



**SULTANATE OF OMAN  
MINISTRY OF EDUCATION**



**!!  
THE EFFECT OF ALQALA FALAJ  
UPON DENTAL HEALTH !!**

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**SUPERVISED BY: AFRA ALDAIHNI**

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And thanks go to the Ministry of Health Represented in Bahla Hospital and Nizwa Hospital as well as Jumah Agricultural Research Center.

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Wishing all the best to all

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### **Summary of the Study:**

The research is aimed at explaining the effect of Falaj's water on teeth bleaching, detecting physical and chemical properties, healthy benefits of various elements in this Falaj and finding out some solutions to the teeth bleaching problem upon village's people. The main focus of the research is teeth discolouring of Qala AlMusalha people as a result of drinking from the water of this Falaj. Drinking from this water is the direct result in bleaching and distorting of the people's teeth. The main question of the research is: what are the elements and minerals that are found in the water of this Falaj which affect the dental health and led to discoloring and bleaching of the teeth? Water protocol was implemented related to Globe program, using its own tools to conduct scientific experiments, salinity and conductivity device, PH and GPS were used in this research. The research comes out with the following results: the Falaj's water contains some elements in different quantities, such as sodium, potassium, chlorine, magnesium. These elements have multiple health benefits. Some governmental institutions have been utilized in this research like Agricultural Research Station and the Ministry of Health. The availability of fluoride element in large quantities reached 3 mg / L, is considered as a large percentage. After investigation and interviewing the dentist, we found that the reason for teeth discoloring and bleaching is fluoride component. Therefore, a comparison was made between this Falaj and Bahla's Falaj, which is also used by people of Fateh for drinking, but their teeth were not affected or coloured. After testing the water, it is found that less than 1 mg / L. fluoride quantity is safe in drinking water. Thus, below 1mg/L or 1-1.5mg/L is (accepted). While 1.5-3 is considered dangerous to teeth fluoride. Whereas, from 3-10 is considered dangerous to the bone structure. While more than 10 mg may cause paralysis. The research recommends the following: studying other Falajs in the same Walayat like Albuaird and AlHadeeth Falajs.

Since the Sultanate is rich with Falajs in its different Governorates, Globe team recommends other schools to carry out wider analytical studies to exchange scientific knowledge and draw comparison between Falaj's physical and chemical water. The team further recommends the concerned authorities (Ministry of Municipality) represented in the municipality related to the Walayat to conduct periodic examination of Falaj's water, observing the changes which occur over the years. The team further recommends (Ministry of Health) to consider the problem of the affected village's people and leave no stone unturned to resolve the problem of discoloring teeth. There are two ways to treat them: whether to cover this color with casserole layer or by coating the teeth completely, according to the interviewed dentist. This study fall in with the previous studies in some points and conflicted in other points. It also led to new questions, other problems and new hypotheses which can be considered a starting point to new research.

### **Research problem and importance**

Our recommendations in the previous study of Waihi Almur Spring, we completed our new study on the water sources. What is the benefit of Falaj? What is the importance of Falaj? Does it have an effect on health? Does it have an effect on the teeth? Several questions posed by the scholar himself and makes him seeks the truth of this Falaj to acquire the secret of the importance of Falaj and its effect on health, especially on the teeth. If the elements of research and study is available with an approach which cares about soil, air and water. The educational Globe program is relevant to the study. Through field visits to a Falaj located in Walayat Alhamra not far from Bahla, in an area called Qalat AlMusalha. The problem of the study begins. It has been observed the teeth of people living in this region is yellow and bleach particularly among all population of the region. After inquiries, we found out that the cause is the Falaj's water which passes through this region. They used to depend on it for drinking, and by conducting field visits to the area, interviewing people and with the dentist, analyze Falaj's water we will reach, God willing, the main cause of yellowing and bleaching of teeth, materials and elements that help in that.

### **Study Questions:**

in this research we will answer the following questions:

Why it is called AlHamam Falaj?

what are the elements and minerals that affect tooth health?

what is the benefit of mineral elements available in Falaj?

what is the reason of discolored teeth of those who live in this area?

### **hypothesis**

I suppose that this Falaj contains some minerals and elements that have the ability to change the color of teeth?

I suppose the presence of minerals and elements are useful to humans and dental health?

