

KNOWLEDGE, ATTITUDE, AND PRACTICE  
AMONG YEMENI DOCTORS IN SANA`A CITY  
ABOUT THE ANTI STREPTOLYSIN O (ASO)  
TEST

معارف ومواقف وممارسة الأطباء اليمنيين في مدينة  
صنعاء حول فحص مضاد الستربتوليسين O (ASO).

## PROPOSAL OF THE STUDY

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# ABSTRACT

**Title:** knowledge, attitude, and practice among Yemeni doctors in Sana'a city about the anti streptolysin o (ASO) test.

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**Introduction:** Streptococcal infections are a major public health problem worldwide, especially in developing countries. The Anti-Streptolysin O Test (ASO) is an important diagnostic tool used to detect these infections. Despite its importance, there is a lack of information regarding the knowledge, attitude, and practice of healthcare providers regarding the ASO test in Yemen. This study aims to address this gap by exploring the ASO knowledge, attitudes, and practices of Yemeni doctors.

**Objective:** this survey aim to magnitude and describe the knowledge, Attitude and knowledge of the Yemeni health physicians about the ASO Test

**Methods:** A KAP cross-sectional study was conducted in Sana`a city regarding ASO among different specialties of medical doctors who frequently request the ASO test , using a questionnaire component and analyzed by SPSS and M. Excel programs, The sample for this study comprises 100 doctors who were selected through convenient sampling from a pool of 3000 doctors representing seven different specialties. These doctors are currently working at health facilities located in Sana'a City and had ordered the ASO test for their patients in 2022.

**Results:** Knowledge directly affected both attitudes (e.g., Frequency order the Test and accuracy belief) and practices e.g., (Management of patients with high ASO titer ). Among the Yemeni doctors who ordering the ASO test ,

Luck of the knowledge was the most influential and significant practice factor. It mediated the relationship between knowledge and frequency of ordering the ASO test and directed management for the patients with high ASO titer, the level of knowledge varied by specialties. ( $p < 0.01$ ).

About 40 % of the participants managed their patients with high ASO titer by prescribing long acting penicillin injection (Penicillin G Benzathine) every 21 days.

**Conclusion:** The findings of this study in general show a decrease in knowledge about the ASO which led to the incorrect attitude and practice therefore A third of the sample considered the ASO test a diagnostic test with high accuracy, on the other hand, the level of practice score was low and that is why 40% of the participants prescribe Antibiotics immediately to their Patients with high ASO titer and this correlated to the decrease in knowledge level among the participants regardless of their medical specialty.

**Keywords:** KAP Study, The Anti-Streptolysin O Test (ASO), Yemeni Doctors, Sana`a City

## INTRODUCTION

Streptococcal infections are a major public health problem worldwide, especially in developing countries. The Anti-Streptolysin O Test (ASO) is an important diagnostic tool used to detect these infections. Despite its importance, there is a lack of information regarding the knowledge, attitude, and practice of healthcare providers regarding the ASO test in Yemen. This study aims to address this gap by exploring the ASO knowledge, attitudes, and practices of Yemeni doctors.

Streptolysin O (SLO): is an immunogenic, oxygen-labile streptococcal hemolytic exotoxin produced by most strains of group A and many strains of groups C and G Streptococcus bacteria. Anti-streptolysin O (ASO) is the antibody made against streptolysin O exotoxin, therefore Presence of Antistreptolysin O antibodies in a patient's sera may be isolated evidence of recent infection by group A or less commonly, group C or G Streptococcus, especially in patients suspected of having a non-suppurative sequel to this infection.

The false negatives rate is 20 to 30%. If a false negative is suspected, then an anti-DNase B titre should be sought. False positives can result from liver disease and tuberculosis.

In our study, we aim to describe the knowledge, attitudes, and practical application of Anti-Streptolysin O (ASO) titers among Yemeni physicians in the clinical practices. In addition, we determined the reason for the high demand for this test compared to other inflammatory tests, for instance, the following table (1) shows the numbers of inflammatory tests requested to the central Lab in Sanaa city during the first four months of 2021 and done by analyzer machine.

