

**ROLE OF ARTIFICIAL INTELLIGENCE AS A DIAGNOSTIC TOOL IN FUNCTIONAL  
ABDOMINAL PAIN IN CHILDREN****Dr. Ankit Pal\* and Asst. Prof. (Dr) Laxmi**

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DOI: <https://doi.org/10.5281/zenodo.20962160>**How to cite this Article:** Dr. Ankit Pal\*, Asst. Prof. (Dr) Laxmi (2026). Role Of Artificial Intelligence As A Diagnostic Tool In Functional Abdominal Pain In Children. World Journal of Pharmaceutical and Medical Research, 12(7), 38-42. This work is licensed under Creative Commons Attribution 4.0 International license.

Article Received on 12/05/2026

Article Revised on 03/06/2026

Article Published on 01/07/2026

**ABSTRACT**

Functional Abdominal Pain Disorders (FAPDs) account for nearly 80% of chronic abdominal pain cases in children and are diagnosed according to Rome IV criteria in the absence of identifiable organic pathology. In classical Ayurveda, this clinical spectrum may be understood in relation to Grahani Roga and Udara Shoola, conditions primarily associated with dysfunction of Agni and imbalance of the Doshas, thereby offering a holistic and constitution-based approach to diagnosis and management. This review explores the current and emerging role of Artificial Intelligence (AI) in the diagnosis of paediatric FAPDs and proposes an integrative framework that incorporates Ayurvedic diagnostic methods such as Prakriti assessment, Nadi Pariksha, Ashtavidha Pariksha, and Agni Bala evaluation as structured multimodal inputs for AI-driven clinical decision support systems. A narrative review of the literature was conducted using PubMed, Google Scholar, AYUSH Research Portal, and AYUSHdhara databases from 2000 to 2026, employing search terms including functional abdominal pain, FAPDs, children, AI, machine learning, Grahani Roga, Prakriti, Nadi Pariksha, Agni, Dosh, gut-brain axis, and Rome IV. The findings suggest that AI-based approaches, including machine learning classifiers such as SVM, ANN, and Random Forest, natural language processing-based symptom extraction, gut-microbiome modelling, and neuroimaging analysis, demonstrate diagnostic accuracy ranging from 53% to 87.5% in phenotyping paediatric abdominal pain. At the same time, AI-enabled digitisation of Ayurvedic diagnostic tools, particularly sensor-based Nadi Pariksha and machine learning-based Prakriti classification, has shown promising accuracy of up to 90% in Dosh identification. The conceptual overlap between Grahani Roga, often considered comparable to irritable bowel syndrome, and FAPDs offers a strong basis for integrative research. In conclusion, an AI-integrated Ayurvedic diagnostic model combining Prakriti profiling, digital Nadi Pariksha, Agni Bala indices, and modern biomarkers may provide a personalised, culturally relevant, and clinically useful approach to the diagnosis and management of FAPDs in children. However, large-scale paediatric validation studies are still needed to establish its clinical utility.

**KEYWORDS:** Functional Abdominal Pain Disorders, Children, Artificial Intelligence, Machine Learning, Grahani Roga, Prakriti, Nadi Pariksha, Rome IV, Gut-Brain Axis, Ashtavidha Pariksha.**INTRODUCTION**

Recurrent abdominal pain represents one of the most prevalent gastrointestinal complaints encountered in paediatric clinical practice worldwide. Among these conditions, Functional Abdominal Pain Disorders (FAPDs) constitute the largest subgroup and are characterised by chronic or recurrent abdominal pain without any identifiable structural, inflammatory, infectious, or biochemical abnormality. According to the Rome IV criteria (2016), FAPDs include Functional Dyspepsia, Irritable Bowel Syndrome, Abdominal Migraine, and Functional Abdominal Pain–Not

Otherwise Specified. Epidemiological studies estimate that FAPDs affect nearly 13.5% of the global paediatric population, with relatively higher prevalence reported in South Asia and South America. These disorders significantly influence physical health, nutritional status, school performance, emotional stability, and overall quality of life of affected children and adolescents.

Despite their high prevalence and clinical importance, the diagnosis of FAPDs remains primarily symptom-based and dependent on exclusion of organic pathology through clinical evaluation and selective investigations.

The absence of reliable biomarkers, overlapping symptom profiles, and the subjective nature of symptom reporting often create diagnostic uncertainty. Consequently, children frequently undergo repeated consultations, unnecessary investigations, and prolonged therapeutic trials, which increase healthcare burden and psychological stress for both patients and caregivers. This limitation highlights the need for more objective, standardised, and reproducible diagnostic approaches.