### **The limits of the study:**

Spatial: Qala Falaj at Walayat AlHamra

Temporal: 1st, 2nd semester (october-march) 2015/2016

Quality: Falaj Characteristics

Explanation of the study's results:

This chapter will answer the questions of the study:

The answer to the first question:

This Falaj is called AlQala Falaj related to its flow in Qala AlMusalha. It is also called Alhamam Falaj because of its high temperature which reaches 40 ° C therefore it is hot. It is said that its upstream is from AlKasfa spring, according with an interview with an old man.

## **Research Procedures**

| <b>Procedures</b>   | <b>Date</b> |
|---|-------------|
| Determine the Falaj be studied  | October     |
| Going to the Falaj site at Walayat AlHamra to determine its geographical location via GPS                                 | November    |
| Measuring the transparency, pH, and temperature of Falaj water by using Globe tools in the site                           | November    |
| Taking a sample of Falaj water and sent to the Agricultural Research Station to examine some of the elements and salinity | November    |
| Taking a sample of Falaj water and sending to the Ministry of Health to examine the bacteria                              | November    |
| interviewing the dentist  | November    |
| Drawing conclusions and comparing them with the previous studies  | November    |
| writing recommendations and suggestions   | November    |

**Research Methodology:**

Experimental method due to its relevance to the analysis of the study

**Research community:**

Falaj AlHamam at Qalat AIMusalha, Walayat AlHamra.

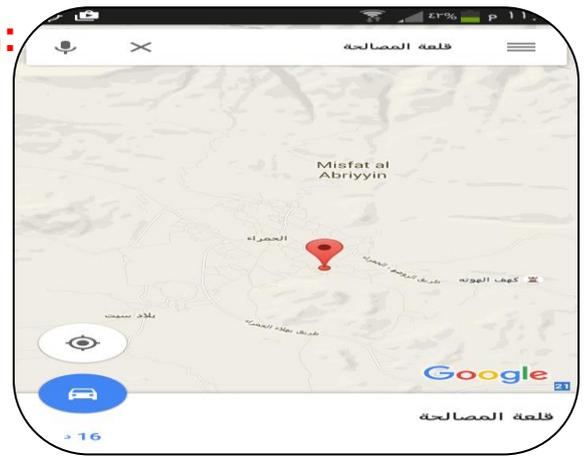
**The research sample:**

Water from Falaj AlHamam at Qalat AIMusalha

**Site by GPS related to Globe Program:**

N 23.08539

E 57.29965



Water stream where the Falaj )  
( passes



Falaj cleaning Channel



the building where the Falaj )  
( comes out

## research method:

- 1- selection the subject of the study .
- 2- Visiting the study location .
- 3- Specifying the directions of the location by GPS .
- 4- Testing the falaj water by GLOBE tools .
- 5- Take samples to be tested by ;
  - A - Agricultural Research Center To find out mineral elements in the water.
  - B - Ministry of Health( Nizwa Hospital in collaboration with Bahla hospital for examination of bacteria in the water Falaj).
- 6- Interviewing with older people who are contemporary to this falaj from the past .
- 7- An interview with the dentist in Bahla.



**Water Falaj screening with Globe tools and taking samples to be tested by government institutions**



**Meeting and interviews with contemporaries , older people and a dentist**

## **Tools:**

To perform the study and ( GLOBE ) We used the tools Globe carry out the required sizes



