



Original article

Socioeconomic status dependent medical complexities in children with sickle cell disease in Saudi Arabia

Shahida Aziz Khan^{a,b,*}, Fayza AlSiny^c, Ahmad Makki^a, Ashraf Ali^a, Ibtehal AlAnsari^a, Sarah Khan^a^a Applied Nutrition Group, King Fahd Medical Research Center, King Abdulaziz University, Jeddah, Saudi Arabia^b Department of Medical Laboratory Technology, Faculty of Applied Medical Sciences, King Abdulaziz University, Jeddah, Saudi Arabia^c Department of Pediatrics, Faculty of Medicine, King Abdulaziz University Hospital, Jeddah, Saudi Arabia

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ABSTRACT

A look into the associations of socioeconomic status (SES) with prevalence of various complications in sickle cell disease (SCD) is necessary, for an improvement of societal norms, governmental health policies and strategies. We therefore studied the influence of SES indices on certain hematological and clinical parameters in children with SCD in Saudi Arabia. We included 32 female and 33 male patients aged 5–16 years, who were classified based upon their family income. Family monthly income was divided into 4 categories from lowest to highest, with socioeconomic class1 having low earnings of <5000 SAR; the middle income class divided further into class 2 with earnings >5000–10,000 SAR, and class 3 with earnings >10,000–15,000 SAR; and the higher income class 4 with earnings of >15,000 SAR. The assessment indices used were, the frequency of vaso-occlusive crisis (VOC), adverse events, and hematological parameters. A higher percentage of children affected with the disease were from class1, which is the low socio-economic class. It was found that the percentage of frequency of VOC pain crisis, and adverse events was higher in social class 1 patients than in the classes 2, 3, and 4. Also, the age group 5–10 years appeared more susceptible to adverse events and VOC. Our findings suggest the need to conduct future larger studies, to deduce the modifying influence of disparity in SES on certain clinical and hematological indices in children with SCD.

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1. Introduction

The social standing of a person in a society is generally governed by the combination of his education, profession and income which is regarded as his SES. Considerable evidence establishes the likelihood of individuals from low SES to suffer from disease, cognitive problems and increased mortality (Lubeck et al., 2019; National Research Council Panel on Race and Health in Later, 2004). SES begins to influence the child health in the prenatal stages itself, possibly continuing through life (Crimmins et al., 2004; National Research Council Panel on Race and Health in

Later, 2004). The health gradient by SES widens through childhood and the adult life.

A child's wellbeing is an important indication of his normal growth. This is influenced by multifactorial indices like; genetic, and/or environmental of which SES is an important parameter. Though science is steadily progressing over the years, economic disparities discourage access to health products, which is an apparent sequel to declining public health (Burton et al., 2010). The disparity in SES, migrations, food insecurity, fast food habits, social and cultural patterns seem to be the main causes of altered nutrition in individuals throughout the globe (Cannas et al., 2019; Darnton-Hill and Coyne, 1998). Children of a lower socioeconomic class are also known to fare poorly as compared with the upper socioeconomic class in terms of physical appearance and health (Animasahun et al., 2011). SES could thus be defined as a complex combination of occupation, income, knowledge, education, and power in a society. And though quite important, very few studies have actually addressed this problem (Link-Gelles et al., 2016). Also, the significance of appropriate nutrition for adequate growth, stresses the need to address the SES requirements and governmental interventions for this vulnerable population.

* Corresponding author at: King Fahd Medical Research Center, King Abdulaziz University, P.O. Box 80216, Jeddah 21589, Saudi Arabia.

E-mail address: sakhan01@kau.edu.sa (S.A. Khan).

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Biological factors do lead to limiting factors in the development of children affected by SCD. But it has been observed that SES, functioning of family units and development of a child also play an important role in shaping the child's health and personality (Fields et al., 2016; Raphael, 2020). As a result, the condition of SCD children could be influenced in many cases by these factors rather than the disease alone.

