Original Article

# Study on knowledge of front-of-pack labeling and food group-based dietary intake among chronic gastritis patients

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## Abstract

**Introduction:** Chronic gastritis is one of the most prevalent disorders affecting individuals, which affects hundreds of millions of people in different ways around the world. The significant incidence of poor dietary quality and diet-related illnesses may be addressed by orienting customers toward healthier food options. The objective of the study was to estimate the knowledge of front-of-package labels (FoPLs) and food group-based dietary intake of nutrients among patients with chronic gastritis. **Materials and Methods:** The study design was a hospital-based cross-sectional study that was done in Guntur district of Andhra Pradesh. The study population included 208 chronic gastritis patients between 20 to 60 years of age selected by systematic sampling. Detailed information on sociodemographic and lifestyle factors was collected using a questionnaire and 24-h dietary recall was done. The objective assessment of Knowledge of FoPLs was assessed mock package images representing a fictional brand to prevent other factors from interfering with product evaluation. **Results:** A total of 208 patients were studied with a near-equal proportion of males and females. Among participants, more than half (57.2%) can interpret FoPL, more than three-fourths (77.4%) have a belief that they eat a healthy diet mostly and only half (52.4%) of participants are somewhat knowledgeable about nutrition, and finally almost half (46.6%) of participants are not seeing the FoP label during food purchase. The mean score of knowledge of FoP labeling was 0.92 ± 1.135. Knowledge of FOPL was positively associated with the age of study participants OR 0.178 (95% CI: 0.178 to 0.856) with *P* value = 0.02. Grains have the maximum intake among all the food groups with a mean intake of 123.21 g/day. **Conclusion:** The majority of participants do not know the food labeling, thus methods of education that focus on dietary interventions are urgently needed to raise awareness among the people.

**Keywords:** Chronic gastritis, food group based, front-of-package labeling, Nutri-Score, packed food

## Introduction

Chronic gastritis (CG) affects hundreds of millions of people in various ways worldwide.[1] Stomachache and gastric distention, the most common symptoms of chronic gastritis, are associated with irregular mealtimes, irregular meal portions, dining out, meats, fried meals, sour foods, sweets, snacks, and salty foods consumption.[2] The significant incidence of poor dietary quality and diet-related illnesses may be addressed by orienting customers toward healthier food options.

Front-of-package labels (FoPLs) are being used more often on food products to give targeted nutritional information or

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representations, for educating consumers on the nutritional value of food, and for promoting healthier lifestyle choices, frequently based on nutrient profiling methods.[3] Currently, different labeling designs have been developed. For example, Health Star Rating system, Multiple Traffic Lights, Nutri-Score, Reference Intakes, and Warning symbols.[4] Family physicians play a crucial role in promoting health and providing comprehensive care to individuals and families. Although their direct involvement in FoP labeling may vary depending on the specific context and healthcare system, they can contribute in several ways including health education, nutrition guidance, and advocacy.

Multiple cross-sectional studies using used self-developed questionnaires, and web-based surveys are conducted on FoPL in the past.[5-11] There is a lack of research in the Indian population on the knowledge of FoPL among chronic gastritis patients using mock images of food products. In addition, there is a lack of literature regarding the knowledge of patients on FoPL with mock images in the local language. The present study was done to estimate the knowledge of FoPLs and food group-based dietary intake of nutrients among patients of chronic gastritis in the outpatient department in tertiary care hospitals using bilingual mock food product packages.

## Materials and Methods

In 2022, cross-sectional research was carried out in the outpatient department of the tertiary care facility, AIIMS Mangalagiri, Andhra Pradesh, India. The study included male and female CG patients between the ages of 20 and 60 years. A patient having symptoms of gastritis at least once per week for the previous 6 months or taking any antacid formulations once per week for the previous 6 months to meet the inclusion criteria. Histologically diagnosed cases of CG or endoscopically diagnosed cases of CG were also included. Patients who would not consent, people who were very sick, pregnant women, people with cancer and HIV, and those who need surgery were all excluded from the study.

According to research from China,[1] 25.1% of CG patients reported eating spicy food. This was used to determine the sample size. After taking into account absolute precision of 6% and a 95% confidence level, the final sample size was determined to be 208. To enroll patients, a systematic sampling strategy was used. Using a questionnaire, comprehensive data on sociodemographic and lifestyle characteristics was obtained. Age, gender, employment, education, marital status, use of tobacco, alcohol, and other drugs, physical activity levels, family history of noncommunicable illnesses, and previous medical treatment histories were all included in the current study.