**Measuring the pH of water**



**A thermometer to measure the temperature**



**The tool measuring the water transparency**

## Results:

The findings of the analytical study by tools Globe

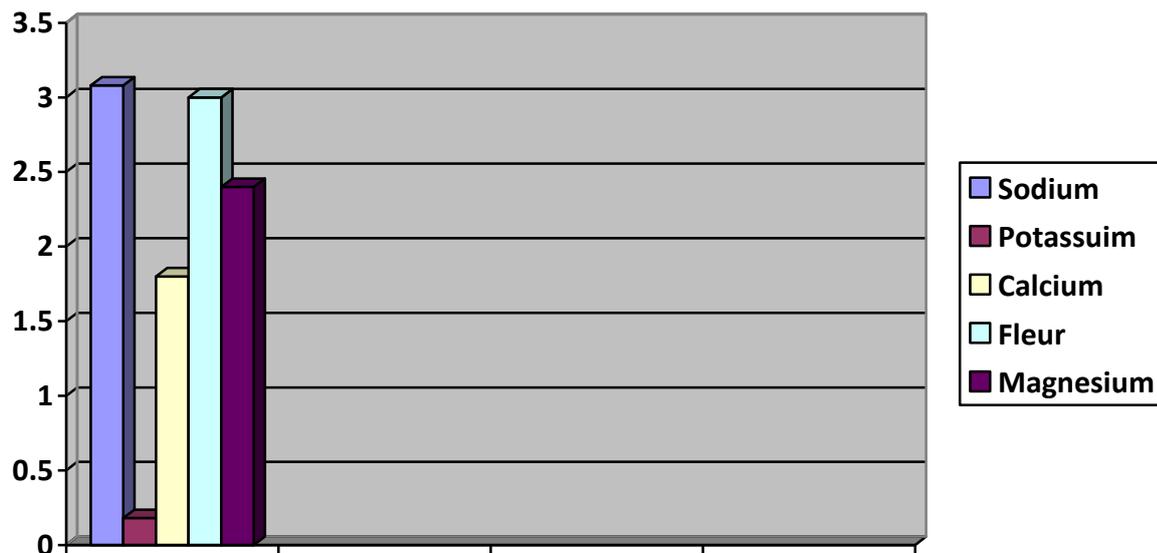
| temperature |     |     | PH Acidity |      |      | Transparency  |               |               | Measurement      |
|-------------|-----|-----|------------|------|------|---------------|---------------|---------------|------------------|
| 3           | 2   | 1   | 3          | 2    | 1    | 3             | 2             | 1             | Number of trials |
| 40c         | 40c | 40c | 7.91       | 7.91 | 7.90 | More than 120 | More than 120 | More than 120 | result           |

The results of the sample analysis Laboratory of Public Health in collaboration with Nizwa and Bahla hospital:

| Number of coliform/100 m |         | Sample No in laboratory | the sample  |            | Sample details |
|--------------------------|---------|-------------------------|-------------|------------|----------------|
| coliform                 | E. coli |                         | Unprocessed | processing |                |
| 165                      | 1       | 1618                    | ✓           |            | Alqalah falaj  |

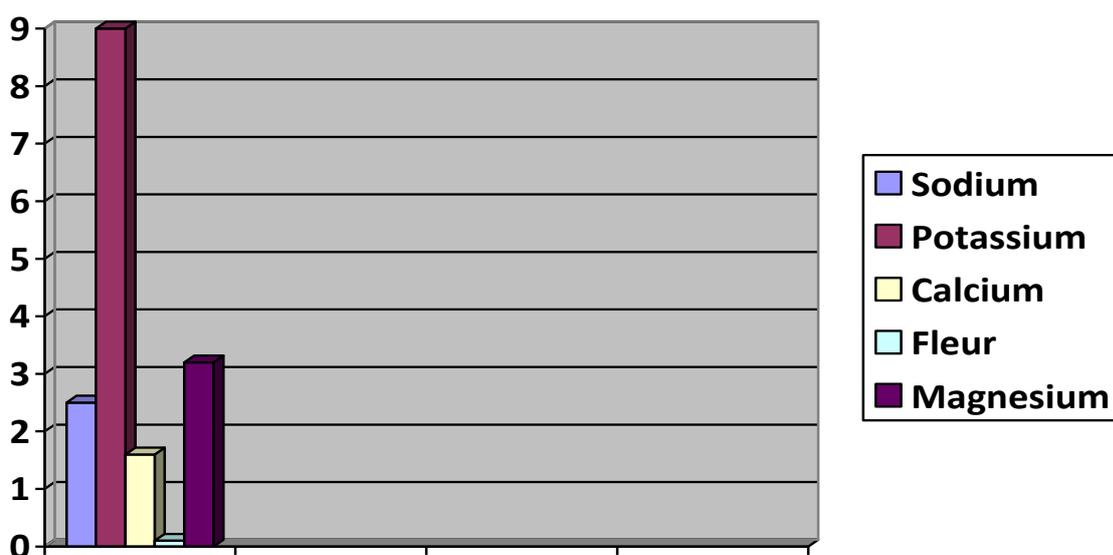
The results of the sample analysis by Agricultural Research Center:

| Ca <sup>++</sup> Meq/1 Calcium Ion | F <sup>-</sup> Meq/1 Flour ion | Mg <sup>++</sup> Meq/1 Magnesium ion | CL <sup>-</sup> Meq/1 Chlorine ion | K <sup>+</sup> Meq/ 1 Potassium ion | Na <sup>+</sup> Meq/1 Sodium ion | PH Acidity PH | E.c /ds / m | Sempel No |
|------------------------------------|--------------------------------|--------------------------------------|------------------------------------|-------------------------------------|----------------------------------|---------------|-------------|-----------|
| 1.8                                | 3                              | 2.4                                  | 6.0                                | 0.18                                | 3.08                             | 8.0           | 1.23        | 1         |