Earlier researchers have reported that SCD children experience an elevated protein turnover and a resting energy expenditure (Khan et al., 2016), which may have a negative impact on the growth parameters. A poor nutritional status in children with SCD, which is reflected in their impaired growth, and delayed puberty, has been observed in the past (Barden et al., 2002). A significant difference has been observed in the growth parameters of maturation, and other physical parameters of physical appearance in children belonging to the lower SES compared to those of higher SES (Animasahun et al., 2011; Lukusa Kazadi et al., 2017). Stunting, and a low BMI, has been noticed in these children. Males are seemingly more affected than females in their growth and development. Most of the growth and developmental downsizings were observed in SCD children from the lower socioeconomic class (Esezobor et al., 2016; Shah et al., 2019). Girls appeared to be less affected in terms of wasting, because when genders were compared, it was found that overweight was more prevalent in females than males across all socioeconomic groups (Dapi et al., 2009). Wasting is observed in these children accompanied by a short stature when compared with children of normal weight. Amongst them, severe growth impairments are generally observed in HbSS and HbS β 0 genotypes. This has direct association with complications of the disease and a longer convalescence period. Proper care and improvised techniques have resulted in a longer life span of these SCD affected children (Ebomoyi et al., 1989). A research study conducted in the UK, found that children belonging to low SES, end up being hospitalized more frequently and also for longer periods in the first decade of their life, when compared with children belonging to higher SES. The hospital admissions were attributed to frequent episodes of VOC among this subset of children (Ellison and Bauchner, 2007). In spite of the financial shortcomings in the lower socioeconomic group, parents of these children have to deal with numerous medical complications and the resulting hospitalizations. It was also observed that SCD children had lower hemoglobin levels and higher rates of absenteeism from school (Olatunya et al., 2018). Moreover, the adverse outcome of low SES was the fatally stronger clinical manifestations leading to higher morbidity and mortality (Animasahun et al., 2011).

As most of the clinical complications of SCD manifest in childhood itself, the need to vouchsafe this problem on a nutritional, clinical and psycho-social perspective needs to be considered at the very start itself. We therefore aimed to evaluate and measure parameters affected primarily by socioeconomic conditions, to family education, profession, anthropometric measurements, nutritional intakes, blood picture, and clinical complications in pediatric SCD patients in a steady state.

2. Materials and methods

2.1. Patients and method

A prospective, observational and analytical cohort study was conducted at the King Fahd Medical Research Center, KAU, Jeddah. It characterizes the socio-economic variable of the local population and checks for associations of occupation, income, education, and Hb level, VOC, and adverse events. The subjects were 65 SCD patients (32 females and 33 males), aged between 5 and 16 years. No phenotype or genotype bias was considered and all patients

enrolled were in a steady state. The absence of a crisis or any attributable acute illness in the preceding 10 weeks was considered as a steady state. Clinical records documenting the adverse events, and VOC in the past one year were collected from the concerned hospital unit. Adverse events such as jaundice, infections, breathing problem, edema, abdominal pain, splenomegaly, or fever in the past one year were listed from the clinical records. The morbidity indices used were calorific intakes, dysfunctional eating (eating things other than food), mean steady hemoglobin level, adverse events, and VOC. Frequency of adverse events and VOC's above six in the past year were recorded and considered for the study. Patients with insufficient medical records were not included.

A detailed personal history with all relevant information was obtained either from the parents/guardians and such children, who were prudent enough to answer. The standard methods for growth assessment have been used. Height of the subject was measured to the nearest centimeter using a measurement tape fixed to the wall, after making the child stand erect barefoot against the wall and looking straight ahead (Lohman et al., 1988). Weights, and BMI were measured barefooted after appropriate deductions for clothing worn, using the Tanita scale [BC 418 MA]. Later, the height and weight measurements were compared with NCHS reference standards for age and sex (Hamill et al., 1979). A questionnaire including information on the child's medical history, family history, nutritional information, was collected from the parent. Information regarding SES of the parent was collected based on family income, and also related to education, and profession.

Family monthly income was divided into 4 categories from lowest to highest, based on the Saudi riyals earned (1 USD = 3.75 Saudi Riyals); class1 low SES - <5000 SAR; the middle income class divided further into class 2 - >5000–10,000 SAR, and class 3 - >10,000–15,000 SAR; and the higher income class 4 - >15,000 SAR. Classification of profession was based on the parent's current employment status, and sectors, such as unemployed; manual worker; professional –skilled; and others (private work, small odd jobs or private businesses).