Test	Number of Tests	percentage	percentage								
ASO	6072	28.30%	<table border="1"><caption>Pie Chart Data</caption><thead><tr><th>Test</th><th>Percentage</th></tr></thead><tbody><tr><td>CRP</td><td>48%</td></tr><tr><td>ASO</td><td>28%</td></tr><tr><td>RF</td><td>24%</td></tr></tbody></table>	Test	Percentage	CRP	48%	ASO	28%	RF	24%
Test	Percentage										
CRP	48%										
ASO	28%										
RF	24%										
CRP	10292	48.10%									
RF	5055	23.60%									

Through this study, to display any misunderstandings that exist regarding its use and connection to diseases and treatments. For example as we know, there is one of the misconception regarding to ASO test among some people in Yemeni community that they believe that a rise in ASO titer signifies the presence of Rheumatic fever and requires a penicillin injection every 21 days or a tonsillectomy. So addition to previous study objective, our study aimed to correct these incorrect beliefs during conducting the study.

## STUDY OBJECTIVE

The general objective of this study is to describe the Knowledge, attitude, and practices of Yemeni doctor in requesting ASO titer during their clinical practices in treating their patients in Sana'a city 2022.

### Hypothesis

- The doctors use the Anti Streptolysin O (ASO) tests only to diagnosis the patients who suspected infect by a group A streptococcal (GAS) infection or they use it a routine test for any patient have symptoms like Sore throat , Fever , and arthralgia .
- specialized doctors (targets) has better using request of ASO test than general practioners in the using of ASO Tests for treatment their patients

### Research Questions

- What is the level of Knowledge, attitude and practice of the doctors about the ASO test

## METHOD:

### Study Design:

A cross-sectional study was carried out in Sana'a city to describe the knowledge, attitudes, and practices of Yemeni doctors who requested ASO tests between January 2022 and December 2022.

To gather data, a structured questionnaire was used and administered to a sample of Yemeni doctors in Sana'a city. The study aimed to provide insights into the current state of ASO testing among Yemeni doctors and identify areas for improvement in their knowledge, attitudes, and practices towards this diagnostic tool. The results of this study will be valuable for healthcare providers in Yemen to enhance their understanding of ASO testing and improve patient care.

### Study population:

We determined 3000 doctors from different medical specialties, who requested the ASO test in 2022; we reached out to them by collecting the data from the most famous and specialized laboratories from different locations in Sanaa city .

Amass a convenient sample of 100 doctors from seven different specialties, those doctors works at different health facilities in Sana`a City and they ordered the ASO test for the patients, these doctors classified into the following groups with percentage of sample (GP 20%, ENT 15%, IM 15%, Ortho 15%, Ped 15%, Cardio 10%,and 10% Dermatologists.

## **Exclusion criteria**

In order to ensure the accuracy and relevance of our study, we implemented strict exclusion criteria.

Specifically, we chose to exclude other medical specialties and doctors who did not frequently request the ASO test. By doing so, we were able to focus our analysis on those healthcare professionals who were most likely to encounter and utilize this particular diagnostic tool in their practice. This approach allowed us to generate more meaningful insights into the clinical utility and effectiveness of the ASO test, while minimizing potential confounding factors that could have otherwise skewed our results.

## **Ethical consideration:**

This study respected research ethics. We maintained the welfare of the participating subjects. Varies among different research fields and designs. Includes but not inclusive of:

- A. We informed the targets about the aim of the study, its importance.
- B. an official letter from our university to the targeted hospital and laboratories to facilitate our work and study.was taken and approved

The confidentiality of the participant's information was maintained, and the collected data had been used for the purpose of the study, only.

## **DATA COLLECTION TECHNIQUE AND TOOLS**

In this study, we are going to use the following tools:

- Conducting interviews with targeted Labs to records measure the percentage of the Positives and negatives ordered ASO tests in the entire 2022 and collecting the names of that doctors to be as our target for this Survey
- After getting the database from the Labs, we classified the concerned doctors according to their medical specialties.
- Then conveniently selected the proposed sample from each specialty according to the sample size proposal .
- We used the questionnaire as our method to assess the knowledge, attitude, and practices of Yemeni doctors in Sanaa City about the ASO test.
- The questionnaire will include both open-ended and closed-ended questions and will be administered in person.
- We were proposed to assess the practices of targeted doctors through their patients but we could not collect the data of patients from the targeted laboratories as many of them totally refused under the privacy of patients .

## Pilot study:

A pilot study was conducted by testing the questionnaire on 20 of the doctors in the study Site in order to identify any unclear or improper questions and to estimate the overall satisfaction rate .The supervisors from the university made minor changes and approved the final form of the questionnaire.