**The analysis water results of alfath Falaj:**

| Ca++<br>Meq/1<br>Calcium<br>ion | F-<br>Meq/1<br>Fleur<br>ion | Mg++<br>Meq/1<br>Magnesium<br>ion | K+<br>Meq/ 1<br>Potassium<br>ion | Na+<br>Meq/1<br>Sodium<br>ion | PH<br>Acidity<br>PH | E.c<br>/ds<br>/ m | Sempel<br>No |
|---------------------------------|-----------------------------|-----------------------------------|----------------------------------|-------------------------------|---------------------|-------------------|--------------|
| 1.6                             | 0.1                         | 3.2                               | 9                                | 2.5                           | 8.32                | 2.01              | 1            |



### **Explanation of the study results:**

This chapter will answer the study questions

The answer of the first question:

This Falaj is called AlQalah Falaj because it passes through a village called Qalat AlMusalha. It is called AlHamam Falaj as well, due to its high temperature which is reaching 40 degrees. Therefore, it is hot. It is said that its source comes from AlKasfa spring as per the interview with an old man.

from the above results (Agriculture Research Center) and the use of Globe tools, the following is appeared:

1- PH is ranging from 7.90 - 8.0

2- Sodium 3.08

3- potassium 0.18

4- chloride 6

5- magnesium 2.4

6- fluorine 3

•Through analysis to water conductivity (1171) microsamins / cm. It is electric connector.

Measuring salinity or TDS through the electrical conductivity is considered one of the most common methods to determine water quality. The electrical conductivity of the fluid's ability to connect the power supply, which depends on the amount of total dissolved solids. This indicates electrical conductivity data for Falaj water most of them less than 2000 microsamins / cm

Based on what is stated in this paragraph, the water is considered good if electrical conductivity does not exceed 4000 microsamins / cm.

Through examination, it shows that the degree of acidity of water is ranging from 7.90 - 8.0 and through the interview with old people, it is found that this Falaj was used for human, sheep and cattle drinking because it is the only source of drinking.

The degree of acidity of the Falaj is suitable for drinking and therefore its water was used by people of this village since it was no other source for

drinking. However, current days there are many water sources for drinking so people of the village stop using it and they only use it for irrigating their crops according to the words of an old man.

Bacteria which live in the neutral water may not live in highly alkaline or acidic water. This is proved through the presence of Ecoli bacteria and coliform bacteria according to the examination of public health at Nizwa.

What is the "E.coli" Bacteria?

"E.coli" is a type of organic bacteria that usually infect the Digestive tract of humans, and there have many kinds, some of them are not harmful while others discharge toxins that cause intestinal cramps and severe diarrhea

Disadvantages: -

1. Renal failure
2. decrease blood platelets rates
3. hemolytic anemia in red blood cells. Hemoglobin run from it.

Coliform bacteria:

The researchers pointed out that the currently used tests do not reveal «E. coli» directly. But, instead, it reveals bacteria «coliform» used by health officials as indicators of fecal contamination. However, the «coliform» can come from natural sources, and does not always constitute reliable indicators of fecal contamination.

Japanese researchers were capable of using genetically modified viruses that infect «E. coli» bacteria to determine a wide range of strains of the bacteria in the sewage.

Number of coliform bacteria in milliliters of water used as evidence of a latent objects.

These bacteria are produced from sewage and human excreta, and the proportion of zero to 10% is acceptable in ordinary water, but drinking water is supposed to be attributed zero%, which, if any, in the water, attacked the man, they cause vomiting and diarrhea, and the water

must be treated quickly by increasing the proportion of chlorine to eliminate this germ.

Water is safe to drink if the pH number is ranging from 6.5 and 10 and the water is considered not safe for dring in other cases. So this water of the Falaj is drinkable if pH number is ranging between (7.90 - 8.0).

- After analytical survey, the study shows that there is amount of sodium ions

- The health benefits of sodium as stated in the study questions:

- Sodium is the primary ion electrolyte within the body. It regulates the blood, also, it is one of the important components of the nerves and helps in regulating muscle contractions.

- \* Organize fluids: Sodium is one of the minerals that helps in regulating fluid levels in the human body.

- Brain function: it is an important element for the development of the brain, where sodium is working to improve the function of the brain.

- Anti-Aging: it helps to restore healthy complexion.

- Removes carbon dioxide: sodium surplus plays an important role in the removal of any of the excess carbon dioxide that has accumulated in the body.

