Sana'a University Journal of Medical and Health Sciences

Evaluation the Oral Health Status for children with Acute Lymphoblastic Leukemia receiving Chemotherapy in Sana'a City, Yemen

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Abstract

Background and aims: Leukemia, a common childhood cancer, is caused by abnormal lymphoid cell changes, affecting bone marrow, blood, and organs. Chemotherapy is the most effective treatment, but oral complications, such as carious lesions, gingivitis, and gum inflammation, can occur due to oncologic therapy.

Objective: Aims of this study was to evaluate the oral health condition of children with acute lymphoblastic leukemia receiving chemotherapy.

Methods: A total of 95 children of both sexes who were newly diagnosed with acute lymphoblastic leukemia and already undergoing different phases of intensive chemotherapy were selected for the study. This study was conducted in the leukemic center of Al-Kuwait Hospital in Sana'a City, Yemen. The gingival status of the oral cavity was examined using the modified gingival index (MGI) to avoid induced bleeding, and probes were not used for gingival examination. The diagnosis of carious lesions was based on the criteria established by the World Health Organization. Mucositis (using the WHO oral toxicity scale) and saliva collection was done in calibrated cylinder and flow rate was measured using standard formula.

Results: The study involved a total of 95 children aged 4-14 years, with a mean age of 8.2 ± 3.4 years. The prevalence of gingival inflammation was highest in the mild inflammation group (46.3%). Oral hygiene status was rated as good (62.2%), moderate (36.8%), or poor (1.1%). Oral mucositis was highest in severe (45.3%) and moderate (31.6%) groups.

Conclusion: Children with acute lymphoblastic leukemia undergoing chemotherapy face increased oral health complications like mucositis, gingival inflammation, opportunistic infections, and dental caries. Early dental assessment, regular monitoring, and tailored care strategies are crucial for effective dental management.

Article Info

Keywords:
Acute Lymphoblastic Leukemia, Chemotherapy, Children, Oral Health Status, Sana'a City, Yemen

Article History:
Received: 21-June-2025,
Revised: 6-July-2025,
Accepted: 9-August-2025,
Available online: 31 August 2025.

INTRODUCTION

Cancer is a deadly, chronic illness that affects both adults and children worldwide. Approximately 80% of cases occur in underdeveloped nations, and the frequency among youngsters is approximately 4%. Increasing survival rates require better treatment strategies, particularly in underdeveloped nations where the majority of cases are recorded [1]. High rates and links with a high incidence of viral infections have been found in Yemen in recent research [2, 3, 4, 5, 6, 7, 8]. Additionally, 90,000 children and adolescents are thought to have lost their lives annually [9]. One of the most prevalent forms of juvenile cancer and leukemia is acute lymphoblastic leukemia (ALL), which accounts for over 75% of newly diagnosed leukemia [10], 26% of cancer cases [11], and 55.82% of leukemia cases among children aged 0–14 years.

During physical examination, people with leukemia may exhibit petechiae, hematomas, ecchymosis, and bleeding in several body areas, including the mouth, because the illness is systemic and affects blood components [12, 13, 14].

Surgery, chemotherapy, and radiation therapy are used to treat childhood cancers, and chemotherapy is most frequently used because of its efficacy. Systemic malignancies that cannot be treated with radiation or surgery are treated with CT, a multi-agent therapy. Remission induction, consolidation, reinduction, and continuation comprise of four stages. Risk categorization determines the administration of steroids such as vincristine, L-asparaginase, cytarabine, methotrexate, and 6-mercaptopurine [15, 16, 17]. The Emidio et al. method, which divides oral symptoms into three categories—primary, secondary, and tertiary—is the most widely used categorization scheme for oral problems in children with hematologic malignancies. Malignant cell infiltration caused by illness causes primary problems, chemotherapy causes secondary difficulties, and side effects and drug interactions cause tertiary complications [17, 18]. The therapies employed have their own drawbacks and increase the risk of a number of ailments in young patients. Oral complications (OCs) are common side effects of cancer treatment in children. These children are more likely to have xerostomia, carious lesions, gingivitis, oral cavity tumors, jawbone abnormalities, temporomandibular joint problems, trismus, and infection [19]. Additionally, OCs cause dry mouth, gum irritation and bleeding, opportunistic infections, and oral mucositis. Oral mucositis (OM) is the most frequent side effect of CT, affecting 52–80% of young and 75% of high-risk individuals [20]. Hospitalization may be necessary because of mild-to-severe symptoms of mucositis. These symptoms, which can affect every part of a child's life, include discomfort, erythema, edema, ulceration, bleeding, dry mouth, burning feeling, and trouble speaking and swallowing [21].