The original questionnaire was amended to include additional questions that aimed to assess the knowledge of the participants, which totaled to nine questions. Furthermore, four questions were added to evaluate their attitude towards the subject matter. Additionally, five questions were included in the revised questionnaire that focused on examining the practices of the doctors.

## DATA PROCESSING AND ANALYSIS:

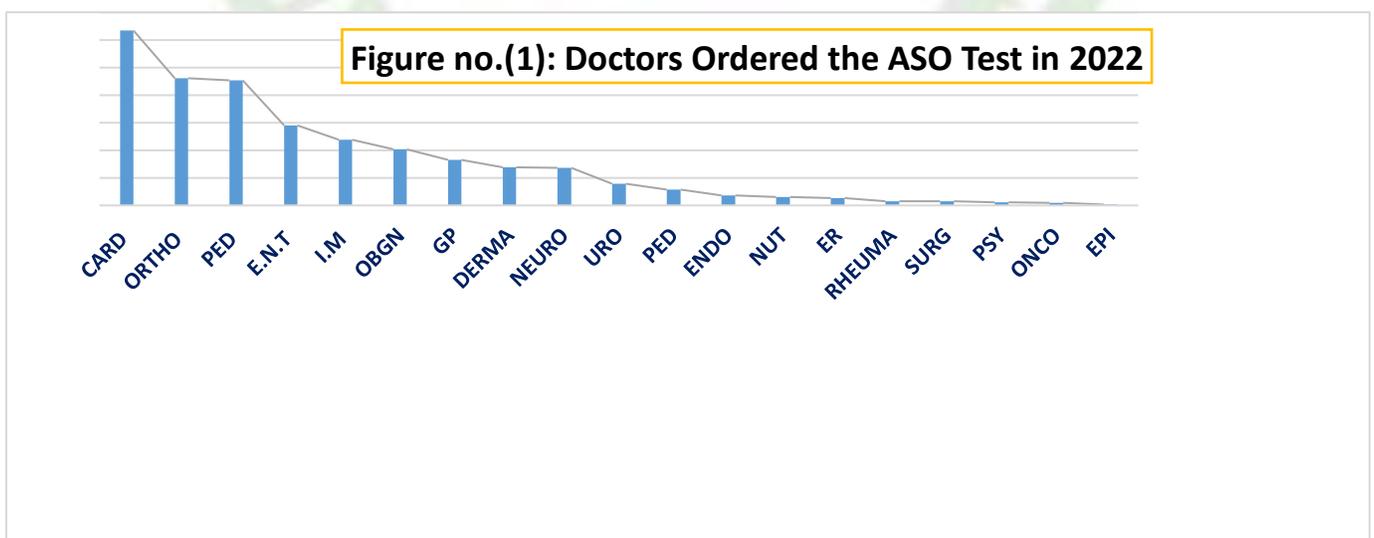
The data was managed by the processing group of students that going to use the computer for data coding and analysis. After the distribution of the questionnaire in the study sites (different Hospitals, medical centers, and private clinics), data was collected and followed by manual calculation of knowledge and compliance score for each questionnaire per the three components of the survey: Knowledge, attitude, and practice.