Level of education was classified as formal education received: uneducated - no formal education; primary (<6 years of schooling); secondary (7–10 years of schooling), precollege (12 years of formal education); and bachelors & above (college/university student). Pre- college and bachelors and above, were put together as tertiary for deducing associations.

The study protocol was approved by the Ethics Committee of the King Abdulaziz University Hospital, Jeddah. Informed consent forms were collected prior to the study, from parents or guardians of the patients. As SES is very prominent in its implications on health outcomes, we attempted to portray the demographic and socioeconomic facets of SCD children and their families in Saudi Arabia and looked for associations, with disease severity and outcomes.

2.2. Data analysis

Results were analyzed with one way ANOVA using SPSS 20 software. Post Hoc tests for multiple comparisons were done using LSD. Graphs with bar errors were plotted to show variability. P values of ≤ 0.05 were considered as statistically significant. Categorical variables for demographic representation were done using the standard methods of percentages.

3. Results

The relation of socio-economic status to co-morbidity was studied in 65 pediatric patients in a steady state. A random selection was done considering no gender bias. The total sex distribution

ratio was 50.76% males to 49.2% females. Most of the patients (73.845%) were of HbSS type with fewer (26.152%) of the HbSA type. The social class and distribution pattern are given in Table 1. Most of the children with the disease (41.538%), belonged to the low socio-economic class 1, followed by 24.615% from class 2, 23.076% from class 3, and 10.769% from class 4 (Table 1).

A geographic distribution shows that 43.076% of the children were KSA nationals, while 56.924% were settlers from neighboring countries like Yemen (32.307%), Sudan (9.23%), Chad and others put together from Syria, Palestine, Jordan, and Egypt (13.846%). Local Saudis majorly were in the group 3, and 4, which is socio-economically more stable. Also, of the two sexes, females were in concentration in class 1 and 3.

Classes 1, and 2 had a small percentage of uneducated parents (7.407% and 18.75% respectively), while there were no uneducated parents from classes 3, and 4. The number of parents who undertook secondary education is almost similar in classes 1, 2, and 3

with class 4 having a higher percentage (28.571%) as seen in Table 2. When the pre- college and Bachelor's degree holders were put together in a tertiary education group, it was found that a linearity exists with an increasing trend from class 1 to class 3 (48.148%, 62.5%, and 86.66%). There was a slight decrease in the percentage of parents from the class 4 (71.428%).

When the profession (Table 3) of the parent was taken into consideration, it was found that educated parents having a stable job were majorly from class 4 as compared to other classes, while class 1 had a small percentage (7.407%) of unemployed parents. No unemployment was observed in the other classes. Parents belonging to class 1, and 2 mostly were into private work and doing odd jobs, while parents of the class 3, and 4 had their own businesses. All parents in class 4 had their own businesses and were economically stable.

Calorie consumption observed was highest in class 1 and lowest in class 4, as seen in Table 4. When looked for associations between

Table 1
Demographic characteristics of SCD pediatric patients.

Socioeconomic Class based on family income	Total no. of children N = 65	Sex		Geographical Distribution		Type of Hemoglobin	
		Male	Female	Saudi	Non Saudi	Hb SS	Hb SA
Class 1 <5,000 SAR	27	12	15	2	25	24	3
percent	41.538	44.444	55.555	7.407	92.592	88.888	11.111
Class 2 >5,000-10,000 SAR	16	10	6	7	9	9	7
percent	24.615	62.5	37.5	43.75	56.25	56.25	43.75
Class 3 > 10,000-15,000 SAR	15	6	9	14	1	10	5
percent	23.076	40.000	60.000	93.333	6.666	66.666	33.333
Class 4 > 15,000 SAR	7	5	2	5	2	5	2
percent	10.769	71.428	28.571	71.428	28.571	71.428	28.571
Total Percent	99.998						

Saudi – Residents of Jeddah originally from Saudi Arabia.

