regarding the frequency of ABO blood groups as shown in Table 3, although it was not significant statistically (p = 0.540963).

“Ninety-eight percent of the citizens in Sulaimani Governorate are Kurds. They are traditionally regarded as Iranians and of Iranian origin, and therefore as Indo-Europeans, mainly, because they speak Iranian”. But “Newest DNA-research of advanced Human Anthropology indicates that the Oldest ancestral forefathers of Kurds were millennia later linguistically Iranianized in several waves by militarily organized elites of (R1a1) immigrants from Central Asia” (Getta et al., ). Izady (Zahra Ghobadian et al., 2014) argues that the period from the 5th century BC through the 6th century AD “marks the homogenization and consolidation of the modern Kurdish national identity. The ethnic designator Kurd is established finally and applied to all segments of the nation (Kurdistan Regional Government, 2010).

ABO and rhesus (Rh) genes and phenotypes vary widely between ethnic groups and both within and between geographical areas (Jaff, 2010; M1Kamali and Hosseinbasi, 1988), for this reason, this city selected to avoid the bias of biological difference and mixed ethnic groups to have minutest biological differences, It became clear from the results

**Table 7**

Comparing the data of present work (prevalence of ABO group types in overweight and obese patients) with others articles in the literature.

Author	Sample size	Group O	Group A	Group B	Group AB	Ratio
Chuemere et al. (2015)	1620	64.80%	18.30%	12.50%	04.30%	15:4:3:1
Jafari et al. (2012)	50 045	29.90%	34.00%	27.10%	09.60%	03:4:3:1
Selçuk Nas (Chandra and Gupta)	14946	27.00%	25.80%	22.90%	27.30%	01:1:1:1
SmithIsaac Abaidooet al. (2018)	412	51.20%	19.70%	26.00%	03.10%	17:6:8:1
Abuel-Fetoh et al. (2016)	401	44.10%	30.90%	18.70%	06.20%	07:5::3:1
Current work	885	40.80%	29.60%	18.19%	11.41%	08:6:3:2

that all ABO groups (O = 37.80%, A = 31.94%, B = 22.90%, AB = 07.36%) were different significantly from Iranian ABO groups (O = 29.75%, A = 21.50%, B = 34.84%, AB = 13.91%) especially in (8.05%) difference Group O and (6.55%) difference in the Group AB.

The same was right regarding significant differences with Turks (O = 34.83%, A = 42.42%, B = 14.89%, AB = 7.86%) and Iraqi non-Kurd (O = 36.00%, A = 30.00%, B = 28.00%, AB = 08.00%) in all types of ABO group system.

Different blood types may produce considerable physiological differences (Qunq and Abdel Hamid, 2012). and susceptibility to diseases, as mentioned in details in the literature (Chandra and Gupta; Dai and Liang, 2014; Payandeh et al., 2015; McMillan, 2006; Franchini et al., 2016; Liumbruno and Franchini, 2013; FalagasMatthew et al., 2006; Kamil et al., 2010; Hercegovac et al., 2017; Jaff, 2011; SmithIsaac Abaidooet al., 2018; SharifiHamza et al., 2015; Jafari et al., 2012; Nas and Fişkın, 2017). The ABO blood group system considered as a genetic marker diseases and obesity (Chandra and Gupta; FalagasMatthew et al., 2006), but still there is wide controversy regarding link of ABO group types to weight problems, there are articles support this linkage (Chandra and Gupta; Hercegovac et al., 2017; SmithIsaac Abaidooet al., 2018; Jafari et al., 2012; Nas and Fişkın, 2017; Hein et al., 2005; Rai and Sapkota, 2017), meanwhile there are studied which deny any association (Alwasaidi et al., 2017).

One may notice that the most common type of ABO groups in Sulemani governorate is group O (37.80%), with (40.80%) of the overweight and obese patients were of group O, but with no statistical significance ( $P = 0.4613$ ), meanwhile there were relatively large number (11.41%) of the overweight and obese patients in the rarest group AB (07.36%), with statistically highly significant difference ( $P = 0.001$ ), and Correlation coefficient ( $r = 0.98$ ).

Abuel-Fetoh et al. (2016) found this association between ABO blood groups and overweight and obesity to group AB, Kelso et al. (1994), found the relation of group AB to Diabetes Mellitus and obesity, While Nwafor Chuemere et al. (2015) found the link between group B and obesity and Diabetes Mellitus. The same link found by Qunq and Abdel Hamid (2012), High incidence of obesity in Malaysia was found in type B.

Chandra Kala Rai and Sapkota (2017) found Maximum obesity in blood group B, no obesity in blood group AB.

In Table 6, the ratio of the ABO groups in obese and overweight patients compared to other works, showing that AB group in the overweight and obese patients in the current study is higher than others. (O:A:B: AB ratio) in the work of Chuemere et al. (2015) (15:4:3:1), Jafari et al.(2012) (03:4:3:1) Selçuk Nas and Fişkın (2017) (01:1:1:1), Samuel SmithIsaac Abaidooet al. (2018)(17:6:8:1), Abuel-Fetoh et al. (2016) (07:5:3:1) versus the present work (O:A:B:AB ratio) was (08:6:3:2). This may explain the statistical correlation between AB blood group and overweight and obesity because the ratio of AB group in the patients in other studies was (:1) versus (:2) in the present work.

The highest prevalence of overweight and obesity in blood group AB, only means that blood group AB may have a link with overweight and obesity in this particular area and this population, who are of the same race, this couldn't be generalized to any other area with a different race or ethnic groups. This may mean every race or ethnic group may need its special evaluation to evaluate any link between the ABO blood

group system and gaining of the weight.

## 5. Conclusion

In the ABO blood group system, group AB was more susceptible to develop overweight and obesity in Kurd race.

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