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ORIGINAL ARTICLE

Efficacy of oral date syrup in enhancing Magnetic Resonance Cholangiopancreatography: a preliminary study

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ABSTRACT

Objective: To assess the efficacy of oral date syrup in suppressing upper gastrointestinal (GI) tract signals and enhancing visualization of pancreatico-biliary structures on magnetic resonance cholangiopancreatography (MRCP).

Methods: This prospective study was conducted at Department of Radiology, Khyber Teaching Hospital, Peshawar, Pakistan, from January to June 2019. Forty healthy volunteers, with no history of diabetes or GI disorders, underwent MRCP before and 30 minutes after oral administration of 100 ml undiluted date syrup. Imaging was performed on a 1.5T Philips MRI scanner using breath-hold MRCP sequences. Two blinded radiologists independently assessed the suppression of upper GI fluid signals and visibility of the common bile duct (CBD) and main pancreatic duct (MPD) using a standardized 4-point scale. Discrepancies were resolved by consensus. Statistical analysis was performed using SPSS v.22, with a p-value <0.05 considered significant.

Results: All participants completed the study without adverse effects. Radiologist-A observed significant signal suppression in the stomach and duodenum and improved visualization of both CBD ($p=0.003$) and MPD ($p=0.001$). Radiologist-B noted improved visibility of the CBD ($p=0.002$), with borderline significance for MPD ($p=0.065$). Contrast-to-noise ratio analysis showed significant improvement in CBD vs. duodenum and MPD vs. stomach ($p<0.001$).

Conclusion: Oral date syrup significantly suppresses upper gastrointestinal signals and improves visualization of panscreatico-biliary structures on MRCP. It appears to be a well-tolerated, cost-effective alternative to conventional negative oral contrast agents. However, larger multicenter studies are needed to confirm these findings and support the routine use of date syrup as a natural contrast agent in clinical practice.

Keywords: Cholangiopancreatographies, Magnetic Resonance(MeSH); MRCP (MeSH), Date syrup (Non-MeSH); Gastrointestinal Tract (MeSH); Magnetic Resonance Imaging (MeSH); Diagnostic Imaging (MeSH).

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INTRODUCTION

Magnetic Resonance Cholangiopancreatography (MRCP) is a non-invasive imaging modality of choice for evaluating the anatomical and pathological features of the pancreato-biliary system.[1] It relies on heavily T2-weighted (T2W) sequences to visualize static or slow-moving fluids, enabling detailed assessment of the biliary and pancreatic ducts without the need for intravenous contrast agents.[2] However, a key limitation of MRCP is the presence of high-signal intensities from other fluid-filled structures in the abdomen, particularly the upper gastrointestinal (GI) tract, even in fasting patients.[2] These hyperintense signals can overlap with the biliary system, reducing the diagnostic quality of MRCP images.

While signals from lymphatic and urinary structures can often be minimized by optimal selection of imaging planes and field of view (FOV), suppression of upper GI tract fluid signals remains challenging due to their anatomic proximity and alignment with the imaging plane.[3] To address this, various oral negative contrast agents-both chemical and natural-have been explored to suppress unwanted signals and enhance MRCP quality.

Among natural substances, fruit-based preparations such as pineapple juice,[4] blueberry juice,[5] and citrus (lemon/orange) juices[6], date syrup, acai pulp and juice,[7,8] black tea,[9] and bananas,[10] have been studied for their signal-suppressing properties. These substances enhance MRCP image quality by suppressing signals from adjacent gastrointestinal tissues. Their effectiveness is primarily due to high concentrations of iron or manganese, which induce T2 shortening effects, thereby reducing hyperintense signals and improving visualization of the pancreato-biliary system.

Despite the availability of various natural oral contrast agents, limited data exist on the comparative efficacy of locally accessible substances such as date syrup in enhancing MRCP image quality. While some studies have explored fruit juices and herbal preparations, evidence regarding the use of date syrup, particularly in South Asian settings, is scarce. Given the affordability, availability, and patient acceptability of date syrup, this study was undertaken to evaluate its effectiveness in suppressing upper GI signals and improving visualization of pancreato-biliary structures on MRCP. This may help fill a critical gap in literature and support the use of natural, culturally acceptable agents in routine radiologic practice.

