

3 ORIGINAL ARTICLE

4 Enteric-coated aspirin use in acute chest
5 pain in Saudi Arabia: a cross-sectional
6 study of practice patterns and system-
7 level implications

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10 ABSTRACT

11 **Objective:** This study aimed to assess aspirin formulation use for acute chest pain in emergency departments
12 and primary care centers in Saudi Arabia, with a focus on Ministry of Health facilities.

13 **Methods:** A cross-sectional, anonymous, convenience-based electronic survey was conducted among the
14 healthcare professionals involved in the care of patients with acute chest pain in the Ministry of Health emer-
15 gency departments and primary care centers. The survey assessed aspirin formulation, dose, and method of
16 administration, as well as knowledge regarding enteric-coated aspirin absorption, availability of non-enteric
17 aspirin, and willingness to change practice.

18 **Results:** A total of 58 participants, most of whom worked in emergency departments (79.3%) and were emer-
19 gency physicians (74.1%), were included. Enteric-coated aspirin was reported as the most commonly used
20 formulation for acute chest pain (57%), most often administered by swallowing the tablet whole (58.6%), and
21 69.0% of participants were aware that enteric-coated aspirin has delayed absorption. Only 32.8% reported that
22 non-enteric aspirin formulations were readily available in their facility. In exploratory analyses, enteric-coated
23 aspirin use was more commonly reported when non-enteric aspirin was unavailable than when it was availa-
24 ble (81.8% vs. 31.6%; Fisher's exact test, $p = 0.0016$). A large majority of participants indicated willingness to
25 use non-enteric aspirin if available (81.0%) and supported system-wide standardization of non-enteric aspirin
26 use (77.6%).

27 **Conclusion:** Enteric-coated aspirin was commonly used for acute chest pain in surveyed Ministry of Health
28 settings in Saudi Arabia despite guideline recommendations favoring non-enteric formulations. This practice
29 appeared to be influenced by system-level factors, particularly medication availability, more than by knowl-
30 edge alone.

31 **Keywords:** Enteric-coated aspirin, acute chest pain, Saudi Arabia, cross-sectional study, practice patterns,
32 system-level implications.

33 Introduction

34 Aspirin administration is a foundational component of
35 early management for patients presenting with acute
36 chest pain and suspected acute coronary syndrome.
37 Clinical guidelines consistently recommend the use of
38 non-enteric, chewable, or soluble aspirin formulations
39 because they provide faster absorption and earlier platelet
40 inhibition in time-sensitive clinical settings [1-3].

41 Enteric-coated aspirin, while widely used for chronic
42 cardiovascular prevention, is associated with delayed

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47 absorption and delayed pharmacologic effect. This delay
48 may persist even when enteric-coated tablets are chewed
49 or crushed, potentially limiting their effectiveness in
50 acute presentations [4-7]. Despite this pharmacokinetic
51 disadvantage, enteric-coated aspirin appears to remain in
52 use in some acute care settings.

53 In Saudi Arabia, emergency and primary care services
54 are delivered across a diverse healthcare landscape that
55 includes Ministry of Health facilities, governmental
56 health systems, and private providers. As the largest
57 healthcare provider in the country, the Ministry of
58 Health plays a major role in shaping clinical pathways,
59 medication formularies, and procurement practices.
60 Acute coronary syndrome remains an important cause of
61 morbidity in the region, yet the extent to which aspirin
62 formulation use in acute chest pain aligns with evidence-
63 based recommendations in Saudi healthcare settings has
64 not been well described [8,9].

65 Medication availability, procurement processes, and
66 institutional formularies are increasingly recognized as
67 important determinants of clinical practice, sometimes
68 exerting greater influence than clinician knowledge alone
69 [10-12]. Understanding these system-level contributors
70 is essential for effective quality improvement and
71 medication standardization. However, data examining
72 aspirin formulation use and the factors influencing this
73 practice in Saudi Arabia remain limited.

74 This study aimed to assess aspirin formulation use for
75 patients presenting with acute chest pain in emergency
76 departments and primary care centers in Saudi Arabia,
77 with a focus on Ministry of Health facilities. Secondary
78 objectives were to evaluate clinician awareness of delayed
79 absorption associated with enteric-coated aspirin, assess
80 the availability of non-enteric formulations, and identify
81 system-level factors influencing aspirin selection. By
82 characterizing current practice patterns, this study seeks
83 to inform health system-level strategies to improve
84 medication standardization and patient safety in the
85 Saudi healthcare context.

