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Body mass index in children with sickle cell anemia at ma tertiary center in Jeddah, Saudi Arabia.

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Abstract

Background: Sickle cell anemia is a defect in the structure of Hb, resulting in sickle cells shaped; which cause several manifestations leading to end-organ damage. Data in children suggest a normal or above healthy BMI have better health outcomes than patients with low BMI. We are hypothesized that the increased weight status of children with SCD would be associated with increased hemoglobin (Hb) levels.

Method: A retrospective study conducted during June 2019, was done at a tertiary center in Jeddah. A sample size of 102 children with SCA of both genders, with ages ranging from (5-16). BMI examined as a continuous variable.

Result: There is significant between BMI and Hb serum ($p<0.05$), out of the 102 children with SCA, 82 children (80.4%) were underweight, children with normal-weight were 12 children (11.8%), overweight children were only 4 children (3.9%), the obese children were 4 (3.9%). There is no significant between sickle cell type and BMI ($p>0.05$) and no relation between BMI and leukocyte.

Conclusion: Our study did not demonstrate an association between SCA type and BMI. However, we found most children with SCA are underweight. With an association between BMI and Hb serum. More studies should focus on the dietary regimen for sticklers.

Keywords: Sickle Cell Disease (SCD), Sickle Cell Anemia (SCA), Body Mass Index (BMI), Pediatrics.

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Introduction

Sickle cell anemia (SCA) is one of the common inherited blood disorders arises out of a point mutation in the bases coding for the sixth amino-acid of the β- chain of hemoglobin gene. This modified substitution gives rise to a mutant variant of hemoglobin (HbS) with different properties than the wild type hemoglobin (HbA) molecule [1]. This disease affected more than 50 million persons worldwide [2].

Under deoxygenated conditions, HbS molecules tend to aggregate in long rigid chains that deform the shape of the erythrocytes causing it to take up its characteristic sickle-shaped conformation [3]. Various clinical manifestations are commonly seen in patients with SCA, such as occlusive crisis, acute chest syndrome, stroke, chronic hemolysis, and persistent organ dysfunction [4]. These clinical manifestations also appear to be associated with changes in physical capacity, higher basal metabolic rate [5], lower levels of Hb, pulmonary and vascular diseases, and myopathy, which can lead to sedentary defensive behavior even in young patients [6].

In SCA, abnormally low levels of oxygen in blood and tissue hypo-perfusion are dangerous complications. That can develop tissue impairment, which disturbs relatively all systems of the body, leads to development and growth retardation, and poor nutritional status. That results in deterioration in different anthropometric dimensions, e.g., body mass index (BMI), weight, height, body fat, skeletal development, and postponed puberty [7].

More recently, a study was conducted at the University of Nigeria Teaching Hospital (UNTH) and published in February 2016 concluded that the BMI and other anthropometric variables among children with sickle cell anemia are low when compared with children with normal Hemoglobin genotype [7].

Another study was done at University Hospital of Modena In 2016, showed that low body weight and BMI are significantly related to the total Hb mean values, and inadequate intake of macro- and micronutrients negatively affect the severity of SCD [8].

Also, there was another study conducted in the tertiary Pediatric Haemoglobinopathy center in London in 2017; Results suggest that HbSS patients with a high BMI may have less severe disease than those with a healthy BMI. These associations were not demonstrated in patients with HbSC disease [9].

Another Retrospective Study was conducted at Aventura, FL, USA, in 2017 results showed Increasing BMI was associated with increased hemoglobin levels, As compared to underweight individuals, obese or healthy weight, individuals tended to have higher levels of hemoglobin in admitted [10].

Another study was published in Pediatric Hematology and Oncology Journal in Jul 2015. Concluded that Obesity and

overweight are becoming prevalent among children with SCA, and so awareness and preventive health education about obesity should be created among caregivers of children with sickle cell anemia in our setting to avert its possible complications [11]. There were no enough studies to estimate the BMI variable in SCA patients in Saudi Arabia, especially in the western region. So, this study aimed to estimate the BMI variable in children with Sickle cell anemia at tertiary Hospital, Jeddah, Saudi Arabia.

Research Methodology

The study aimed to estimate BMI in children with SCA at tertiary centers in Jeddah, Saudi Arabia. A retrospective study conducted during June 2019, was done at a tertiary center in Jeddah, Saudi Arabia. A sample size of 102. Children with SCA of both genders (5-16) years old were included in the study. The patient's dysmorphic data, type of SCA, and labs were of patients were extracted from the hospital record. Data entered by using. Microsoft Excel and SPSS V21 performed statistical analysis.

Results

The study aimed to estimate BMI in children with SCA at a tertiary center in Jeddah. A total of 102 SCA patients were included in this study, 44 of them were male (43.1%), and 58 of them were female (56.9%). Their ages ranged from (5-16) years old; the mean age was 7.85 years old (Tables 1 and 2). They are sickle cell patients, 74 of them have HBSS (72.5%), and 28 of them have HBSC (27.5%) (Table 3).