Artificial Intelligence (AI), particularly Machine Learning (ML), has emerged as a transformative technology in modern medicine with the potential to improve diagnostic precision and clinical decision-making. AI systems are capable of analysing large and complex datasets, recognising hidden patterns, and generating predictive models based on clinical, laboratory, behavioural, and physiological variables. In gastroenterology, AI has already demonstrated promising applications in endoscopic image analysis, disease prediction, symptom clustering, and risk stratification. In the context of Functional Abdominal Pain Disorders, AI-based models may assist clinicians in differentiating functional conditions from organic diseases, predicting disease severity, identifying psychosocial contributors, and facilitating personalised management strategies.

Concurrently, increasing attention is being directed toward the integration of traditional medical systems with emerging digital technologies. In Ayurveda, the symptom complex of recurrent and functional abdominal pain can be conceptually correlated with Grahani Roga, a disorder involving impairment of Agni (digestive and metabolic fire), formation of Ama (metabolic toxins), and vitiation of Doshas, especially Vata and Pitta.

Classical Ayurvedic texts such as the Charaka Samhita and Sushruta Samhita provide detailed descriptions regarding the etiopathogenesis, symptomatology, and management of Grahani Roga. Acharya Kashyapa also described agitation (Shobh), fear (Traas), and mental strain caused by excessive study (Adhyayan) as causes of pain. Modern advancements in digital health technologies have enabled the development of AI-assisted tools for Ayurvedic diagnostics, including Prakriti assessment, Nadi Pariksha analysis, and predictive modelling based on Dosha predominance. Such innovations offer the possibility of integrating traditional Ayurvedic principles with evidence-based computational methods.

Therefore, the application of Artificial Intelligence in the diagnosis of Functional Abdominal Pain Disorders represents a significant advancement toward precision medicine, objective diagnostics, and integrative healthcare. AI-driven approaches may help bridge the gap between conventional symptom-based diagnosis and personalised patient-centred care while also creating opportunities for scientific validation and digital integration of Ayurvedic diagnostic concepts. The present study aims to explore the emerging role of AI in improving the diagnostic framework of Functional Abdominal Pain Disorders and its potential relevance within an integrative Ayurvedic perspective.

#### Rome IV Classification of FAPDs

The Rome IV criteria (2016) classify paediatric FAPDs into four subtypes, all requiring recurrent abdominal pain of at least 4 episodes per month over 2 months, without a better explanatory organic diagnosis:

Rome IV Subtype	Key Features	Ayurvedic Correlate
Irritable Bowel Syndrome (IBS)	Abdominal pain associated with alter bowel habits (constipation/diarrhoea/mixed)	Vataja / Pittaja / Kaphaja Grahani Roga.
Functional Dyspepsia (FD)	Epigastric pain, early satiety, nausea; no organic cause	Amlapitta, Ajirna, Pittaja Grahani.
Abdominal Migraine	Episodic periumbilical pain with pallor, anorexia, nausea.	Vataja Shoola with Manasika component.
FAP – Not Otherwise Specified	Does not meet criteria for IBS, FD, or abdominal migraine.	Tridoshaja Udara Shoola / Annavaaha Srotodushti.

#### Ayurvedic Diagnostic Tools Relevant to FAPDs in Children

##### Prakriti Pariksha (Constitutional Assessment)

*Prakriti* refers to the unique psychophysiological constitution of an individual, determined at conception by the relative predominance of the three *Doshas*. Assessment of *Prakriti* in children with abdominal pain provides critical insight into constitutional vulnerability: *Vata Prakriti* children exhibit heightened visceral sensitivity and irregular bowel habits; *Pitta Prakriti* children manifest inflammatory tendencies and hyperacidity; *Kapha Prakriti* children present with sluggish digestion, nausea, and heaviness. In

Kaumarabhritya (Ayurvedic Paediatrics), *Prakriti* assessment guides not only diagnosis but also dietary counselling, herbal selection, and Panchakarma planning.

##### Nadi Pariksha (Pulse Diagnosis)

*Nadi Pariksha* is one of the eight limbs of *Ashtavidha Pariksha* (eightfold examination). Through palpation of the radial artery with the index, middle, and ring fingers at the Vata, Pitta, and Kapha positions respectively, a skilled Ayurvedic physician identifies Dosha predominance, *Agni* status, and systemic imbalances. Classical texts describe the *Nadi* as moving like a serpent (*Vataja*), frog (*Pittaja*), or swan (*Kaphaja*), each

reflecting distinct physiological states. In children with *Grahani Roga*, the pulse typically reveals irregular Vata

characteristics with Pitta aggravation.