86 **Subjects and Methods**

87 This was a cross-sectional, anonymous, survey-
88 based study conducted across the Ministry of Health
89 emergency departments and primary care centers in
90 Saudi Arabia. The study population included healthcare
91 professionals involved in the care of patients with acute
92 chest pain, including emergency physicians, primary
93 care physicians, nurses, and clinical pharmacists.

94 Eligible participants were licensed healthcare
95 professionals currently working in Ministry of Health
96 emergency departments or primary care centers who
97 voluntarily agreed to participate in the survey. Patients,
98 non-clinical staff, and incomplete survey responses were
99 excluded.

100 A structured questionnaire was developed by the
101 investigators to assess current aspirin use practices and
102 system-level factors influencing aspirin formulation
103 selection. The questionnaire was developed based
104 on existing literature on aspirin pharmacokinetics,
105 acute coronary syndrome guidelines, and prior studies

examining barriers to guideline implementation. It 106
was reviewed for clarity and content validity before 107
distribution, but it was not formally psychometrically 108
validated. 109

The survey included items addressing clinical setting 110
and professional role, years of clinical experience, 111
aspirin formulation commonly used for acute chest pain, 112
aspirin dose and method of administration, awareness 113
of delayed absorption associated with enteric-coated 114
aspirin, availability of non-enteric aspirin formulations, 115
reasons for enteric-coated aspirin use, willingness to 116
change practice, and support for standardization. The 117
survey was designed to be completed in approximately 118
3-5 minutes. No personal identifiers or facility identifiers 119
were collected. 120

The survey was administered electronically using 121
Google Forms and distributed through institutional and 122
professional communication channels used by clinicians 123
in the Ministry of Health emergency departments and 124
primary care centers. Participation was voluntary. An 125
information statement was provided at the beginning 126
of the survey, and completion of the questionnaire 127
constituted implied consent. 128

Because the survey link was distributed through 129
group-based communication channels and may have 130
been secondarily shared, the exact number of eligible 131
healthcare professionals who received the survey could 132
not be determined. As a result, a formal response rate 133
could not be calculated. Data collection occurred over a 134
defined study period and was closed after 58 complete 135
responses were obtained. 136

Survey responses were exported from Google Forms into 137
a spreadsheet for analysis. Responses were reviewed for 138
completeness, and all completed surveys were included. 139
Analyses were primarily descriptive in nature. Categorical 140
variables were summarized using frequencies and 141
percentages. In addition, exploratory bivariate analyses 142
were performed to examine associations between selected 143
variables, including reported availability of non-enteric 144
aspirin and the aspirin formulation most commonly used, 145
as well as awareness of delayed absorption and reported 146
aspirin formulation. For these analyses, responses of 147
“not sure” were excluded, and Fisher’s exact test was 148
used because of small cell sizes. These analyses were 149
considered exploratory given the modest convenience 150
sample. A *p*-value of 0.05 was considered statistically 151
significant. 152

153 **Results**

154 A total of 58 healthcare professionals completed
155 the survey. Most participants worked in emergency
156 departments (79.3%), and the majority were emergency
157 physicians (74.1%). Participants represented a broad
158 range of clinical experience, with 20.7% reporting less
159 than 5 years of experience, 34.5% reporting 5-10 years,
160 29.3% reporting 11-20 years, and 15.5% reporting more
161 than 20 years of experience (Table 1).

162 Enteric-coated aspirin was reported as the most commonly
163 used formulation for acute chest pain by 33 participants
164 (56.9%), while 20 participants (34.5%) reported use of

Table 1. Participants' characteristics.

Characteristic	Frequency (Percentage) n (%)
Practice setting	
Emergency department	46 (79.3)
Primary care center	6 (10.3)
Both ED and primary care	2 (3.4)
Other	4 (6.9)
Professional role	
Emergency physician	43 (74.1)
Primary care physician	5 (8.6)
Nurse	5 (8.6)
Clinical pharmacist	3 (5.2)
Other	2 (3.4)
Years of clinical experience	
< 5 years	12 (20.7)
5-10 years	20 (34.5)
11-20 years	17 (29.3)
> 20 years	9 (15.5)

Table 2. Aspirin use for acute chest pain.

