Revista Española de Enfermedades Digestivas
The Spanish Journal of Gastroenterology

Title:
Exploring the predictive power of a combined model of cellular indices and food allergies in the screening for eosinophilic esophagitis in children

Authors:
Julio César Moreno-Alfonso, Rocío del Campo-Pedrosa, Ada Molina Caballero, Alberto Pérez Martínez, María Concepción Yárnoz Irazábal

DOI: 10.17235/reed.2025.11294/2025
Link: PubMed (Epub ahead of print)

Please cite this article as:
Moreno-Alfonso Julio César, del Campo-Pedrosa Rocío, Molina Caballero Ada, Pérez Martínez Alberto, Yárnoz Irazábal María Concepción. Exploring the predictive power of a combined model of cellular indices and food allergies in the screening for eosinophilic esophagitis in children. Rev Esp Enferm Dig 2025. doi: 10.17235/reed.2025.11294/2025.

Revista Española de Enfermedades Digestivas
The Spanish Journal of Gastroenterology

Exploring the predictive power of a combined model of cellular indices and food allergies in the screening for eosinophilic esophagitis in children

Julio César Moreno-Alfonso[1,2]; Rocío del Campo-Pedrosa[3]; Ada Molina Caballero[1]; Alberto Pérez Martínez[1]; María Concepción Yárnoz Irazábal[2,4]

1: Pediatric Surgery Department. Hospital Universitario de Navarra. Calle Irunlarrea, 3. C.P. 31008. Pamplona, Navarra; Spain.

2: Doctoral School of Health Sciences. Universidad Pública de Navarra (UPNA). Pamplona, Navarra; Spain.

3: Department of Mechanical Engineering, University of La Rioja, C.P. 26006. Logroño, La Rioja; Spain.

4: General and Digestive Surgery Department. Hospital Universitario de Navarra. Calle Irunlarrea, 3. C.P. 31008. Pamplona, Navarra; Spain.

Corresponding author:

Julio César Moreno-Alfonso

email: juliomoreno.md@gmail.com

ORCID: https://orcid.org/0000-0002-0414-2888

Conflict of interest and funding: None to declare.

Keywords: Eosinophilic esophagitis. Biomarker. Food allergy. Dysphagia. Screening. Esophagus. Endoscopy. Pediatrics.

Revista Española de Enfermedades Digestivas
The Spanish Journal of Gastroenterology

Dear Editor,

Eosinophilic esophagitis (EoE) typically presents with dysphagia and is frequently linked to food allergies (FA), although esophagoscopy remains essential for diagnosis as no dependable diagnostic biomarkers are currently available (1,2). While cellular indices obtained from the hemogram have been evaluated as diagnostic markers in EoE, their utility when combined with FA history for screening EoE remains uninvestigated (3). This research explores the predictive power of combined models of cellular indices and FA history for EoE screening through a diagnostic study of patients <15 years old undergoing esophagoscopy for suspected EoE in a children's hospital between 2015 and 2022 (Reg. 341E/2023). Patients with EoE histologically confirmed and those with normal biopsies (NEoE) were included, while children with other esophageal diseases were excluded. Using logistic regression models, we compared FA, the eosinophil-to-lymphocyte ratio (ELR) and eosinophil-to-neutrophil ratio (ENR), calculated as the quotient of the respective cell counts and posteriorly dichotomized using optimal cutoff values derived from the Youden index. Different combinations of these features were analyzed through predictive models to determine their performance for screening EoE. Internal validation of the models was performed using bootstrap techniques (n = 1,000) and confounding factors such as eosinophilic diseases and atopic comorbidities were controlled. During this period, 46 endoscopies were performed for suspected EoE. Ultimately, 24 patients with EoE and 17 with NEoE were included. The best predictive model for EoE included FA, ELR and ENR, yielding a sensitivity of 79%, positive predictive value (PPV) of 83%, and false negative rate of 20% (**Table 1**). Recent investigations have explored the role of cellular indices in EoE diagnosis, demostrating that ENR with a cut-off of 0.113 and an AUC of 0.782, achieved a sensitivity of 83%, specificity of 64%, and PPV of 77% (3,4). While these results are comparable to ours, that paper did not evaluate the indices in a screening context nor incorporate FA history. Thus, direct comparability remains limited, as this is the first study to assess these combined predictive models as potential biomarkers for EoE screening.