After receiving large doses of methotrexate, a condition known as mucositis (OM) disrupts the oral mucosa and causes inflammatory sores and erythema. It normally disappears within 21 days and occurs a week after intravenous CT treatment. OM may worsen the disease, result in lower chemotherapy dosages or treatment cessation, and cause problems with chewing, swallowing, tasting food, and foul breath [22]. Therefore, chemotherapy efficiency deteriorates, interfering with the remission phase and decreasing recovery and child survival. raising the price and eventually lowering the children's quality of life. Thus, early diagnosis of OM is critical to schedule dental care and initiate the right therapy [23]. Pediatric dentists are essential in treating life-threatening conditions that may affect everyday activities such as gum, teeth, and oral mucositis. The degree of side effects may vary depending on several factors, including age, self-care abilities, dental cavities, poor oral hygiene, and nutritional conditions. It is crucial to follow preventive dental-care guidelines [24]. Therefore, this study aimed to evaluate the oral health of children with ALL receiving chemotherapy.

METHODOLOGY

Study design: The study was a cross-sectional design to assess the oral health status and management of Yemeni children with acute lymphoblastic leukemia (ALL) undergoing treatment.

Study area: This study was carried out in the leukemic center at Al-Kuwait Hospital in Sana'a city, Yemen.

Study population and Sample size: Study population included patients which had been referred to the leukemic center at Al-Kuwait Hospital in Sana'a city for treatment from April to September 2024.

Inclusion criteria: Yemeni children residing in Sana'a city, aged 4-14 years, encompassing both sexes, diagnosed with acute lymphoblastic leukemia currently, receiving chemotherapy treatment and free of other systemic disease.

Sample size: A total of 95 children of both sexes who were newly diagnosed with acute lymphoblastic leukemia and already undergoing different phases of intensive chemotherapy were selected for the study.

Data Collection: Data was obtained from administered questionnaires completed by patients, parents or guardians and intraoral examinations.

Clinical examination: The parents or guardians of the young patients gave their informed agreement

so that their children may get dental examinations. Demographic information (age, sex, age at diagnosis, parents' education, occupation, and socioeconomic status) and illness information (symptoms, treatment phase, medications used, and blood test results) were included prior to the clinical examination. Every patient received treatment in accordance with the institutional clinical practice guidelines for pediatric leukemia, which were modified from the COG protocol.

Mouth mirrors, dental probes, tweezers, cotton, artificial light, and sterile gloves were used for the dental examinations. The modified gingival index-visual index (MGI) was used to assess gingival health in the oral cavity; probes were not required to prevent bleeding. Oral hygiene was assessed using the simplified Oral Hygiene Index (OHI-S). It includes the simplified calculus index (CI-S) and simplified debris index (DI-S). The buccal surface of the primary maxillary right second molar and the primary maxillary left second molar, the lingual surface of the primary mandibular left second molar, the primary mandibular right second molar, and the plaque/calculus of the labial surface of the primary maxillary right central incisor and the primary mandibular left central incisor were inspected for primary teeth. The primary first molar was used to replace the inspected teeth if the main second molar had not yet erupted. For permanent teeth, the buccal surface of the permanent maxillary right first molar and permanent maxillary left first molar, lingual surface of the permanent mandibular right first molar, permanent mandibular left first molar, and labial surface of the permanent maxillary right central incisor and permanent mandibular left central incisor were examined for plaque/calculus. The plaque/calculus region of the tooth surface was used to record scores. No plaque or calculus, plaque or calculus area < 1/3, plaque or calculus area < 2/3, and plaque or calculus area > 2/3 were scored as 0, 1, 2, and 3, respectively. Only teeth that had erupted completely were scored. Natural teeth with full crown restorations and surfaces reduced in height owing to caries or trauma were not scored. DI/CI = number of surfaces examined/total score. The calculation of OHI-S = DI-S + CI-S [25].

Carious lesions have been diagnosed based on the World Health Organization criteria [26]. The number of tooth surfaces that were decayed (d/D), number of teeth that were missing because of caries (m/M), and number of surfaces filled after decay (f/F) were among them. The caries parameter was recorded as Decayed Missing Filled Teeth (DMFT) for the permanent teeth and decayed missing filled teeth (DMFT) for the primary teeth. According to the World Health Organization (WHO) oral toxicity scale, the severity of mucositis is rated from 0 to 4. Although grade 0 denotes the absence of mucositis, grades 1 through 4 are mild, moderate, severe, and life-threatening, respectively, [26].