METHODS

This prospective study was conducted

in the Radiology Department of Khyber Teaching Hospital, Peshawar, Pakistan, from January to June 2019, following approval from the Institutional Research and Ethics Committee vide letter # 102/DME/KMC dated 12-11-2018. Forty healthy volunteers with no history of diabetes mellitus or gastrointestinal disorders were recruited for MRCP. Informed written consent was obtained from all participants. Age and gender data were recorded, and all participants were instructed to fast for at least six hours prior to imaging.

MRCP was performed using a 1.5 Tesla Philips MRI scanner. Imaging was initially conducted in the fasting state using standard MRCP sequences with breath-hold technique. Each participant then received 100 ml of undiluted date syrup orally, and a second MRCP was performed 30 minutes later using identical imaging parameters. Circular regions of interest (ROIs) were drawn over the stomach and adjacent soft tissues in both pre- and post-date syrup images to assess signal changes.

All MRCP images were anonymized and re-labeled to ensure blind evaluation. Two radiologists, identified as "A" and "B," independently assessed the suppression of high-signal intensity from the upper GI tract and the visualization of pancreatico-biliary ductal anatomy. A standardized 4-point scoring system was used to evaluate perceived signal intensity in the stomach and duodenum (Table I), as well as the visibility of the common bile duct (CBD) and main pancreatic duct (MPD) [Table II].

Discrepancies between the two radiologists' scores were reviewed and resolved by consensus. Each radiologist completed an evaluation form for every subject. Data were entered into SPSS (IBM SPSS Statistics for Windows) for statistical analysis. Pre- and post-intervention scores were compared for each anatomical structure, and a p-value <0.05 was considered statistically significant.

RESULTS

A total of 40 volunteers were included in the study, the median age was 45yrs, with women presenting higher age (50yrs) than men (45yrs). All the volunteers tolerated the examination well without adverse reactions.

MRCP images obtained before and after oral administration of date syrup were independently evaluated by two radiologists using a 4-point scoring system. Both radiologists observed improved visualization CBD and MPD following the intake of date syrup. Radiologist A reported statistically significant enhancement in the visibility of the CBD ($p=0.003$) and MPD ($p=0.001$), while radiologist B noted significant improvement in CBD visualization ($p=0.002$), with near-significant findings for MPD ($p=0.065$). No significant changes were observed in the depiction of the gallbladder or intrahepatic ducts by either radiologist (Table III).

Table I: Perception of signal intensity in the stomach and duodenum

Score	Suppression of high signals in the stomach and duodenum
0	poor (high signal intensity)
1	Fair (moderate signal intensity)
2	Good (subtle signal intensity)
3	Excellent (no signal intensity anywhere)

Table II: Visualization of common bile duct/main pancreatic Duct

Score	Visibility	Detectability of CBD and MPD
0	Poor	Anatomy partly obscured
1	Fair	Better visualization of anatomy with minimal obscuration
2	Good	Good (subtle signal intensity)
3	Excellent	Best visibility of anatomical structures

CBD: Common Bile Duct; MPD: Main Pancreatic Duct

Table III: Comparison of anatomical structure visualization before and after date syrup administration as assessed by two independent radiologists

Structure	Radiologist "A"		Radiologist "B"	
	Total (n=40)	p value	Total (n=40)	p value
Gall bladder	20	0.999	20	0.999
Common bile duct	35	0.003*	36	0.002*
Intrahepatic ducts	17	0.289	18	0.375
Main pancreatic duct	37	0.001*	26	0.065

For p value <0.05, conspicuity is different maximally between without and with date syrup

Table IV: Comparison of contrast-to-noise ratios with and without oral administration of date syrup on magnetic resonance cholangiopancreatography

Structure	With Date Syrup		Without Date Syrup		p value*
	Mean SI	SD	Mean SI	SD	
Common bile duct vs duodenum	-8.06	17.48	10.95	10.07	<0.001*
Gall Bladder vs duodenum	12.87	28.88	31.95	23.75	<0.007*
Main pancreatic duct vs stomach	-47.33	45.40	6.56	7.76	<0.001*

*If p value <0.05 then there is significant difference in contrast to noise ratio of with and without orally administering date syrup

Contrast-to-noise ratio (CNR) analysis further supported these findings. A significant reduction in signal intensity was observed in the stomach and duodenum after date syrup administration. Specifically, CNR between CBD and duodenum, as well as MPD and stomach, showed statistically significant improvement ($p<0.001$). Gallbladder-to-duodenum contrast also improved ($p=0.007$), although to a lesser extent (Table IV).