- maintain a healthy heart: helping to maintain normal contractions of the heart. It plays a vital role in maintaining the blood pressure in the human body.

- The results shows that Falaj's water contain potassium, but in low rate (0.18 mg l l)

- The health benefits of potassium as stated in the study questions:

- Potassium is very essential for nerves, heart, arteries and muscles. It also has a big affair to modify harmful acids to the body but excessive acids which may lead to many disadvantages. The excessive intake of elemental potassium and sodium may lead to a lack of other metal salts, which made the human body lacks to them. In brief, potassium is as significant as sodium. Salt cab be found in various natural fluids in the body as well as potassium is present in muscle cells and blood cells, etc.

- 

- The results of the analysis of AlHamam water samples, it is found that chlorine ratio reaching the average of (6 mg l l)

- • The health benefits of chlorine as stated in the study questions:
- Chlorine is considered one of the basic minerals. The benefits of chlorine is making fluid balance and helping digestion. The lack of chlorine, causing poor growth, cramps and loss of appetite.
- Chlorine is used in the manufacture of many products that are used on a daily basis.
- It is used to kill bacteria and other microbes from drinking water and bath tubs. Even small water sources are chloridized periodically.
- It is used widely in paper products, disinfectants, pigments, food, insecticides, paints, petroleum products, plastics, medicine, textiles, solvents, and many consumer products.
- the Chlorine is used for water purification from microbes in pools, but it takes time to finish. It is therefore important to ensure that the ratio of chlorine remains all the time within the effective amount to accomplish this task as it is medically advisable. There are several factors that reduce the necessary ratio of chlorine to sterilize water, such as the sun, dirt and decaying parts of the swimmers skin tissues during swimming. This calls to note the percentage constantly in order to maintain the sterilizing water from microbes.
- It is found out that the presence of E. coli bacteria and coliform bacteria in Falaj is the result of the screening process which was sent to the Ministry of Health. This is due to the fact that this Falaj is used for the purpose of personal use, swimming and throw dirt and animal wastes in it.
- the analysis of water sample of the Falaj, it is found that magnesium ratio is about
  - (2 .4 mg/l)
  - • The health benefits of magnesium as stated in the study questions:
  - • Magnesium is a necessary mineral and is an important element for the growth of bone, teeth, and its health and strength. Magnesium is very important for the safety of the nervous system, blood organ, and blood vessels. Further, Magnesium is essential for the work and effectiveness of the enzymes. Therefore, magnesium affect the work of the various organs of the body and maintain the body's cells and starting power.
  - It is found out from the examined sample by the Ministry of Health that it contains calcium at a rate of (1.8). Calcium is a

necessary element for the formation of bones and teeth, in addition to the other different benefits in the body.

- • The results show that Falaj's water contain high rate fluorine element of (3 mg l l)
- • The healthy benefits of fluorine as stated in the study questions:
  - • fluorine is an important mineral which helps reduce cavities and tooth decay and helps to strengthen teeth and bones and strengthening the upper layer of the tooth.
  - • Fluoride is highly reactive element which is found in many rocks in nature
  - • Therefore, it is available in a lot of groundwater, as well as in many different nutrients that are planted or irrigated by ground water.
  - • Eating large amounts of fluoride, either through water or food, can cause serious health problems for humans and animals alike, which make us to beware.
- This damage appears as yellow distorted teeth, in addition to the pain, deformities in joints and Osteoporoses, impeding the growth and deformation of the limbs and neurological disorders problems.
- This is consistent with what the dentist said



in the interview

with him conducted by researchers from the Globe team. When he was asked about the main reason for the discolouring and bleaching of the teeth, he confirmed that the fluoride component in the water is the main cause of this phenomenon. He further talked about a patient who was frequently visiting him and suffers from bleaching teeth in the year of (2000 - 2001) from Walayat AlHamra. This confirms that fluoride is the main reason of bleached teeth.

The dentist emphasized that whenever fluoride ratio increased in the water, the bleaching in the teeth is increase. Fluoride is naturally found in the water and fluoride increases in Falaj and wells because Falaj's water and wells flow like a river and thus it

deposited in the soil and increases in rate and significantly affect the lacteal teeth more than permanent ones.

The shortage of fluorine leads to scoliosis and delayed healing of broken bones in addition to tooth decay. The increase in the proportion of fluorine leads to tooth bleaching.