Then it was entered to and analyzed using M. Excel and SPSS programs

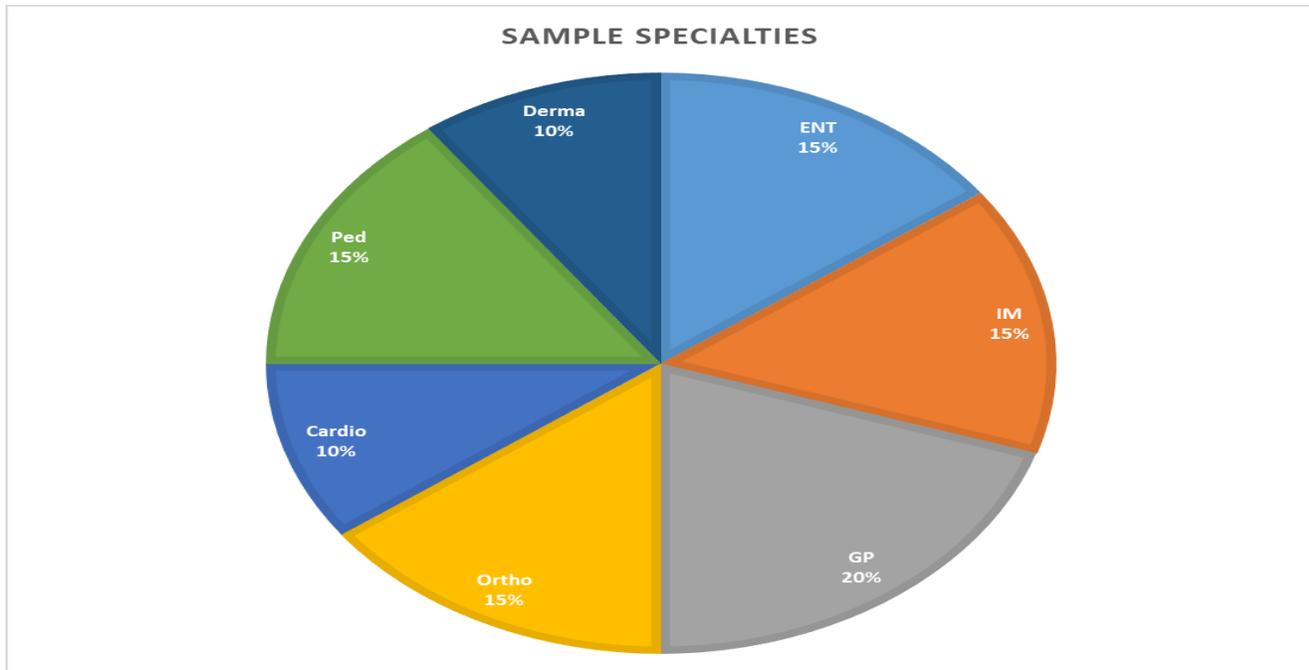
The analysis included descriptive statistics, frequencies, and cross-tabulations .The results were presented in frequencies, percentages, graphs and tables.

## RESULTS:

As per the data that have been collected from the Laboratories we found out that the ASO test is frequently ordered by some of the doctors in Sanaa City from different medical specialties as shown in figure no. 1.



**Figure 2: THE PERCENTAGE OF SAMPLING ACCORDING TO THE SPECIALTIES, SANA'A CITY 2022.**



### Knowledge of participant about ASO Test:

The assessment of knowledge regarding the ASO test involved questions related to general information about streptolysin O, cases indicating a high level of ASO titer, and knowledge about conditions and medications that can affect the test result.

The overall percentage of correct knowledge about the ASO was found to be **69%** (M=68.4, SD=21.9).

The knowledge score varied by the medical specialty, the *general practitioners* and cardiologists were more likely to have accurate information about the ASO test **78% and 73%** respectively, on the other side the incorrect knowledge was found to be higher in **dermatology and ENT specialties 44% and 40% respectively**.

The table( ٢ ) reveals that **only 54% of participants** correctly identified the primary effect of streptolysin O on RBCs, while 31% answered incorrect "WBC" and 15% believed it affects both cells. Additionally, 14% considered ASO as an antigen 5% of them were ENT specialists.

Out of 100 participants, **75** did not know the conditions that could lead to a false positive for the ASO test.

Moreover, **only 59 participants** knew that a high level of ASO titer may indicate past or recent infection; among them, 28 answered "recent infection," while 12 answered "past infection," and one had no answer .

Table 2 summarizes the responses of study participants to questions assessing their knowledge.

<b>TABLE 2: THE INCLUSIVE RESULT OF THE PARTICIPANTS' KNOWLEDGE : KNOWLEDGE (N=100)</b>																
Specialty	ENT		Ortho		Ped		Cardio		IM		Derma		GP		Overall	
Indicators	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes (Correct)	No(Incorrect)
Known ASO is an Antibody	10	5	12	3	15	0	9	1	14	1	9	1	17	3	86	14
know the conditions that indicates ASO	13	2	15	0	15	0	10	0	15	0	10	0	19	1	97	3
know the medications that affect the result of the ASO	14	1	8	7	9	6	8	2	10	5	5	5	18	2	72	28
ASO levels begin to rise after exposure by weeks	10	5	11	4	13	2	10	0	11	4	7	3	16	4	78	22
The ASO level stay elevated for months	5	10	8	7	11	4	7	3	10	5	2	8	16	4	59	41
Not necessary for the patient to be fasting prior to the ASO test	12	3	14	1	14	1	8	2	13	2	9	1	17	3	87	13
The primary effect of streptolysin O is on the RBC cells	9	6	8	7	7	8	6	4	8	7	2	8	14	6	54	46
A high level of ASO titer indicate Past & Recent infection	7	8	8	7	9	6	4	6	11	4	6	4	14	6	59	41
Know the conditions that have a false positive for ASO.	1	14	4	11	4	11	4	6	3	12	0	10	9	11	25	75
Score	81	54	88	47	97	38	66	24	95	40	50	40	140	40	617	283
Scoring Percentage	60%	40%	65%	35%	72%	28%	73%	27%	70%	30%	56%	44%	78%	22%	69%	31%