Revista Española de Enfermedades Digestivas
The Spanish Journal of Gastroenterology

Moreover, there are currently no validated screening pathways for EoE, which highlights the potential utility of the proposed predictive model. In fact, if applied to the described population, a total of 13 unnecessary endoscopies and general anesthesias could be avoided, saving approximately €20,000. Additionally, the operating rooms could have been used to treat other patients; although five EoE cases would have remained undiagnosed. Whilst our findings are exploratory and prospective multicenter studies with larger sample sizes are needed for external validation, the combination of FA history, ELR, and ENR appears promising as a practical tool for identifying patients with suspected EoE. This model could assist in the primary care setting by prioritizing gastroenterology consultations and endoscopic procedures when positive (FA [+], ELR ≥0.25, ENR ≥0.12), or support the consideration of less invasive initial evaluations in those below this threshold (FA [–], ELR <0.25, ENR <0.12. Finally, as cellular indices are obtained from the hemogram, they may be influenced by acute inflammatory diseases; therefore, this should be considered to avoid false-positive results**.**

Revista Española de Enfermedades Digestivas
The Spanish Journal of Gastroenterology

REFERENCES

1. Furuta EJM, Atkins D, Furuta GT. Diagnosing eosinophilic esophagitis in pediatric patients. Expert Rev Gastroenterol Hepatol. 2025;19(2):145-153. DOI: 10.1080/17474124.2025.2462221
2. Carucci L, Votto M, Licari A, Marseglia GL, Berni R. Food allergy: cause or consequence of pediatric eosinophilic esophagitis? Potential implications of ultraprocessed foods in prevention and management. Front Allergy. 2023;4:1138400. DOI: 10.3389/falgy.2023.1138400
3. Moreno-Alfonso JC, Barbosa-Velásquez S, Molina Caballero A, Pérez Martínez A, Yárnoz Irazábal MC. Exploring the role of eosinophil cell indices in diagnosing eosinophilic esophagitis. An Pediatr. 2025. In Press. DOI: 10.1016/j.anpedi.2025.503809
4. Moreno-Alfonso JC, del Campo-Pedrosa R, Beher A, Molina Caballero A, Pérez Martínez A, Yárnoz Irazábal MC. Exploring a predictive model for screening eosinophilic esophagitis in children with dysphagia. Rev Esp Enferm Dig. 2025. In Press. DOI: In Press

Revista Española de Enfermedades Digestivas
The Spanish Journal of Gastroenterology

Table 1. Demographic and analytical characteristics of the studied population and predictive power of combined models in eosinophilic esophagitis.

Variable	NEoE (n = 17)	EoE (n = 24)	*p* Value
Age (years)	12.9 (10.1 -14.3)	11.2 (9.4 -13.1)	0.213
Female n (%)	10 (58.8 %)	9 (37.5 %)	0.302
Male n (%)	7 (41.2 %)	15 (62.5 %)	
FA history n (%)	5 (29.4%)	14 (**58.3**%)	0.131
Lymphocytes	2324/mm^3 (2061-3448)	2998/mm^3 (2020-3362)	0.685
Neutrophils	3168/mm^3 (1976-3960)	2481/mm^3 (1998-2654)	0.184
Eosinophils	261/mm^3 (130-381)	636/mm^3 (375-954)	**0.005**
ELR	0.11 (0.07-0.17)	0.26 (0.16-0.33)	**0.003**
ENR	0.08 (0.05-0.14)	0.24 (0.14-0.39)	**0.002**

Predictive model	**ENR + FA**	**ELR + FA**	**ENR + ELR + FA**

Revista Española de Enfermedades Digestivas
The Spanish Journal of Gastroenterology

AUC	0.772	0.838	**0.864**
Cut-off point	FA (+) ENR= 0.12	FA (+) ELR= 0.25	FA (+) ENR= 0.12 ELR= 0.25
Sensitivity	83% (68-98)	**88**% (74-100)	79%
Specificity	65% (42-87)	65% (42-87%)	**76**%
PPV	77% (61-93)	78% (62-93)	**83**%
NPV	73% (51-96)	**79**% (57-100)	72%
LR+	2.36 (1.21-4.61)	2.48 (1.28-4.8)	**3.36** (1.39-8.12)
LR-	0.26 (0.10-0.66)	**0.19** (0.06-0.59)	0.27 (0.12-0.62)
PTP (+)	70% (55-82)	71% (56-83)	**77**% (58-89)
PTP (-)	20% (9-40%)	**16**% (6-37%)	21% (11-38)
FNR	16.6% (4/24)	**12.5**% (**3**/24)	20% (5/24)
FPR	35% (**6**/17)	35% (6/17)	**23**% (**4**/17)
Clinical value in screening	Model with moderate screening performance. A total of 26 out of 41 patients would undergo endoscopy, while four	Most sensitive model. While a greater number of endoscopies would be conducted (n=27/41), it would fail	Most specific model. Only **23** out of 41 endoscopies would be performed, but five EoE patients

	cases of EoE would undetected.	to identify fewer EoE cases (n=**3**/24) than the other models.	would remain undiagnosed.

Bold values represent statistically significant differences or better performance of a metric. **FA:** Food allergy; **AUC**: Area under the receiver operating characteristic curve; **PPV**: Positive predictive value; **NPV**: Negative predictive value; **LR+**: Positive likelihood ratio; **LR-**: Negative likelihood ratio; **PTP (+)**: Post-test probability for a positive result; **PTP (-)**: Post-test probability for a negative result; **FNR**: False negative rate; **FPR**: False positive rate.