Non-Saudi – Residents of Jeddah originally from Yemen, Palestine, Jordan, Egypt, Syria.

Table 2
Demographics of parent's education of children with SCD in relation to their socioeconomic class.

Social Class	N Total 65	Uneducated	Primary 6–11yrs of age	Secondary 12–15yrs of age	Pre-College 16–18yrs of age	Bachelor's and above above 18yrs of age	Tertiary total Pre-college & above
Class 1	27	2 (7.407%)	10 (37.037%)	2 (7.407%)	11 (40.74%)	2 (7.407%)	13 (48.148%)
Class 2	16	3 (18.75%)	2 (12.5%)	1 (6.25%)	4 (25%)	6 (37.5%)	10 (62.50%)
Class 3	15	0 (0%)	1 (6.666%)	1 (6.666%)	4 (26.666%)	9 (60%)	13 (86.666%)
Class 4	7	0 (0%)	0 (0%)	2 (28.571%)	4 (57.142%)	1 (14.285%)	5 (71.428%)

Uneducated—no formal education; Primary- < 6 years of schooling; Secondary 7–10 years of schooling; Precollege. 12 years of formal education; and Bachelors & above (college/university student). Tertiary—Pre-college and Bachelors group put together.

Table 3
Demographics of parental profession with different socioeconomic class of children with SCD.

Social Class	N [65]	Profession of parent			
		Unemployed	Manual Worker	Professional Worker	Other
Class 1	27	2(7.407%)	7(25.925%)	1(3.703%)	17(62.962%)
Class 2	16	0(0%)	0(0%)	3(18.75%)	13(81.25%)
Class 3	15	0(0%)	0(0%)	3(20%)	12(80%)
Class 4	7	0(0%)	0(0%)	0(0%)	7(100%)

Other – Class 1, 2-private work, small odd jobs; class 3, and 4—owned private business.

classes, no significance was noted. Children belonging to class 4 were found to be fussy and consumed less food. A commonality observed trait was that of dysfunctional eating among a few of these children. This was observed in an increasing trend across the classes with class 1 depicting 11.11%; class 2 – 18.75%; class 3 – 20%; and class 4 – with 28.571% of dysfunctionality. As the numbers were small and unequal, further statistics were not done. These children ate things other than normal food items – like paper, sand, nails, and tissue paper.

Anthropometrical characteristics of age related weights and body mass indices of all male and female subjects were found to be lower than those of WHO/Saudi standards which was also observed in previous studies (Al Herbish et al., 2009). The study could not reveal any differences in the physical parameters of height, weight, and body mass index amongst children from different economic classes. BMI was low in all children enrolled, ranging from 14.84 ± 1.94 to 16.81 ± 3.07 across different classes, with no significant changes. Body fat percent for all socio economic classes, was in the normal range in our study, ranging from 17.79 ± 6.8 to 20.71 ± 6.71 . But no significant changes were observed between the classes in these parameters. Though not significant, the BMI of females was found to be slightly higher than males in all the

SES classes (17.15 ± 3.17 in females as compared to 16.41 ± 3.04 for class1; 15.85 ± 2.19 as compared to 14.24 ± 1.59 for class2; 14.45 ± 2.07 as compared to 13.87 ± 0.85 for class3; and 16.35 ± 1.48 as compared to 16.28 ± 3.85 for class4.

All classes exhibited low hemoglobin values, and were anemic. When checked for associations between the classes -- class one showed a significance in RBC, Hb, Hct, MCV and RDW values; Class2 showed significant associations in RBC, Hb, Hct, MCV, MCH, & RDW; Class3 showed significant associations only in RDW value; and class4 showed significant associations in RBC, MCV, MCH, & RDW as shown in Table 5.

Adverse events experienced, and frequency of VOC's observed in both genders and in different age groups, is depicted in Figs. 1A and 1B, and 2A and 2B respectively. More number of females of class 1 experienced larger number of VOC's and adverse events as compared to other classes. A higher percentage of males from classes 2 and 4 experienced increased frequency of VOC Include crisis, and also experienced more number of adverse events. Class 3 had almost the same frequency of VOC's and adverse events for both genders, as seen in Figs. 1A and 1B. The 5–10 age group from classes 1–4, exhibited a higher percentage of children experiencing crisis in a descending manner with class 1 displaying a higher frequency. This 5–10 yr age group also experienced more number of adverse events across all classes, as compared to the 11–16 yr age group (Figs. 2A and 2B).