## Attitude to the ASO Test:

In this study, it was found that 82% of participants frequently order the ASO test, with 36 of them using it as a routine investigation. However, only 18% of participants considered the ASO test to be highly accurate at detecting streptococcal infections, while 34% believed it to be moderately accurate. A significant proportion (57%) considered the test to be less accurate, and 9% deemed it not accurate at all.

Of the 100 participants surveyed, 73 of them (SD = 26.1) took the results of the ASO test into consideration when making treatment decisions for patients with suspected streptococcal infections. The remaining 27 participants did not factor in the results of the ASO test.

Interestingly, it was observed that a majority (79%) of participants had not attended any continuing medical education courses or workshops related to the ASO test in recent years.

**Table 3** provides a summary of study participants' attitudes towards the ASO test based on their responses to various questions.

TABLE 3: THE INCLUSIVE RESULT OF THE PARTICIPANTS' ATTITUDES TOWARDS THE ASO TEST																
ATTITUDE (n=100)																
Specialty	ENT		Ortho		Ped		Cardio		IM		Derma		GP		Overall	
Indicator	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Frequently order the ASO test	13	2	13	2	13	2	8	2	12	3	5	5	18	2	82	18
Think the ASO is high accurate test .	4	11	5	10	6	9	4	6	6	9	3	7	6	14	34	66
take the results of the ASO test in treatment decisions	12	3	13	2	10	5	7	3	11	4	7	3	13	7	73	27
Attitude Scores	29	16	31	14	29	16	19	11	29	16	15	15	37	23	189	111
Scoring Percentage	64 %	36 %	69 %	31 %	64 %	36 %	63 %	37 %	64 %	36 %	50 %	50 %	62 %	38 %	63 %	37 %
Attended any continuing medical education courses or workshops related to the ASO .	4	11	2	13	4	11	2	8	4	11	2	8	3	17	21	79

## Practices with the ASO Test:

Generally, the doctors exhibited poor practices (43%) regarding the ASO test. Specifically, 36% of the doctors used the ASO test as a routine investigation for their patients, and 40% immediately prescribed long-acting penicillin for patients with high ASO titers. Furthermore, 51% of the participants did not specify the ASO testing techniques when ordering the ASO test, and only 55% of them inquired about their patient's recent medications before ordering the ASO test.

The percentage of good practice was among the participants as follows: general practitioners and cardiologists obtained 66% and 63%, respectively. The least percentage of good practice was observed in dermatologists and orthopedists, both scoring 50% as shown in the table no. (4):

TABLE 4: THE INCLUSIVE RESULT OF THE PARTICIPANTS' PRACTICE																
PRACTICE (n=100)																
Specialty	ENT		Ortho		Ped		Cardio		IM		Derma		GP		Overall	
Indicator	Yes	No	Yes	No												
Using the ASO test as a routine investigation	6	9	6	9	4	11	4	6	6	9	2	8	8	12	36	64
Manage the Pt. with high ASO titer by ABO (Penicillin)	5	10	6	9	7	8	3	7	7	8	5	5	7	13	40	60
less ask the patient about his recent medications	7	8	8	7	9	6	5	5	7	8	5	5	4	16	45	55
They don't mention to the method ASO testing techniques .	6	9	10	5	9	6	3	7	7	8	8	2	8	12	51	49
<b>Score</b>	<b>24</b>	<b>36</b>	<b>30</b>	<b>30</b>	<b>29</b>	<b>31</b>	<b>15</b>	<b>25</b>	<b>27</b>	<b>33</b>	<b>20</b>	<b>20</b>	<b>27</b>	<b>53</b>	<b>172</b>	<b>228</b>
<b>Percentage of Scoring</b>	<b>40</b>	<b>60</b>	<b>50</b>	<b>50</b>	<b>48</b>	<b>52</b>	<b>38</b>	<b>63</b>	<b>45</b>	<b>55</b>	<b>50</b>	<b>50</b>	<b>34</b>	<b>66</b>	<b>43</b>	<b>57</b>
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%

## Management of the Patient with High ASO titer

Statistical analysis of the results (Table 4) showed that 40 % of the participants managed their patients with high ASO titer by prescribing long acting penicillin injection (Penicillin G Benzathine) every 21 days without taking into consideration the other factors as patient's condition, further investigations and Echo etc .