Variable	Frequency (Percentage) n (%)
Aspirin formulation most commonly used	
Enteric-coated aspirin	33 (56.9)
Chewable aspirin	20 (34.5)
Not sure	5 (8.6)
Aspirin dose administered	
81 mg	3 (5.2)
160-162 mg	4 (6.9)
300-325 mg	50 (86.2)
Not sure	1 (1.7)
Method of administration	
Swallowed whole	34 (58.6)
Chewed	20 (34.5)
Variable/not sure	4 (6.9)

Only 32.8% of participants reported that non-enteric aspirin formulations, such as chewable or soluble aspirin, were readily available in their facility pharmacy. The most frequently cited reason was limited availability, with 25 participants indicating that enteric-coated aspirin was the only available formulation (Table 3).

A substantial majority of participants (81.0%) indicated that they would prefer to use non-enteric aspirin for patients with acute chest pain if it were readily available. Similarly, 77.6% supported standardization of non-enteric aspirin use for acute chest pain across Ministry of Health facilities (Figure 2).

Editable data embedded in the chart:

Response	Percentage
Yes	81%
No	5.2%
Not sure	13.8%

In exploratory analyses excluding participants who selected "not sure," reported availability of non-enteric aspirin was associated with the aspirin formulation most commonly used. Among participants who reported that non-enteric aspirin was unavailable, 81.8% reported enteric-coated aspirin as the most commonly used formulation, compared with 31.6% among those who reported that non-enteric aspirin was available (Fisher's exact test, $p = 0.0016$). By contrast, awareness that enteric-coated aspirin has delayed absorption was not significantly associated with the formulation most commonly used. Enteric-coated aspirin was reported by 55.3% of participants who were aware of delayed absorption and by 80.0% of those who were not aware or were unsure (Fisher's exact test, $p = 0.123$).

Discussion

This cross-sectional survey found that enteric-coated aspirin remains commonly used for acute chest pain in surveyed Ministry of Health settings in Saudi Arabia, despite guideline recommendations favoring non-enteric formulations in acute coronary syndromes [1-5]. More than half of the participants reported enteric-coated aspirin as the most commonly used formulation, and aspirin was more often reported to be swallowed whole rather than chewed. In the setting of enteric-coated aspirin, this practice might further delay absorption and onset of action in time-sensitive presentations.

An important finding of this study was that the observed practice pattern does not appear to be explained by a lack of clinician willingness to change alone. Most participants were aware that enteric-coated aspirin has delayed absorption, and a large majority indicated that they would prefer to use non-enteric aspirin if it were available. Similarly, most participants supported the standardization of non-enteric aspirin use for acute chest pain. Taken together, these findings suggested that the continued use of enteric-coated aspirin might be influenced more by system-level constraints than by clinician preference alone [10,11].

This interpretation was supported by exploratory analyses. Reported use of enteric-coated aspirin was substantially more common among participants who reported that non-

165 chewable aspirin; 5 participants (8.6%) were unsure of
166 the formulation used (Table 2).

167 Most participants (86.2%) reported that a 300-325 mg
168 dose is commonly administered for acute chest pain.
169 Aspirin was most often administered by swallowing the
170 tablet whole (58.6%), while 34.5% reported that it is
171 typically chewed (Figure 1).

172 Chart data embedded in the editable chart excludes the
173 0% category:

Response	Percentage
Enteric-coated aspirin	56.9%
Chewable aspirin	34.5%
Not sure	8.6%

178 Most participants (69.0%) indicated awareness that
179 enteric-coated aspirin has delayed absorption compared
180 with non-enteric formulations in acute coronary
181 syndromes. However, 43.1% believed that chewing or
182 crushing enteric-coated aspirin eliminates this delay.

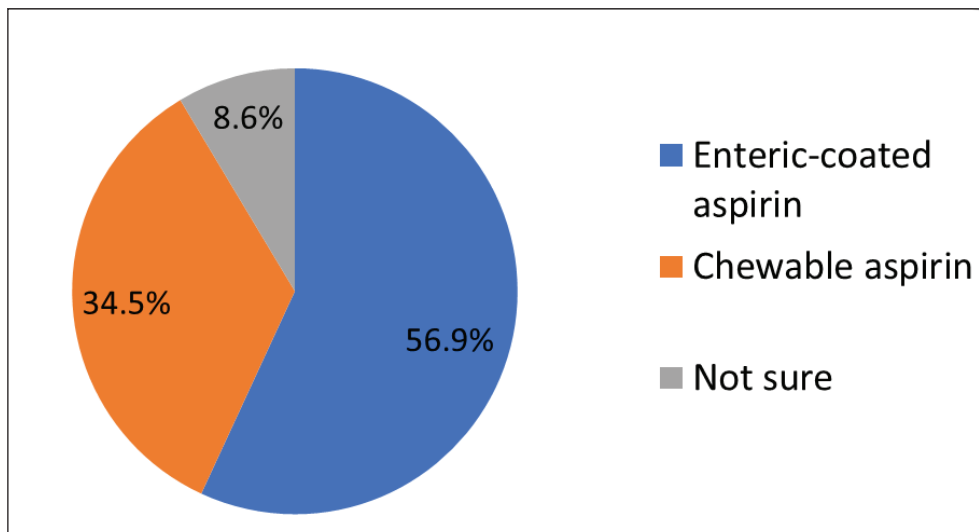


Figure 1. Most commonly used aspirin formulation for acute chest pain.