Table 4
Calorie consumption in children with SCD from different socioeconomic classes.

Social class	N = 65	Calorie intake Mean \pm SD	P value Between. groups
Class 1(C1)	27	1265.822 \pm 419.912	C2–0.733 NS C3–0.319 NS C4–0.176 NS
Class 2(C2)	16	1230.292 \pm 236.344	C1–0.733 NS C3–0.553 NS C4–0.307 NS
Class 3(C3)	15	1159.427 \pm 211.648	C1–0.319 NS C2–0.553 NS C4–0.591 NS
Class 4(C4)	7	1079.529 \pm 156.941	C1–0.176 NS C2–0.307 NS C3–0.591 NS

4. Discussion

Increased prevalence of SCD remains a major health issue in the eastern, western, and in the southern, areas of KSA. Therefore, parameters other than genetics should be considered whilst studying the complications in SCD patients. Socioeconomic parameters are of dire importance to bring about a positive change in the attitudes of people and helps government adopt policies for better health of its citizens. In our study, most of the enrolled children with SCD, were from the low socio economic class 1, as has been observed in earlier studies too (Animasahun et al., 2011; Barden et al., 2002; Esezobor et al., 2016; Lukusa Kazadi et al., 2017). Eth-

Table 5
Complete blood count of children with SCD from different socio-economic classes.

Parameter/class	Class1 (C1)	Class2 (C2)	Class3 (C3)	Class4 (C4)
n	24	14	12	7
RBC($\times 10^{12}/L$)	2.615 \pm 0.489	3.136 \pm 0.721	2.852 \pm 0.523	2.451 \pm 0.480
P value	*C2–0.008	C1–0.008 C4–0.011	NS	*C2–0.011
Hb(mg/dl)	7.254 \pm 0.790	7.892 \pm 0.961	7.550 \pm 0.721	7.328 \pm 0.975
P value	*C2–0.029	*C1–0.029	NS	NS
Hct (%)	22.020 \pm 1.794	24.071 \pm 2.728	23.316 \pm 2.280	22.657 \pm 3.304
P value	C2–0.012	C1–0.012	NS	NS
MCV (fl)	81.775 \pm 9.821	78.471 \pm 11.943	83.775 \pm 9.808	92.957 \pm 8.837
P value	*C4–0.014	*C4–0.004	NS	*C1–0.014 *C2–0.004
MCH(pg)	27.207 \pm 3.593	25.907 \pm 4.942	26.925 \pm 3.335	30.228 \pm 3.126
P value	NS	C4–0.019	NS	*C4–0.019
MCHC (%)	32.854 \pm 1.792	32.728 \pm 2.147	32.083 \pm 1.259	32.571 \pm 0.822
P value	NS	NS	NS	NS
RDW (%)	21.847 \pm 4.21	18.824 \pm 3.078	18.833 \pm 1.925	17.785 \pm 1.803
P value	*C2–0.011 *C3–0.014 *C4–0.007	*C2–0.011	*C1–0.014	*C1–0.007
Platelet-($\times 10^9/l$)	388.565 \pm 177.397	474.750 \pm 147.375	391.727 \pm 151.592	406.428 \pm 131.214
P value	NS	NS	NS	NS
WBC ($\times 10^9/L$)	11.667 \pm 3.145	12.026 \pm 4.216	12.452 \pm 3.996	12.885 \pm 4.895
P value	NS	NS	NS	NS

RBC - red blood cell; Hb - hemoglobin; Hct-hematocrit; MCV-mean corpuscular volume; MCH- mean corpuscular hemoglobin; platelet count; MCHC-mean corpuscular hemoglobin concentration; WBC -white blood cells.

* Only the parameters showing significance between classes, have been mentioned. P values of ≤ 0.05 were considered significant.