Saliva was collected in a calibrated cylinder, and the flow rate was measured using a standard formula. Prior to saliva sample collection, all individuals were told to abstain from food and liquids for at least two hours. Prior to therapy, the patient was instructed to passively drive into a funnel that was placed in a graded cylinder for five minutes between 9 am and 12 pm. This was performed by letting the patient sit in a coachman posture. The unstimulated salivary flow rate was calculated by dividing the volume of saliva collected in the cylinder after five minutes by five. The pH of the paper was used to assess salivary pH. The color shift of the pH paper was consistent with the norm.

Data analysis: Descriptive statistics, such as frequency, mean, and standard deviation, were used to report the data. Excel 2010 and Statistical Package for Social Science (SPSS) version 24 were used for all statistical analyses. It involves recording and entering the data into SPSS for analysis once it is collected.

Ethical approval: The Medical Ethics Committee of Sana'a University's Faculty of Dentistry provided ethical approval. A thorough explanation of the study was provided to each participant and/or family member, and their consent was obtained.

Budget: All Costs including instruments of clinical examination, some of equipment is in data collection and data processing were self-funding.

RESULTS

Of the 95 patients in the population sample, 38 (40%) were female and 57 (60%) were male. The patients' ages varied from 4 to 15 years, with an average age of 8.2±3.4. Patients with ALL were treated for a mean of 15 months (range 2–86 months). According to the chemotherapeutic regimen for all risk categories (Pediatric Nordic Society of Pediatric Hematology and Oncology 1992-2000 ALL regimen), 9 children received treatment. This included ongoing care that was divided into three stages: vincristine, doxorubicin, prednisone, L-asparaginase, and methotrexate, which were used to induce remission (weeks 0–7). High dosages of methotrexate, dexamethasone, arabinoside of cytosine, cytotarabine, and cyclophosphamide were used during the consolidation-intensification phase (weeks 7–14), whereas the maintenance phase (weeks 14– 3) involved either methotrexate, 6-Mercaptopurine, cyclophosphamide, cytotarabine, or a combination of treatments: prednisone, vincristine, and arabinoside of cytosine. Anemia (23.2%), bleeding (10.5%), petechiae (10.5%), bruising (15.8%), weariness (6.3%), lymphadenopathy (15.8%), splenomegaly

(21.1%), and fever (75.7%) were among the findings.

We also assessed the potential impact of several risk variables on the emergence of oral symptoms in this patient population. Table 5 lists the standard and high risk of leukemia as a risk factor for the emergence of oral symptoms; the standard-risk ALL patients had a 98.1% chance of developing oral symptoms. When the gums were examined, children in different phases of therapy showed substantial variation in the gingival index. The majority of patients had gingivitis, with mild partial gingivitis accounting for 46.3% of cases, light complete gingivitis for 31.6%, moderate gingivitis for 14.7%, and severe gingivitis for 6.3% (Table 5). Only one patient (1.1%) had healthy gums.

Considering plaque index for our patients 73.7% of them were in grade 0.7-1.8, followed by 16% in grade 0-0.6, while 10.5% of our patients were had 1.9-3 grade (plaque is enlarged in the cervical third of the crown) (Table 6). Overall, oral hygiene status (OHI-S) was recorded as good (score range 0.0–1.2) in 59 children (62.2%), fair (score range 1.3–3.0) in 35 children (36.8%), and poor (score range 3.1–6.0) in one child (1.1%) (Table 7). Mucositis was recorded in 76.8% of all pediatric patients, with 31.6% having moderate mucositis, 45.3% having severe mucositis, and no cases of mild mucositis or severe life-threatening mucositis were recorded (Table 7). Overall, permanent DMFT scores of 1.0–2.0 were recorded in 15 of 22 children (68.2%), 3–4.0 in 5 of 22 children (22.7%), and scores above 4.0 in 2 children (9.1%) (Table 8). Overall, falling DMFT scores of 1.0–3.0 were recorded in 49 children (47.2%), 4–6 in 23 children (24.2%), and scores above 7.0 in 23 children (24.2%) (Table 8).

The unstimulated salivary flow rate of our patients is presented in Table 9, where 29.5% of patients had less than 0.5 ml/5 min, 64.2% had 0.5-2 ml/5 min while only 6.3% had a normal rate (>2.0 ml/5 min). Saliva pH is normally slightly acidic to neutral, typically ranging from 6.7 to 7.3, and in our patients, the saliva pH was between 6.2-6.8 indicating a slightly acidic normal rate.