#### Ashtavidha Pariksha (Eightfold Examination)

	Ashtavidha Pariksha	Relevance to FAPDs in Children
1.	<b>Nadi</b>	Dosha identification, Agni status
2.	<b>Mala</b>	Grahani function, Dosha in Mala
3.	<b>Mutra</b>	Ama presence
4.	<b>Jivha</b>	Ama coating, Pachaka Pitta status
5.	<b>Sparsha</b>	Vata status, hydration, temperature
6.	<b>Akriti</b>	Constitutional body type
7.	<b>Druk</b>	Ojas level, Pittaja signs
8.	<b>Shabda</b>	Psychological distress, Vata aggravation

#### Agni Bala Pariksha (Assessment of Digestive Strength)

*Agni Bala* (strength of digestive fire) assessment is central to FAPD diagnosis in Ayurveda. The four states *Sama Agni* (balanced), *Vishama Agni* (irregular, Vata-predominant), *Tikshna Agni* (sharp, Pitta-predominant), and *Manda Agni* (sluggish, Kapha-predominant) — closely correspond to IBS-M, IBS-D, FD (hypersensitive), and IBS-C subtypes respectively. Clinical assessment of *Agni Bala* in children includes evaluation of appetite (*Kshudha*), digestion time, stool consistency, presence of *Ama* (tongue coating, foul odour, heaviness), and post-prandial symptoms.

#### Artificial Intelligence Approaches in Paediatric FAPD Diagnosis

##### Natural Language Processing NLP and Electronic Health Record Mining

Natural Language Processing (NLP) enables systematic extraction of Rome IV diagnostic criteria, alarm symptoms (rectal bleeding, weight loss, fever, family history of IBD), and psychosocial risk factors from unstructured clinical notes in electronic health records. In paediatric gastroenterology, NLP-based clinical decision support tools can reduce unnecessary colonoscopy and advanced imaging while improving adherence to evidence based diagnostic algorithms. This mirrors the Ayurvedic principle of *Prashnottara Pariksha* (structured history-taking) a systematic enquiry into *Nidana* (causative factors), *Purvaroop* (prodromal symptoms), and *Roopa* (manifest symptoms).

#### AI and the Gut Microbiome: The Agni-Microbiome Interface

Contemporary research establishes a compelling parallel between the Ayurvedic concept of *Agni* and the gut microbiome: both are central determinants of digestive capacity, immune regulation, and systemic health.

*Grahani Roga* - with its emphasis on *Ama* (toxic metabolites of impaired digestion) — anticipates the modern concept of dysbiosis. AI methods, particularly transformer-based language models pre-trained on large microbiome datasets, have achieved state-of-the-art performance for IBD and IBS prediction and hold strong potential for FAPD subtype classification in children.

#### Neuroimaging and the Gut-Brain Axis

The Ayurvedic concept of *Manasika Dosha* involvement in *Grahani Roga* - with *Manovaha Srotas* (psychological channels) vitiation contributing to gut dysfunction - parallels the central sensitisation and dysregulated gut-brain axis pathology of modern FAPDs. AI models using resting-state fMRI functional connectivity features have successfully differentiated IBS from healthy controls, while fNIRS-based neural activity combined with food preference data achieved 72.3% accuracy for Disorders of Gut-Brain Interaction (DGBI) and 77.1% for Functional Dyspepsia.

#### AI-Powered Digital Nadi Pariksha

The digitisation of *Nadi Pariksha* through sensor-based technologies represents one of the most exciting frontiers in integrative AI-Ayurveda research. Sensor-based *Nadi Pariksha* devices - using piezoelectric, pressure, and photoplethysmography (PPG) sensors to acquire radial artery waveforms - combined with AI signal processing algorithms have demonstrated the technical feasibility of automated Dosha assessment. The commercially available *Nadi Tarangini* device (patented, AYUSH-linked) analyses 22 Ayurvediparameters including Tridosha balance, digestive health, and stress markers through AI powered predictive analytics.

A comprehensive review of 67 studies confirmed six active research themes in automated **Nadi Pariksha**: sensor/device development, signal preprocessing, feature extraction (time and frequency domain), feature selection, machine learning classification, and disease diagnosis. For paediatric FAPD assessment, digital Nadi Pariksha could objectively characterise the Vataja, Pittaja, or Kaphaja pulse patterns associated with specific FAPD subtypes, providing a reproducible, non-invasive, and culturally validated biomarker.