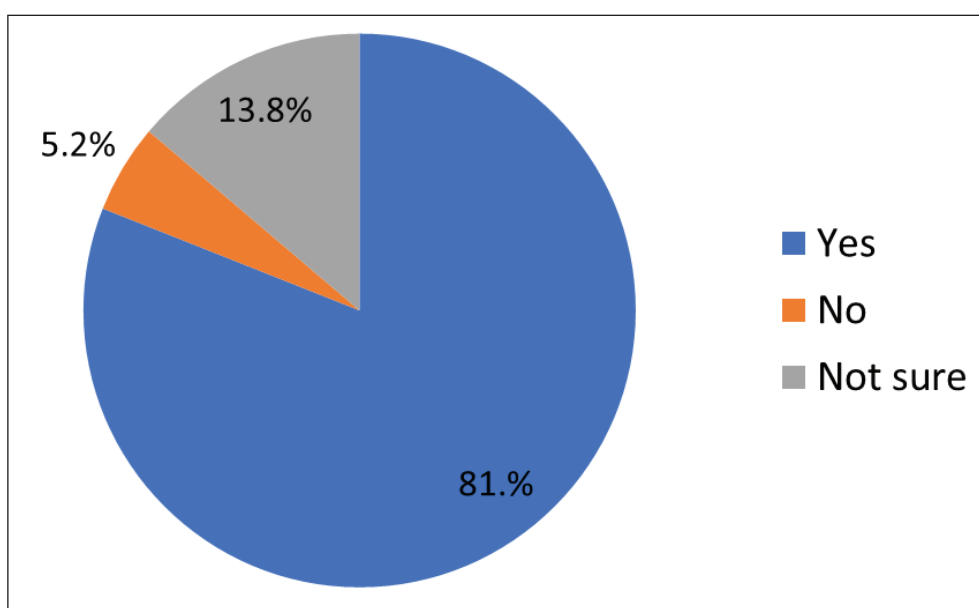


Figure 2. Availability of non-enteric aspirin formulations and willingness to change practice.

242 enteric aspirin was unavailable than among those who
 243 reported that it was available. By contrast, awareness of
 244 delayed absorption was not significantly associated with
 245 the formulation most commonly used. Although these
 246 analyses should be interpreted cautiously because of
 247 the modest sample size and exploratory design, it was
 248 suggested that availability might be a more important
 249 determinant of practice than knowledge alone.

250 The findings also highlighted an important knowledge
 251 gap. While most participants recognized that enteric-
 252 coated aspirin has delayed absorption, a substantial
 253 proportion believed that chewing or crushing enteric-
 254 coated aspirin eliminates this delay. This misconception
 255 is clinically relevant because it might lead clinicians
 256 to assume that modifying the tablet can compensate
 257 for an inherently slower formulation. In acute chest
 258 pain, that assumption might result in delayed effective

antiplatelet therapy. Targeted education might therefore 259
 be useful, particularly if it emphasized both the preferred 260
 formulation and the limitations of enteric-coated aspirin 261
 even when chewed or crushed [7]. 262

At the same time, education alone is unlikely to be 263
 sufficient. Participants frequently identified limited 264
 availability, procurement practices, and habitual use as 265
 reasons for enteric-coated aspirin use. These findings 266
 suggested that medication formulary decisions and supply 267
 processes might have an important influence on bedside 268
 practice. In this context, improving access to chewable or 269
 soluble aspirin might have a greater practical impact than 270
 isolated educational efforts [11,12]. 271

From a health systems perspective, aspirin represented 272
 a low-cost, high-impact intervention, and optimizing 273
 its formulation in acute chest pain might offer a simple 274
 opportunity to improve care quality without requiring 275

Table 3. System factors, knowledge, and willingness to change practice.