Hence, these poor practices accrued consequently to the decrease level of the knowledge.

This study found that there is a strong relation between level of knowledge and the poor practice score of participants,  $r = 0.91$ ,  $P < 0.01$ .

**TABLE 5: SUMMARY OF THE OF THE KAP SURVEY**

Targeted Percentage Score	100	52%	24%	24%	100%
Spec	n= Sample	Knowledge	Attitude	Practice	Total Percentage Score
GP	20	41%	11%	16%	68%
CARDIO	10	38%	11%	15%	64%
IM	15	37%	11%	13%	61%
PED	15	38%	11%	12%	61%
ENT	15	28%	11%	14%	53%
ORTHO	15	35%	11%	12%	57%
DERMA	10	29%	9%	12%	49%

The table above shows that our survey sample was 100 doctors, most of the sample was general practitioners 20% as they form the majority of our sample frame.

Our survey scored the results according to the Survey questionnaire, the scores were distributed according to the questions targeted the parts of the survey (52 % for Knowledge and 24 % for both attitude and practice).

We noticed that the best result was for the GP specialty and Cardiologist and they got 68 % and 64% respectively, and the least result was for the dermatologist 49 % as shown in table no.5.

**TABLE 6: The relation between level of knowledge Score and the Practice**

There is a strong relation between level of knowledge and the practice score of the participants ,  $r = 0.91$  ,  $P < 0.01$  .

Correlation	Knowledge	Practice
Knowledge	1	0.906972
Practice	0.91	1

Regression Statistics	
Multiple R	0.91
R Square	0.82
Adjusted R Square	0.79
Standard Error	4.82
Observations	7

**P-Value: 0.0048**

**TABLE 7: The relation between level of knowledge Score and the Attitude**

There is a significant relation between level of knowledge and the Attitude score of participants,  $r = 0.93$  ,  $P < 0.01$  .

Correlation	Knowledge	Attitude
Knowledge	1	0.93
Attitude	0.93	1

Regression Statistics	
Multiple R	0.927442
R Square	0.860148
Adjusted R Square	0.832178
Standard Error	2.351624
Observations	7

**P-Value: 0.0026**

## CONCLUSION OF THE SURVEY

The general purpose of our survey is to describe the knowledge, attitude, and practicality of Yemeni doctors in Sana'a about using anti-streptolysin O (ASO) titers in clinical practice, so we conclude from our results the following:

- 67 percent of our sample had good scientific knowledge about the ASO test, while one-third needed to improve their knowledge.
- We noticed that the GPs had a good percentage score about the ASO in general 78%% and this may be related to the freshness and updating of their information. On the other hand, we found the level of knowledge score was lower with the specialized doctors.
- The cardiology specialty got the highest score among the medical specialties and had a score of 72% in scientific knowledge about the ASO test.
- Only 46% of the sample has the right attitude about the ASO test, and 34% of the participants considers that the ASO has high rate of accuracy test for diagnosing patients with streptococcal infection.
- Only 57 percent of the participants provides proper way in management for patients with positive ASO tests, while 43 percent of them do not; 40 percent of [participants administer the long-acting penicillin injection every 21 days.
- According to the practice analysis for each specialty, this study found that the GPs and cardiologists are the best at providing proper management for the patients with ASO tests, which correlates to their good scores in knowledge about the ASO test.
- On the other hand, this study found that Derma and Ortho specialties have the lowest score in the practice regarding the ASO, and this correlates with the score of the knowledge.
- The current study found that there is a significant correlation and relationship between the level of knowledge and the score of the practice among the sample, irrespective of the specialty.