DISCUSSION

This study demonstrates that oral administration of date syrup significantly improves the quality of MRCP images by suppressing high-signal intensities from the upper gastrointestinal tract and enhancing the visualization of key pancreatico-biliary structures. The improved delineation of CBD and MPD, as confirmed by both radiologists and supported by contrast-to-noise ratio analysis, suggests that date syrup may serve as an effective natural negative oral contrast agent.

Oral contrast agents reduce the signals from upper gastrointestinal tracts, which is a hindrance in proper visualization of pancreatico-biliary system. Oral contrast agents with T2 low signal intensities not only improve the anatomy but also help in differential diagnosis. With the good taste and palatability, there is productive use of these agents in paediatric imaging.[12] The administration of negative contrast agents not only removes the artifacts due to peristaltic motion of the gut but results in higher conspicuity of pancreatico-biliary tree.

Available preparations of oral contrast agents on the market are relatively expensive and unpalatable, with some adverse effects.[13-15] Multiple other products have been evaluated like pineapple, blueberry juice and CO2 producing crystals as contrast agents.[4,16,17] All these products have shown somewhat adverse effects likely to be differ from patient to patient.

In our study we evaluated the MRCP images with use of date syrup as negative contrast agent in healthy volunteers by oral intake of 100 ml to reduce the upper GI tract signals. No case of toxicity or adverse outcome has been notified in any of the volunteer. The study conducted by Govindarajan A, et al.,[3] also showed that date syrup has significant T2 shortening effect and produce a very low signal to noise ratio on T2 weighted and single shot MRCP images.

Our study shows that with the use of date syrup there is significant signal suppression from gastrointestinal tract ($p<0.001$) aiding the visualization and proper evaluation of pancreatico-biliary tree. The analysis shows significant improvement in visualization of CBD by both radiologists. Visibility of CBD is greatly affected by fluid in the duodenal bulb and duodenal c-loop. Henceforth, CBD was clearly visualized by both radiologists, which proves fruitful for the purpose of present study. Fasting before MRCP does not remove all the unwanted signals of gastrointestinal tract from the background as confirmed in study conducted by Riordan RD, et al.,[4] Thus, this limitation must be omitted by negative contrast agents. The result of the present study corresponds to the study by Chan JH, et al.,[18] used diluted gadopentetate Dimeglumine in patients with pancreatico-biliary diseases shows marked improved depiction of CBD and MPD.

Although the use of these agents is helpful, there are some potential drawbacks too that sometimes are hindrance in the proper evaluation of pancreatico-biliary structures. The opening site of CBD and MPD into the duodenum, may sometimes are difficult to visualize.[19] Orally administered agents have been used in MRCP having good results[20] but they are costly which is burden to the patient, secondly are not widely available and are not palatable.

Limitations of the study

The study's small sample size, inclusion of only healthy volunteers, and single-center design may limit generalizability. Image interpretation involved some subjectivity, and no direct comparison with other contrast agents was made. Interobserver variability was not statistically analyzed.

CONCLUSION

In this study, oral administration of date syrup resulted in significant suppression of upper gastrointestinal signals on MRCP in healthy volunteers. This suppression led to clearer and more accurate visualization of key pancreatico-biliary structures, particularly the CBD and MPD. The improvement in image quality was consistently observed in pre- and post-date syrup comparisons. In addition to its imaging benefits, date syrup is safe, inexpensive, readily available in our clinical setting, and has a patient-friendly taste, making it a practical alternative to conventional negative oral contrast agents. These findings support the potential integration of date syrup into routine MRCP protocols; however, further large-scale, multicenter studies are recommended to validate these results and establish standardized usage guidelines.

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AUTHORS' CONTRIBUTION

The following authors have made substantial contributions to the manuscript as under:

KN & IS: Concept and study design, acquisition, analysis and interpretation of data, critical review, approval of the final version to be published

AuH: Analysis and interpretation of data, drafting the manuscript, approval of the final version to be published

SI, HG, MA & HA: Acquisition of data, drafting the manuscript, approval of the final version to be published

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

CONFLICT OF INTEREST

Authors declared no conflict of interest, whether financial or otherwise, that could influence the integrity, objectivity, or validity of their research work.

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DATA SHARING STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request

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