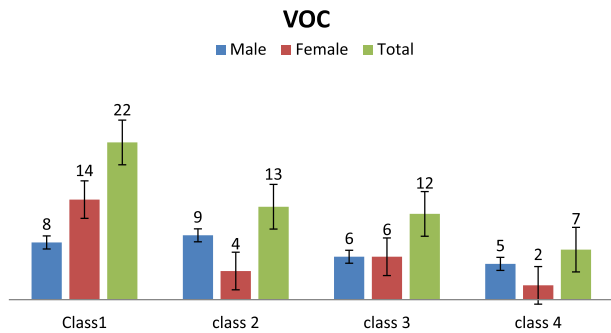


Fig. 1A. Gender wise differentiation in frequency of vaso occlusive crisis in the different socioeconomic classes of children with SCD.

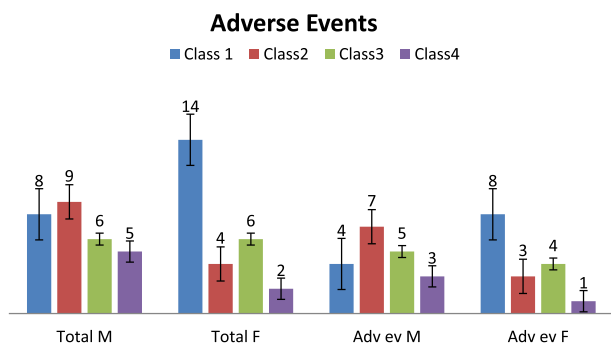


Fig. 1B. Gender wise differentiation in number of adverse events in the different socioeconomic classes of children with SCD.

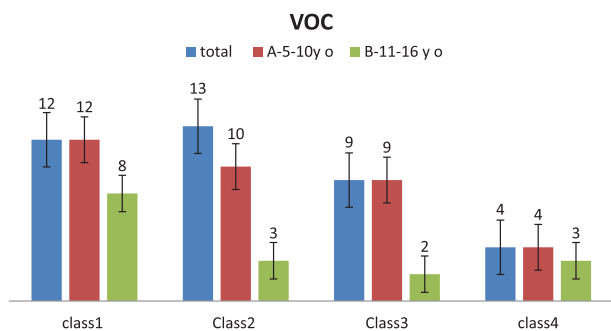


Fig. 2A. Age wise differentiation in frequency of vaso occlusive crisis in the different socioeconomic classes of children with SCD.

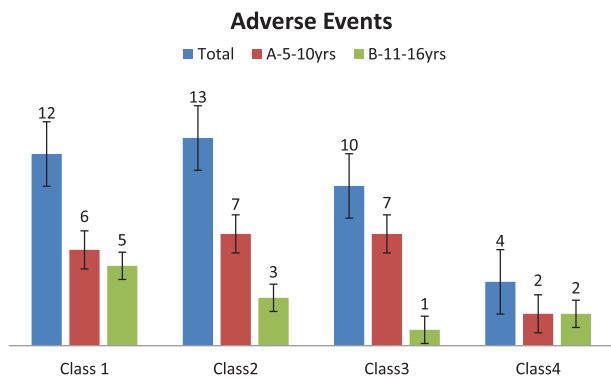


Fig. 2B. Age wise differentiation in number of adverse events in the different socioeconomic classes of children with SCD.

nicity also seemed to affect the frequency and severity of the disease, within the same socio-economic class. Saudis fared slightly better than those from other countries as seen in Table 1. Children of parents originally from Yemen, Egypt and other neighboring countries, fared poorly in terms of physical health, and associated medical complications. As most of the patients were of the HbSS type, we have not further segregated patients into HbSS & HbSA groups for finer understanding of each parameter. Moreover fewer numbers did not allow for the same.

Saudi nationals were found to be more educated than their fellow counterparts from other countries as seen in Table 2. Parents of patients from socio economic class 3 and 4 who were majorly Saudis had either a pre-college or a Bachelor's degree or above and also had private businesses with better incomes. Parents of patients from other countries were less educated and also their employment levels were low with lower incomes (Table 3). Our results show that children with SCD mostly belonged to families from class 1, whose parents had low educational levels and incomes, as compared to parents of other socioeconomic classes. This is in accordance to earlier research in the US (Farber et al., 1985). As adults, a lack of employment and low income in the SCD affected population is seen, suggesting that resources are needed to make health care more accessible and affordable to these patients (Matthie et al., 2015). This socio demographic information would help the health professional while counseling for pre-marital screening programs, to put forth these considerations, to the concerned governmental authorities.