DISCUSSION

In Sana'a, Yemen, this study assessed oral symptoms in children undergoing chemotherapy for ALL and discovered that these manifestations were common. Regarding the most prevalent oral symptoms, children in various treatment phases showed considerable variation in the gingival index. All patients (98.9%) had gingivitis, with only one patient (1.1%) having healthy gums; light partial gingivitis affected 46.3% of patients, followed by light complete gingivitis (31.6%), moderate gingivitis (14.7%), and severe gingivitis (6.3%) (Table 5). These findings are comparable to those reported by El-Housseiny [27] and Lopez [28].

In the current study, overall, oral hygiene status (OHI-S) was recorded as good (score range 0.0–1.2) in 59 children (62.2%), fair (score range 1.3–3.0) in 35 children (36.8%), and poor (score range 3.1–6.0) in one child (1.1%) (Table 7). Mucositis was recorded in 76.8% of all pediatric patients, with 31.6% having moderate mucositis, 45.3% having severe mucositis, and no cases of mild mucositis or severe life-threatening mucositis were recorded (Table 7). Poor oral hygiene is a common cause of gingivitis and other oral disorders in children with ALL. This may exacerbate pre-existing problems and the impact of the disease and medications on the immune system of children. Depending on the type of leukemia, treatment phase, degree of oral hygiene, and high risk of ALL, this is comparable to what has been reported in the literature. The administration of certain medications concurrently with chemotherapy, such as methotrexate and prednisone, should be included as risk factors because they may affect the appearance of oral lesions. For example, gingivitis developed in our study population within 3–7 d of administration, which is comparable to that previously reported [29, 30]. There was no correlation between the occurrence of oral symptoms and the use of additional medications to treat opportunistic infections during the three stages of chemotherapy. The lack of signs of inflammation is another underlying issue that often arises, leading to an initial diagnosis of a more complex infection. Young patients receiving chemotherapy may be at risk in such circumstances, as the weakened immune system might lead to the development of potentially fatal hemorrhagic and septicemic infections, as previously reported by Alberth *et al.* [31].

According to the plaque index for our patients in the current study, 73.7% of them had plaques in grades 0.7–1.8, 16% in grades 0-0.6, and 10.5% in grades 1.9–3 (plaque increased in the cervical third of the crown). Nine patients experienced calculus index, with 77.8% falling into the 0–0.6 range, 11.1% falling into the 0.7–1.8 scale, and 1 patient (11.1%) falling into the 0f 1.9–3 scale. These findings are comparable to those of Lopez [27], El-Housseiny [28], and Alberth et al. [31], who found that children with ALL have significantly higher calculus and plaque indices.

Overall, 15 out of 22 children (68.2%) in the current study had permanent DMFT values between 1.0 and 2.0, five out of 22 children (22.7%) had scores between 3 and 4.0, and two out of 22 children (9.1%) had scores above 4.0. Additionally, altogether, 49 children (47.2%) had declining DMFT scores of 1.0–3.0, 23 children (24.2%) had scores between 4 and 6, and 23 children (24.2%) had scores above 7.0 (Table 8). These findings are comparable to those of Ponce-Torres et al., who found that these oral health indicators were negatively correlated with both declining and increasing permanent DMFT scores [32].

Table 9 shows our patients' unstimulated salivary flow rates: 29.5% had less than 0.5 ml/5 min, 64.2% had 0.5-

2 ml/5 min, and only 6.3% had a normal rate (>2.0 ml/5 min). These findings, which are comparable to those published by An et al. [33], show that the majority of our patients had xerostomia or reduced salivary flow rate. Children with leukemia frequently develop xerostomia or dry mouth as a result of both the illness and its treatment. Chemotherapy and radiation therapy, which are commonly used to treat leukemia, can either directly harm or interfere with salivary gland function, resulting in dry mouth and reduced saliva production [33].