Variable	Frequency (Percentage) n (%)
Aware that enteric-coated aspirin has delayed absorption	
Yes	40 (69.0)
No	10 (17.2)
Not sure	8 (13.8)
Belief that chewing enteric-coated aspirin eliminates the delay	
Yes	25 (43.1)
No	16 (27.6)
Not sure	17 (29.3)
Availability of non-enteric aspirin in the facility	
Yes	19 (32.8)
No	23 (39.7)
Not sure	16 (27.6)
Reasons for enteric-coated aspirin use*	
Only formulation available	25
Habit / routine practice	12
Pharmacy procurement policy	11
Lack of awareness of alternatives	11
Concern about gastrointestinal side effects	9
Hospital or departmental policy	7
Would prefer non-enteric aspirin if available	
Yes	47 (81.0)
No	3 (5.2)
Not sure	8 (13.8)
Support the standardization of non-enteric aspirin use.	
Yes	45 (77.6)
No	4 (6.9)
Not sure	9 (15.5)

Participants could select more than one reason; therefore, responses are not mutually exclusive and totals may exceed the number of participants.

survey used a convenience-based recruitment strategy, and participation was voluntary. Because the survey was distributed through group-based communication channels and might have been secondarily shared, the exact number of eligible clinicians who received the survey could not be determined, and a formal response rate could not be calculated. This also raised the possibility of selection bias. Third, the sample size was modest, and participants were drawn predominantly from the Ministry of Health emergency settings, with emergency physicians comprising most participants. As a result, the findings might not be representative of all clinicians or all healthcare sectors in Saudi Arabia, including private hospitals and other governmental systems.

Fourth, the questionnaire was investigator-developed and, although reviewed for clarity and content validity, it was not formally psychometrically validated. This might limit confidence in the precision of some survey measures. Fifth, reported availability of aspirin formulations was based on participant perception and was not independently verified through pharmacy stock review or procurement records. Similarly, the study did not include direct observational data on medication administration. Finally, the study was designed primarily to describe practice patterns and identify potential system-level influences. It did not assess patient-level outcomes such as time to platelet inhibition, treatment delays, or clinical outcomes. The exploratory associations reported should therefore be interpreted cautiously and not as evidence of causality. Despite these limitations, the study provided useful insight into real-world aspirin use practices and identified potentially modifiable system-level factors that might contribute to variation in care.

Conclusion

In surveyed Ministry of Health settings in Saudi Arabia, enteric-coated aspirin remains commonly used for acute chest pain, despite guideline recommendations favoring non-enteric formulations. This practice appears to be influenced more by medication availability and other system-level factors than by clinician knowledge alone. The frequent use of enteric-coated aspirin, often administered swallowed whole, might represent an avoidable mismatch between evidence-based recommendations and real-world practice. These findings suggest that improving access to chewable or soluble aspirin, alongside targeted clinician education and clearer standardized pathways, may represent a simple and low-cost opportunity to improve medication standardization and patient safety. Further work across a broader range of Saudi healthcare settings would help determine the extent to which these findings apply beyond Ministry of Health facilities.

List of Abbreviations

ACS	Acute coronary syndrome	
ED	Emergency department	
IRB	Institutional Review Board	
MOH	Ministry of Health	

additional infrastructure or staffing [12]. The findings of this study therefore support consideration of system-level interventions such as formulary alignment, procurement review, and standardized acute chest pain pathways that specify non-enteric aspirin as the preferred formulation when appropriate.

More broadly, this study illustrated how variation in practice might reflect the structure of the system in which clinicians work rather than individual decision-making alone. In the Saudi healthcare context, where medication standardization and quality improvement are ongoing priorities, these findings might help inform efforts to align frontline practice with evidence-based recommendations [9].

This study had several limitations. First, it relied on self-reported practice, which might differ from actual bedside behavior. Participants might have described perceived or intended practice rather than observed practice, and social desirability bias cannot be excluded. Second, the

352	Conflict of interest	J. 2017;39(2):119–77. https://doi.org/10.1093/eurheartj/ehx393	395
353	The authors declare that there is no conflict of interest		396
354	regarding the publication of this article.		
355	Funding		
356	None.		
357	Consent to participate		
358	Informed consent was obtained from all the participants.		
359	Ethical approval		
360	The study involved an anonymous survey of healthcare		
361	professionals and did not include patients, patient data,		
362	biological samples, or clinical interventions. Given the		
363	minimal-risk nature of the study, it was submitted for ethical		
364	review and determined to be exempt from full Institutional		
365	Review Board review in accordance with Ministry of Health		
366	research ethics guidelines. All data were collected and		
367	analyzed in aggregate form.		
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