#### Proposed Integrative AI-Ayurveda Diagnostic Framework for Paediatric FAPDs

We propose a novel four-tier integrative diagnostic framework combining Ayurvedic diagnostic tools with AI-enabled modern investigations.

Tier	Domain	Inputs	AI Method	Output
I	Ayurvedic Constitutional Profiling	Prakriti questionnaire (AYUSH/CCRAS 24-item), Agni Bala checklist, Ashtavidha Pariksha, Digital Nadi Pariksha waveform.	ML-based Prakriti classifier (MNB/SVM); ANN for Nadi signal classification.	Dosha predominance; Agni status; Constitutional FAPD subtype prediction.
II	Symptom & History Analysis	Structured Rome IV symptom questionnaire; Alarm feature checklist; Psychosocial stress score; Dietary history.	NLP-based EHR extraction; Rule-based alarm flag algorithm.	Rome IV subtype classification; Organic disease risk score.
III	Biomarker Integration	Fecal calprotectin; Occult blood; CBC; CRP; H2 breath test; Gut microbiome (16S rRNA).	Random Forest / SVM multi-biomarker classifier; Transformer microbiome model.	Organic vs functional probability score; Microbiome-based Subtype.
IV	Neuroimaging/Advanced	fNIRS brain activity (optional); Food preference data; Wearable autonomic data	Deep learning gut-brain axis model	DGBI phenotype; Visceral hypersensitivity index

Outputs from all four tiers feed into a **Clinical Decision Support System (CDSS)** generating: (a) a probable FAPD subtype per Rome IV; (b) an Ayurvedic Dosha-based diagnosis (Vataja/Pittaja/Kaphaja/Sannipatika Grahani); (c) a personalised management recommendation integrating *Ahara* (diet), *Vihara* (lifestyle), *Aushadha* (herbal medicine), and *Panchakarma* where indicated; and (d) a risk-stratified recommendation for further investigation or specialist referral.

### AI in Excluding Organic Mimics: Protecting the FAPD Diagnosis

Ayurvedic diagnosis of *Grahani Roga* itself demands the exclusion of *Atisar* (infective diarrhoea), *Gulma* (abdominal masses), *Udara Roga* (abdominal swellings), and other organic conditions. Similarly, AI tools have been validated for the triage and exclusion of important organic paediatric abdominal conditions.

Condition	AI tool	Evidence level
Acute Appendicitis	ML classifier (CBC-based, n=2,379); validated by ROC, calibration, decision curves	External validation
Ileocolic Intussusception	Deep learning on plain abdominal radiographs; multi-centre validation.	External validation
Inflammatory Bowel Disease	Fecal calprotectin + ML; fMRI gut-brain models distinguishing organic from functional	Pilot studies
Celiac Disease	AI-assisted endoscopy (Marsh score); serological ML models	Emerging

### Limitations and Challenges

The integration of AI with Ayurvedic tools in paediatric FAPD faces challenges spanning technical, clinical, regulatory, and philosophical dimensions.

- **Paediatric Dataset Scarcity:** Children are underrepresented in AI training data. FAPD-specific paediatric datasets are particularly scarce, limiting model generalisability across developmental stages.
- **Model Explainability:** Most ML models function as 'black boxes', incompatible with Ayurveda's emphasis on transparent, reasoned diagnosis rooted in classical texts. Explainable AI (XAI) methods are essential for clinical adoption.
- **Absence of Gold Standard Biomarker:** FAPDs have no validated biological gold standard. AI models trained on Rome IV labels inherit the subjectivity of the symptom-based diagnostic system.
- **Ethics, Privacy and Consent:** Data collection from minors requires rigorous institutional ethics

approval, parental consent, and assent from older children. Cultural sensitivity regarding the digitisation of traditional diagnostic practices must also be addressed.

- **Validation in Indian Paediatric Populations:** Most published AI models are trained on Western cohorts. Given the higher FAPD prevalence in South Asia, India-specific paediatric cohort studies are critically needed.

### CONCLUSION

Functional Abdominal Pain Disorders in children represent a complex, heterogeneous, and poorly biomarked clinical challenge. Artificial Intelligence offers transformative potential for phenotyping patients, excluding organic mimics, and integrating multi-domain data - clinical, biochemical, microbiome, and neuroimaging - into personalised diagnostic models. Crucially, classical Ayurveda offers a rich, validated, and culturally resonant diagnostic framework through

*Grahani Roga* characterisation, *Prakriti Pariksha*, *Nadi Pariksha*, *Agni Bala* assessment, and *Ashtavidha Pariksha* - all of which are now being digitised and AI-enabled. The conceptual convergence of the Ayurvedic gut-Agni-mind triad with the modern gut-brain-microbiome axis is particularly compelling, and suggests that Ayurveda offers not merely a complementary but a foundational conceptual framework for understanding FAPDs.