The dentist confirmed the risk of overexposure to fluoride teeth occur at any age but is more occurring in a small age. There are mild forms, which often seem remarkable for its formation of small white streaks or spots on the enamel of the teeth. As for the most severe teething shape by discolouring or the appearance of signs structure it becomes difficult to clean.

This is what happened with the people of this village, where they used this water for drinking at a younger age (during the first eight years of life), which is the suitable time for the formation of most of the permanent teeth so they suffered from bleaching in the teeth

This is consistent with the scientific study carried out by the Americans. They found out that the increase in the fluoride causes discoloration and pigmentation in teeth.

- This does not conflict with a study done by the National Council that fluoride is harmful to the brain, especially when given to infants with a low concentration. This occurs in drinking water, and these damages in the form of memory loss. Based on other studies conducted on humans, the scientists found that swallowing fluoride reduces IQ level in children.

To ensure that fluorine is the cause of this bleach, a comparison study has been made with AlFateh Falaj. People used to drink from this water but not affected. The percentage of fluorine in this Falaj is found less than 1 Mg / L (0.1 mg / l) while in AlHamam Falaj, the fluorine ratio is 3 mg / l.

The fluoride level for safe drinking water should be below 1 mg / l, and 1-1.5 mg / l is acceptable. 1,5-3 mg / l is considered risk on teeth. 3-10 mg / l is dangerous to the bone structure. While more than 10 mg / l lead to structural paralysis.

Globe team measured the temperature by the available tools, they found the following:

The temperature of ALQala Falaj reached 40 degrees Celsius.

It became clear through the interview with an old woman who said that a lot of people visiting this Falaj for cure and healing since ancient times. Its smell of sulfur is important in the treatment of skin illnesses.

The individual swims in the water and his body acclimates with the water temperature and stay in the water a period of 5 to 9 minutes

as a first stage. Water effect the ill-body organ so he feels relieved. The process of treatment continuous for at least 3 times per day, preferably before dawn prayers and before sleeping. After leaving Falaj, he feels cold, although the water is hot.

- Through examination by Globe tools and use a transparent water, it is found that the transparency of Falaj water is high and reached more than 120.

## **Recommendations**

In the light of the analytical results of this study, and through the application of Globe Project tools which support serving the aquatic environment, we have obtained the following recommendations according to its importance:

1. Globe Team recommends a study to investigate the other falajes in the same Willayat like Falaj Albuweyred and Falaj Al Hadith.
2. As the Sultanate is rich in many falajs, the team recommends Globe teams in other schools to do a broader analytical studies in order to exchange scientific knowledge and to compare the physical and chemical properties of the falajs water.
3. The team recommends that the competent authorities (Ministry of Municipals) represented in the municipality of each Willayat to provide regulations and guidelines, provide cleanliness and maintenance workers for the Falaj and to examine the changes that happen in it over the years.
4. The team recommends that the competent authorities (Ministry of Health) represented by the respective personnel oral hygiene to consider the problem of the people of this village affected (spotted teeth) by all means to resolve the problem of the color of their teeth change in appropriate ways, there first to treat it: coverage of this color layer ceramic

Second: dental full dressing as stated by a dentist we interviewed.

## **Suggestions :**

1. Provide developmental services for tourists and visitors from both inside and outside the country and consider these falajes a part of the Omani heritage which we should save.
2. Survey of people formerly affected by this Falaj spotted in their teeth and do treat them in appropriate ways.

3. The Ministry of Regional Municipalities should conduct a research and analysis to falajes in general and this particular Falaj to determine the cause of increasing the proportion of fluoride in this Falaj and seek to resolve this problem.

## Conclusion

Thank to Allah for His Blessings and Mercy

We would like to put our last drops after a trip through the five chapters in this research between thinking and prudence on the subject.

It was a hard journey to elevate the mind and the ascension of various ideas, what this little effort, but not

Pretend it perfect, but our excuse that we have made our best . We have the honor of trying and learning.

In conclusion it can be inferred that the GLOBE Program has helped us to know Falaj Al Hammam water properties in Qalaat Al Mosalha in willayat Al Hamra.

We have studied the health benefits of this Falaj, which had a good effect in understanding some of the amazing scientific facts for this Falaj and its name.

And we investigated the cause of the people of this village teeth color change.

We have studied its Physical, chemical and various bacterial (microorganisms) features

The results show, according to the Ministry of Regional Municipalities report that these Falaj water drinkable if there is no other sources of drinking water.

We ask Allah Almighty that this study be a springboard for wider scientific studies.

Hoping to obtain acceptance and deliver plaudits.

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# INDEXES