## RECOMMENDATIONS

We are presenting key recommendations based only on the findings of the study, which are as follows:

- ✓ Our university and all medical colleges should give more attention to the ASO test by doing lectures, research, activities, and other things related thereto.
- ✓ Further research studies should be undertaken on the wide sample and on another target to identify confounding factors that have an effect on the proper management of patients with positive ASO.
- ✓ The Ministry of Health officials need to formulate and implement a clinical guideline for the management of patients with positive ASO.
- ✓ The doctors should attend continuing education about the ASO to refresh their knowledge.
- ✓ The doctors and other health care professionals should think carefully about the accuracy, reliability, and cost-effectiveness of the ASO test, as this test has lower accuracy than other diagnostic practices.
- ✓ The specialized laboratories should prompt the anti-DNase B antibodies test as having higher accuracy than the ASO and make it available.
- ✓ The doctors and other health professionals should follow the updated international guidelines for the management of patients with a positive ASO test and stop giving the ABO.
- ✓ We recommend further KAP studies about the ASO test among the Yemeni doctors with a large sample frame and unit.

## **DIFFICULTIES**

- 1) Some of the specialized laboratories refused to give the needed data from the test.
- 2) After the application of the pilot study using the questionnaire, some mistakes appeared and were then modified.
- 3) During the period of conducting our survey, we had many final examinations at the university, and this caused some troubles in our survey.
- 4) During the collection of previous research, We did not find any study like ours, so our study has no literature review.
- 5) In the timetable of research, there was a long gap of six months in duration (dead time) because of political problems in Yemen.
- 6) Some of the targeted doctors refused to fill out the questionnaire, and this led to some troubles.

## **Discussion**

67 percent of our participants had good scientific knowledge about the ASO test, while one-third needed to improve their knowledge. This finding of about third of doctors have poor knowledge regarding to requesting ASO test is supported by that physicians did not have appropriate and updated knowledge about ASO request reported by a published paper from Madagascar<sup>26</sup> . Also, the cardiologist has the most knowledge among specialists that is could be supported by that the most cases had request ASO test were for cardiac diseases such as rheumatic fever and else which may reflect the close and much knowledge about the most diseases needed to be investigated and requesting ASO test<sup>24</sup>. We recommend further research in depth in future to give more perspective about the KAP OF DOCTORS ABOUT REQUESTING ASO TEST. The lack of published of similar research discussing this issue making a challenge to go to more comprehensive argument regarding to studied topic in this study.

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# QUESTIONNAIRE IN ENGLISH VERSION

REPUBLIC OF YEMEN  
Ministry of Higher Education and  
Scientific Research

21 SEPTEMBER UNIVERSITY

Faculty Medicine



الجمهورية اليمنية  
وزارة التعليم العالي والبحث العلمي  
جامعة 21 سبتمبر  
كلية الطب البشري

Dear Doctors :

We are 6th-year medical students doing research to measure the knowledge, attitude, and practice of Yemeni doctors in Sana'a about the Anti-Streptolysin O Test (ASO)..

Thanks for your cooperation & time.

Serial number: .....

Date: .....

Specialty: .....

1. What is the ASO, according to your knowledge?

An Antigen.  An Antibody.

2. What are the conditions that indicate a high ASO titer level??

1. ....

2. ....

3. ....

3. Do you know any medications that can affect the result of the ASO test?

Yes,  No

If Yes, please mention some of those medications.

.....  
.....

4. The ASO levels begin to rise after exposure by?

Immediately  Weeks  Months

5. How long does the ASO titer remain high following exposure?

.....

6. Do you use the ASO test as a routine investigation?

Yes.  No.

7. If Yes, please for what conditions you do use the ASO Test?

.....  
.....

8. Do you think it is necessary for the patient to be fasting prior to the ASO test?

Yes, It is necessary  No, It isn't necessary

الصفحة 1



9. What is your management plan for your patient with high ASO titer

.....  
.....

10. Prior to ordering the ASO test, Do you ask the patient about his recent medications?

Always  Sometimes  Never

11. Which types of ASO testing techniques do you prefer?

By Manual (Latex).  By Analyzer Machine.  I don't mention it

12. What is the primary effect of streptolysin O on the body?

Hemolysis of RBC  Hemolysis of WBCs  Both

13. What does a high level of ASO titer indicate?

Past Infection  Recent infection  Both

14. What are the conditions that have a false positive for ASO?

.....

15. How often do you order the ASO test?

Always  Usually  Sometimes  Rarely  Never

16. In your opinion, how accurate is the ASO test at detecting streptococcal infections?

High accurate  Less accurate  Not accurate

17. Do you use the ASO test results in your treatment decisions for patients with suspected streptococcal infections?

Yes  No  Sometimes

18. Have you attended any continuing medical education courses or workshops related to the ASO test in the past few years?

Yes  No