It has been shown that a preventative dental and oral care regimen, when combined with chemotherapy, lowers the risk of mouth problems. Therefore, it is crucial to have a pediatric dentist present during the early stages of the condition when it is at its worst. Dento-periodontal changes of the oral cavity are caused by the disease process, and the treatment can only be clinically diagnosed by careful observation [34]. Every stage of therapy must consider the patient's health and the family's availability, which is usually beneficial. Parents are often open to information and encouragement on how illness impacts their child's health. Finally, because the disease symptoms and chemotherapeutic medications can cause serious oral issues during the early phase of therapy, multidisciplinary care, including pediatric dentistry, is crucial for children with ALL. Ideally, all dental work should be completed prior to starting cancer treatment [34]. If this is not possible, therapy can wait until the patient's hematological condition stabilizes, and interim restorations can be placed. Infection, extraction, periodontal care, and tissue irritation should be prioritized [35]. During immunosuppression, only conservative, urgent dental treatment should be administered, and only after discussing platelet and antibiotic therapy with the medical staff.

Monitoring the oral cavity enables prompt identification and treatment of bacterial, viral, and fungal infections; efforts are focused on minimizing the impact of secondary causes of mucositis to control oral problems associated with chemotherapy. Treatment for oral bleeding should include systemic interventions, such as platelet transfusions, as well as local interventions, such as pressure packs. Fluoride gels and rinses are strongly recommended to prevent dental cavities [36, 37]. According to the American Academy of Pediatric Dentistry, early and drastic dental interventions, including strict oral hygiene practices, lower the risk of oral and related systemic complications because pediatric dentists are crucial in diagnosing, preventing, stabilizing, and treating oral and dental issues that can impair a child's quality of life before, during, and after chemotherapy [34].

Modern guidelines for treating juvenile cancer patients in dentistry settings were incorporated into this study. In addition to educating patients and caregivers about the significance of optimal care to minimize oral problems during and after treatment, we identified and stabilized or eliminated any potential sources of infection, local irritants, and irregular surfaces that might complicate cancer therapy before it started.

A preventative procedure that considers a review of medical history was included: details on the underlying illness, the diagnostic date, the patient's post-diagnosis therapy options, and any problems; dental history review, which contains details on dental care throughout immunosuppressive periods, trauma and preventative measures, treatment symptomatology and prior dental treatments, oral hygiene, habits, and food. Maintaining good oral health throughout cancer treatment is the aim of managing any adverse effects that may arise from the treatment, including xerostomia, mucositis, oral mucosal infection, oral bleeding, and tooth sensitivity discomfort.

Fungal, viral, and bacterial infections can be promptly diagnosed and treated by closely monitoring the oral cavity. Symptoms can be palliated, secondary factors can be lessened, and patients and caregivers can be educated about the significance of receiving the best possible care to minimize oral issues and discomfort during treatment[33, 38, 39]. In addition to establishing particular treatment procedures for each phase of chemotherapy based on the type of leukemia, treatment phase, and disease risk, more research is required to ascertain the prospective impact of the risk variables discussed here.

CONCLUSIONS

Children with acute lymphoblastic leukemia undergoing chemotherapy have a significantly increased risk of oral health complications owing to both the disease and its treatment. The evaluation highlights a high prevalence of oral manifestations such as mucositis, gingival inflammation, opportunistic infections, and dental caries. These issues not only impact the quality of life, but can also complicate systemic treatment and increase the risk of infections. Early dental assessment, regular monitoring, and tailored preventive and therapeutic oral care strategies are essential for the effective management of these complications.

ACKNOWLEDGMENTS

The authors would like to thank the National Oncology Center in Al-Kuwait Hospital in Sana'a city for kind cooperation.

A DISPUTE OF INTEREST

The authors declare no conflict of interest regarding this project.

AUTHOR'S CONTRIBUTIONS

Dr. Ebtehal Abdulmalik Sharf Al-Wajeeh: formal analysis, conceptualization, and data organization to obtain a clinical degree of MSc in Dental Sciences. Hassan Abdulwahab Al-Shamahy, Taghreed Ahmed Al-kibsi and Abdulrahman M Alhadi supervised the work, reviewed the article and approved the final version.

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RESULTS

Table 1. Sex and age distribution of 95 ALL children patients tested for oral health in oncology center in Sana'a city.