In the relation between gender and BMI, (44 male) 33 of them are underweight, 8 of them are a healthy weight, 2 of them are overweight, one is obese. (58 female) Forty-nine of them underweight, 4 of the average weight, 2 of them overweight, 3 of them obese. No significance between BMI and gender. ($p>0.05$) (Tables 4 and 5).

Out of all the children with sickle cell 82 children (80.4%) were underweight 56 of them with HBSS and 26 with HBSC, children with normal-weight were 12 children (11.8%) 10 of them with HBSS and 2 with HBSC, overweight children were only 4 children (3.9%) all of them with HBSS. Also, the obese children were 4 (3.9%), all of them with HBSS (Table 6). There is no significant between sickle cell type and BMI ($p>0.05$) (Table 7).

Table 1. *Descriptive statistics.*

Variables	N	Minimum	Maximum	Mean	Std. Deviation
Age Valid N (List wise)	102	5	16	7.854	4.2599

Table 2. *Sex.*

Sex	Frequency	Percent	Valid Percent	Cumulative Percent
Male	44	43.1	43.1	43.1
Female	58	56.9	56.9	100
Total	102	100	100	--

Table 3. *SCDG.*

Variables	Frequency	Percent	Valid Percent	Cumulative Percent
HBSS	74	72.5	72.5	72.5
HBSC	28	27.5	27.5	100
Total	102	100	100	--

Table 4. *Sex × C. BMI Cross-tabulation.*

Variables		C. BMI				Total
		Underweight	Normal	Overweight	Obese	
Sex	Male	33	8	2	1	44
	Female	49	4	2	3	58
Total		82	12	4	4	102

Table 5. *Chi-square tests.*

Variables	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	3.602[a]	3	0.308
Likelihood Ratio	3.62	3	0.306
Linear-by-Linear Association	0.107	1	0.744
N of Valid Cases	102	--	--

[a.] 4 cells (50.0%) have expected count less than 5. The minimum expected count is 1.73.

Table 6. *SCDG × C.BMI Cross-tabulation.*

Variables		C.BMI				Total
		Underweight	Normal	Overweight	Obese	
SCDG	HBSS	56	10	4	4	74
	HBSC	26	2	0	0	28
Total		82	12	4	4	102

Table 7. *Chi-square tests.*

Variables	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	4.474a	3	0.215
Likelihood Ratio	6.634	3	0.085
Linear-by-Linear Association	4.241	1	0.039
N of Valid Cases	102	--	--

a. 5 cells (62.5%) have expected count less than 5. The minimum expected count is 1.10.

Table 8. *ANOVA Hb serum.*

Variables	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	54.869	3	18.29	5.104	0.003
Within Groups	351.202	98	3.584	--	--
Total	406.071	101	--	--	--

Table 9. *ANOVA leukocytes.*

Variables	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	332.684	3	110.895	1.316	0.274
Within Groups	8257.24	98	84.258	--	--
Total	8589.925	101	--	--	--

A study between BMI and Hb serum was statistically significant ($p<0.05$) (Table 8). In a relation between BMI and leukocyte, there is no significant ($p>0.05$) (Table 9).

In summary, we found there is no significant between Body mass index and type of sickle cell anemia ($p>0.05$). There is a significant between BMI and Hb serum ($p<0.05$), as shown above in Table 9.

Discussion

This study aim is to estimate the BMI in children with Sickle cell anemia in Saudi Arabia western region of Saudi Arabia (80%) of them underweight (%11.8) healthy weight, (3.9%) overweight, and (3.9%) obese.

Our study shows there is no significant relationship between SCA and BMI, comparing to another study that was done in 2019 at the Department of Pediatrics, University of Nigeria Teaching Hospital (UNTH) on a total of 81 patients they found the BMI of SCA patient is significantly lower than that of healthy control and SCA [12]. However, one study was published in Pediatric Hematology, and Oncology journal in 2015 concluded that Obesity and overweight are becoming among children with SCA [11]. Also, there was a study in Philadelphia, USA 2017, on 328 patients with SCD; the result shows Overweight and obesity are associated with HbSC than HbSS [10].

Other authors, like Odetunde OI et al. [7], conducted from 20 males and 20 females with SCA aged among (6-20) at the University of Nigeria Teaching Hospital (UNTH) Ituku-Ozalla Enugu reported that body mass index and other anthropometric measurements among sickle cell anemic children were lower than healthy children but were underweight with male predominance [7].

In contrast, we found a stable relationship between the four BMI groups and Serum hemoglobin levels with a significant P-value of 0.001 on the other side there is no the relation between the four BMI groups and the Leukocyte levels with a non-significant P-value of 0.23, similar to our result one study was conducted in Italy, 2016 on 29 children with SCA in Italy, showed that body weight and BMI are significantly directly related to total Hb mean values [8-12]. The main limitation of our study is the small sample size and the limited variables available, which affect the result significance as shown.

Conclusion

Our aim to estimate body mass index (BMI) in children with sickle cell anemia. Our result showed no significant relationship between the body mass index and sickle cell anemia, compared to other studies, we found a different result. However, we found (80%) of children with SCA were underweight. Also, we found a significant relationship between the BMI and serum hemoglobin, as some published researches. However, this was a retrospective study; we suggest that future studies should focus on dietary interventions for those patients with different age groups.

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