## REFERENCES

- Vandenplas Y, Darma A, Indrio F, et al. Understanding functional abdominal pain disorders among children: a multidisciplinary expert consensus statement. *Front Pediatr*, 2025; 13: 1576698.
- Apley J, Naish N. Recurrent abdominal pains: a field survey of 1,000 school children. *Arch Dis Child*, 1958; 33(168): 165–170.
- Hyams JS, Di Lorenzo C, Saps M, et al. Childhood functional gastrointestinal disorders: child/adolescent. *Gastroenterology*, 2016; 150(6): 1456–1468.
- Drossman DA. Functional gastrointestinal disorders: history, pathophysiology, clinical features and Rome IV. *Gastroenterology*, 2016; 150(6): 1262–1279.
- Charaka Samhita, Chikitsa Sthana 15 (Grahani Dosha Chikitsa Adhyaya). Krishnamurthy KH, Sharma PV, eds. Varanasi: Chowkhamba Sanskrit Series; 2009.
- Sushruta Samhita, Uttara Tantra 40 (Grahani Roga Nidana). Kaviraja KL, ed. Varanasi: Chowkhamba Sanskrit Series; 2010.
- Vagbhata. Ashtanga Hridayam, Nidana Sthana 12. Srikantha Murthy KR, ed. Varanasi: Krishnadas Academy; 2000.
- Patel A, Shah R, Mehta C. Efficacy of whole system Ayurveda protocol in irritable bowel syndrome a randomized controlled clinical trial. *J Ayurveda Integr Med*, 2023; 14(2): 100598. PMC10105243.
- Schnedl WJ, Schenk M, Michaelis S, et al. Functional abdominal pain disorders in children may be associated with food intolerance/malabsorption. *Children*, 2023; 10(9): 1444.
- Singh B, Rao M, Thakur A. Enhancing Ayurvedic diagnosis using Multinomial Naïve Bayes and K-modes clustering: an investigation into Prakriti types and Dosha overlapping. *arXiv*, 2023. arXiv: 2310.02920.
- Prakriti200: A questionnaire-based dataset of 200 Ayurvedic Prakriti assessments. *IEEE DataPort*, 2024. DOI: 10.21227/k748-f379. arXiv: 2510.06262.
- Vijayan V, Ajitha K. A review article on exploring the scope of AI in Ayurveda. *Kerala J Ayurveda*, 2024; 3(2). DOI: 10.55718/kja.297.
- Patel K, Shreekumar T, Rajesh S. Nadi Pariksha — an Ayurvedic technique to diagnose diseases using IoT and machine learning. *Proceedings of 2nd IEEE International Conference on Advances in Information Technology (ICAIT)*, 2024.
- Sonavane SS, et al. A comprehensive review on technological advancements for sensor-based Nadi Pariksha. *J Ayurveda Integr Med*, 2024. DOI: 10.1016/j.jaim.2024. PMID: 38815517.
- Manjunatha YC, Raghu B, Kumar YCP. Nadifit, data-driven diagnosis: a clinical study for evaluating significance of traditional Chinese medicine organ patterns through pulse diagnosis (Nadi Pariksha). *Int J Community Med Public Health*, 2024; 11(4): 1661–1666.
- Artificial intelligence in personalized Ayurveda: transforming Prakriti-based health care through digital health innovation. *Int J Ayurveda Res*, 2026; 13: 4476–4481.
- Majhi V, Choudhury B, Saha G, Paul S. Development of a machine learning-based Parkinson's disease prediction system through Ayurvedic Dosha analysis. *Int J Ayurvedic Med*, 2023; 14(1): 180–189.
- Zhao J, Tian Z, Li Y, et al. Support vector machine-based differentiation of IBS patients using fMRI functional connectivity features. *Front Neurosci*, 2022.
- National Ayush Mission. NAMASTE Portal — National Ayush Morbidity and Standardised Terminologies Electronic Portal. Ministry of AYUSH, Government of India; 2023.
- De Palma G, Collins SM, Bercik P. The microbiota-gut-brain axis in functional gastrointestinal disorders. *Gut Microbes*, 2014; 5: 419–429.
- Paul MK, Khobragade N. Descriptive and comparative study of Ashta Udara Roga: an Ayurvedic review. *J Ayurveda Integr Med Sci*, 2024.
- An integrated literary review on Grahani Roga (IBS). *IJCRT*, 2026; 14(1). ISSN: 2320-2882.