Our study revealed a poor nutrition in all the SCD children irrespective of their SES, when calorie intake was considered. The cheap affordability of food for subsistence being easily available in KSA, defies disparity of intake of basic nutrition due to varying SES (Table 4). This is a unique feature not observed in other countries. Class 1 children eat everything available to them due to the low spending ability of the parent. Classes 2 & 3 are the conscious middle-income groups. These two classes struggle to keep abreast with whatever nutritious food could be available and affordable to them. The 4th class has a paying capacity for healthy foods, but the ample choices available to them make them fussy and choosy. They apparently seem to consume junk food most of the times. Few children from all classes exhibited dysfunctional eating. But surprisingly it was found to increase with increasing SES, which warrants a further study into the mental health of these patients' too. Obesity and overweight were not commonly observed in the SC patients of our cohort. Lowered growth parameters like wasting and in many cases stunting too were the common features noticed. A strong association of these parameters was observed with SES, especially in males and in children of the older age group, by earlier researchers (Esezobor et al., 2016). The BMI of all children in our study, was lower when compared with healthy children according to WHO /Saudi standards. Earlier researches too witnessed similar results in the growth parameters of different socioeconomic classes (Animasahun et al., 2011; Janes, 1974; Osinusi and Adeleye, 1989). Body fat percent for all socio economic classes, was in the normal range in our study, when compared with past studies (Odetunde et al., 2016). Also, it was observed that the BMI of females was slightly higher than males in all the SES classes, though not significant. This could probably be due to their decreased activity which has also been reported earlier by Dapi et al in 2009. Females in the Saudi society are majorly indoors after school hours, unlike boys who play. This could only be generalized though larger sample sizes.

Classes 1, 2, and 4, show significance in RBC values between the classes as shown in Table 5. Protein deficiency is a reflection of Hb values. Patients from all classes had low Hb levels. Classes 1, and 2,

show significance in Hb and HCT values, between the two classes. MCV depicts the average size of the red blood cells. Lower MCV values represent increased anemic condition. Significantly higher MCV values were observed in class 4, as compared between classes 1, and 2. Also, when enough Hb is not available to the cells, there is a lack of oxygen availability, leading to fatigue and represented by lowered MCH values. In our study, MCH values are highest in class 4 and significant between this class and class 2 as seen in Table 5, though other classes do not show significance. MCHC values depicting lowered Hb concentration is found comparable in patients from all classes without any significant associations. This seems obvious as all represent an anemic condition. Red blood cell distribution width (RDW) is significantly higher in class 1 as compared between all other classes 2, 3, and 4. A higher RDW value is observed in macrocytic anemia when the body is unable to produce enough RBC's that are normal and the size of these RBC, s produced are larger. This is also indicative of nutrient deficiency of vitamins folate and B12 or iron. Folates are generally prescribed to SCD children, but the inability of class1 patients to receive enough of these due to either poor adherence to therapy or decreased visits to the clinic, may be the underlying cause. Though not significant, the platelet count was lowest in group1 when compared to the other three classes. WBC was found to be lowest in the lower income class 1, as compared to other classes, though no significance could be drawn. Possibly class 1 children develop immunity owing to their eating whatever whenever available, with no restrictions. Lower immunity levels are observed in the higher income classes 3 and 4, wherein foods catering to the child's taste are mostly consumed. Studies with larger numbers would have immense potential, addressing these issues to show the differences within each class.