Characters	Number	Percentage
Sex		
Male	57	60
Female	38	40
Age in Years		
Less than 6 years	30	31.6
6 - 10 years	36	37.9
11 – 14 years	29	30.5
Mean	8.2 years	
SD	3.4 years	
Mode	4 years	
Min to Max	4-15 years	

Table 2. Initial clinical symptoms of 95 pediatric patients examined for oral health at the Oncology Center in Sana'a City

Symptoms	Number	Percentage
Fever	72	75.8
Joints and bone pain	56	58.9
Anemia	22	23.2
Bleeding	10	10.5
Petechiae	10	10.5
Bruising	15	15.8
Fatigue	6	6.3
Lymphadenopathy	15	15.8
Splenomegaly	20	21.1

Table 3. Stage of the treatment for 95 pediatric patients examined for oral health at the Oncology Center in Sana'a City

Characters	Number	Percentage
Introduction phase	25	26.3
Consolidation phase	18	18.9
Maintenance phase	52	54.8

Table 4. Oral hygiene status of 95 pediatric patients examined for oral health at the Oncology Center in Sana'a City

Practices	Number	Percentage
Regular Dentist visit		
Regular	1	1.1
When needed	16	16.8
Never	78	82.1
Care of cleaning teeth	62	65.3
Time of cleaning teeth		
Once a day	21/62	33.9
Twice a day	22/62	35.5
More than twice a day	9/62	14.5
Rare	10	16.1
Brush with tooth paste	62	65.3
Water only	52	54.7
Misswak	0	0.0

Table 5. Oral examination for 95 ALL pediatric patients examined for modified gingival index (visual index) at the Oncology Center in Sana'a City

Gingivitis	**No**	**%**
Healthy	1	1.1
Mild inflammation (partial)	44	46.3
Mild inflammation (entire)	30	31.6
Moderate inflammation	14	14.7
Sever inflammation	6	6.3
Mean of gingivitis by MGI	1.8	
SD	0.93	

Table 6. Plaque index and Calculus index for 95 ALL pediatric patients examined for modified gingival index (visual index) at the Oncology Center in Sana'a City

Plaque index	**No**	**%**
0- 0.6	15	16
0.7-1.8	70	73.7
1.9 – 3.0	10	10.5
Mean	1.1	
SD	0.54	
Median	1.0	
Mode	1.0	
Min to Max	0.2-3	
Calculus index		
0- 0.6	7	77.8
0.7-1.8	1	11.1
1.9 – 3.0	1	11.1
Mean	0.55	
SD	0.59	
Median	0.3	
Mode	0.2	
Min to Max	0.2-2	

Table 7. Oral hygiene status (OHI-S) index and Mucositis for 95 ALL pediatric patients at the Oncology Center in Sana'a City

Oral hygiene status (OHI-S) index	**No**	**%**
0.0 – 1.2	59	62.2
1.3 -3.0	35	36.8
3.1-6.0	1	1.1
Mean	1.17	
SD	0.68	
Median	1.0	
Mode	1.0	
Min to Max	0.2 -5	
Mucositis		
0-None	22	23.2
1-Mild	0.0	0.0
2-Modrate	30	31.6
3-Sever	43	45.3
4-Sver life threatening	0	0.0
Mean	1.98	
SD	1.18	
Median	2.0	
Mode	3.0	
Min to Max	0.0 - 3	

OHI-S scores may be interpreted as; good (0–1.2), fair (1.3–3.0) and poor (3.1–6.0).

Table 8. DMFT (permanent and deciduous)) for 95 ALL pediatric patients at the Oncology Center in Sana'a City

DMFT (permanent)	**No**	**%**
1.0 -2.0	15/22	68.2
3.0 -4.0	5/22	22.7
>4.0	2/22	9.1
Mean	2.4	
SD	1.7	
Median	2.0	
Mode	1.0	
Min to Max	1 - 8	
DMFT (deciduous)		
1.0 – 3.0	49	47.2
4.0 -6.0	23	24.2
>7.0	23	24.2
Mean	4.8	
SD	3.8	
Median	4.0	
Mode	2.0	
Min to Max	1-20	

DMFT and dmft are indices used in dentistry to measure the prevalence and severity of dental caries (tooth decay) in permanent and deciduous (primary) teeth, respectively.

Table 9. Saliva flow rate and pH for 95 ALL pediatric patients at the Oncology Center in Sana'a City

Characters	No	%
Saliva amounts		
Less than 0.5 ml/5mins	28	29.5
0.5 – 2.0 ml/5mins	61	64.2
>2.0 ml/5mins	6	6.3
Mean	1.16	
SD	0.22	
pH of the saliva		
6.2	29	30.5
6.4	34	35.8
6.6	11	11.6
6.8	21	22.1
Mean	6.4	
SD	0.21	
Median	6.4	
Mode	6.4	
Min to Max	6.2 -6.8	

The pH of saliva is normally slightly acidic to neutral, typically ranging from 6.7 to 7.3. The unstimulated salivary flow rate, which is the rate of saliva production when there is no stimulation (like eating or chewing), is generally between 1.5 and 2.5 ml/5 min.