An observational study in England found that, deprivation due to SES increases the risk of re-admissions and mortality in these SCD children (Aljuburi et al., 2013). A greater number of children from class1 experienced VOC's and adverse events, with females showing a higher frequency (Fig. 1A&1B). In other classes mostly males experienced greater number of adverse events and VOC's. Males being more vocal and attended to, seem to express their grievance more than females. Also it was generally observed in our study that the pain threshold appears low in males as compared to females. Age wise segregation showed that older children (11–16 years) exhibited fewer adverse events and VOC when compared with the lower age group of 5–10 years (Figs. 2A and 2B) probably due to better tolerance and management of the disease as age advances. Also, the ability to bear the VOC pain and other minor complications increases in older children due to their past experience. Therefore, entry in medical records does not exist, though the patient may have had some problem. This is in agreement with previous studies (Ellison and Bauchner, 2007).

Our study shows that poor SES does have an adverse effect on the overall growth parameters of SCD children which warrants a provision of appropriate health and basic amenities available to these underprivileged children. This would contribute to the development of strategies for management and control of clinical complications of the disease by imposing certain governmental programs of support for such underprivileged and deprived children.

Awareness is more prevalent in the higher socioeconomic class, leading to better practices and fewer consanguineous marriages. This is reflected in the lesser incidence of SCD in this class. An awareness drive is therefore necessary in Saudi Arabia on a continual basis, for reducing the frequency of this disease as well as its outcomes. Focus should therefore be on improving their health not only by way of marriage counseling, but also family counseling, and rehabilitation counseling. Effective counseling for self-care at home would also be contributory to the effective management of

painful crisis. Access to clinics by way of distance and utilization of services was another cause of distress to many belonging to the low SES. This led to poorer healthcare services rendered, especially in the rural areas which have also been observed earlier (Haque and Telfair, 2000). The SES factor also appears to directly affect the right to proper health care and treatment. Moreover, adherence to continue the follow-up visits is also compromised due to low incomes, if the distances of travel are especially long. The dependency of children with chronic disease is aggravated in such a situation. This is in agreement with earlier work (Jesus et al., 2018). In Saudi Arabia, social norms require the father or a male family member to accompany the mother and the sickle cell patient to the clinic. Though societal change has begun contradicting this tradition, it would take a few years to be accepted by the common man. The higher social class does not face this issue. Attendance to clinics by the patients of lower classes is low, and they also exhibit a poor adherence to therapy. A demand therefore exists, for a multifaceted approach integrating the concerned governmental and societal authorities, to work towards better health for SCD children belonging to all status in the society (Kien et al., 2016).

Our data provides important information regarding the socioeconomic and demographic indices in SCD children in KSA. This gives us an idea for areas of improvement and focus. Public policies therefore need to be improved and put in place integrating this subset of the society as has been put forth by earlier researchers too (Fernandes et al., 2015).

Limitations – Larger sample sizes would help in corroborating the noted effects. Segregation of patients according to their genotypes for finer understanding of each parameter needs to be done. Fewer numbers did not allow for the same in the present study. Details of the treatment like, use of hydroxyurea, adherence to the treatment being given, vaccination records were not taken into consideration in our present study. Despite HU being used successfully as a therapy, SCD patients belonging to the low SES do have certain unmet needs in terms of adhering to medication, due to high treatment costs, and social inhibition where mostly the father has to take the child to a doctor. These social factors were not considered in our study. Also counselling details and school absences due to pain episodes were not considered. One of the major limitations was our reliance on self-reports for income and other demographic details, and few past illnesses. WBC values do suggest inflammation but other inflammatory markers like erythrocyte sedimentation rate, C-reactive protein and, transferrin were not considered.

5. Conclusions

As the majority of SCD children have a vulnerable socioeconomic condition, leading to a deterioration of their overall health, they deserve special attention from the psychosocial as well as medical perspectives. Increase in awareness is necessary to contain and reduce the prevalence of SCD in the lower classes. Social awareness programs for better health to these patients and removal of stigma attached should be considered. Formation and implementation of public policies providing these children with better access to health care systems, and governmental funds for their wellbeing, would go a far way in improving their condition (Raphael, 2020). The primary prevention of complications, by self-care interventions, and enhancing social support programs, like family counseling which are culturally appropriate, should be encouraged and implemented in the kingdom. Responsive parenting would go a far way in improving the physical and mental health of children with SCD. Future research exploring this facet and baseline data with a larger population would benefit the sickle cell children in KSA.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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