The objective assessment of knowledge of FoPLs was assessed using mock package images representing a fictional brand to prevent other factors from interfering with product evaluation (e.g. familiarity, loyalty, and habit). The mock package images were created to resemble real food products, and a zoom function will be developed to allow participants to enlarge any area of the package, including the FoPL. Within three food categories, namely, beverage (juices, milk products, etc.), ready-to-eat (biscuits, chips, etc.), easy to cook (noodles, pasta, etc.), a set of three products with distinct nutritional profiles (lower, intermediate, and higher nutritional quality) was created to allow ranking. No other nutritional information or quality indicators (e.g. organic certification) appeared on the mock package images, so as not to influence participants' perceptions of the products.

Nutri-Score for mock images is an algorithm that gives points for each element in the nutrition table (per 100 g or ml), which means bad nutrients (energy, sugars, saturated fats, and sodium) and good nutrients (protein, fiber, and percentage of fruit and vegetable). We then subtract the positive points from the negative ones and convert them to a Nutri-Score table.[12] All eligible patients presenting to the outpatient department (OPD) were systematically sampled using a random number. They were provided participant information sheet that explains the objectives and procedure of the study and the rights of the participants. If the patient agrees to participate, written consent was taken from the participant. The study participants were interviewed according to the interview schedule. The participants were given random nine mock package images to cover different food categories to interpret and one option from tick "A" (highest nutritional value) to "E" (lowest nutritional value) for that image. Based on the distribution of FoPL knowledge, a score less than 3 was considered to be no knowledge, 3 to 6 some knowledge, and more than 6 good knowledge of FoP labeling. The minimum possible FoPL score was zero and the maximum possible score was nine. The survey was conducted until the final sample size was achieved. Institute Ethics Committee approval was obtained [AIIMS/MG/IEC/2022-23/172]. All coronavirus disease 2019 (COVID-19) precautions were followed during the data collection.

Means and standard deviations were used to represent continuous data, and proportions were used to show categorical variables. A significance test was conducted using the independent *t* test and $X^2$ tests. Logistic regression analysis was used to estimate the association of knowledge of FoPL. The statistical analyses of the data were performed using Statistical Package for the Social Sciences (SPSS) V.23.0 software package and Dietcalc software to estimate the food group-based dietary intake. A $P < 0.05$ (two-tailed) was considered significant.

## Results

A total of 208 participants were enrolled in this study. Males and females participants were near equal proportions. Approximately 73% of participants were more than 40 years of age. Over half (58.65%) of the study participants were working [Table 1].

Table 2 shows diabetes mellitus was the commonest morbidity present among almost half (44.7%) of participants followed by the coexistence of diabetes mellitus and hypertension (13.9%).

Table 3 shows in group 1, grains, almost everyone (207) had grains in the last 24 h in which the minimum intake is 15.0 g/day to maximum intake is 301.0 g/day, the mean intake is (123.21 g/day), the median is (123 g/day) and the standard deviation is (123.0 g/day). In group 2, vegetables, only 168 participants consumed in the last 24 h with, which the minimum intake is (9.50 g/day) and the maximum intake is (910 g/day). In group 3, fruits, only 58 participants consumed fruits in the last 24 h with the mean intake being (59.79 ± 54.77 g/day). Protein-rich foods, 139 participants had protein-rich food in the last 24 h with a mean of 93.94 ± 49.97 g/day). Finally, in group 5, milk and milk products, 169 participants had it in the last 24 h with a mean of 122.27 ± 95.42 ml/day.

Table 4 shows more than half (59.1%) of participants are facing difficulty in reading English and almost three-fourths (74.5%) of participants are comfortable reading Telegu. Furthermore, more than half (57.2%) of participants can interpret FoPL. In the given participants, more than three-fourths (77.4%) of participants have a belief that they eat a healthy diet mostly and only half (52.4%) of participants is somewhat knowledgeable about nutrition, and finally, almost half (46.6%) of participants are not seeing the FoP label during food purchase.

Figure 1 shows a histogram depicting the frequency of knowledge of the FoP labeling score with a minimum score of 0 and a maximum score of 6. The mean score of knowledge of FoP labeling was 1.23 ± 1.12. The mean score of knowledge of FoP labeling was a median of 1.00 (IQR 2).

Table 5 shows the unadjusted and adjusted Odds Ratios for Knowledge on FoPL in the study population. On univariate analysis, knowledge of FoPL was significantly higher in the educational status of 10 standards or more OR 4.41. Middle class or higher socioeconomic status OR 2.49, with normal nutritional status OR 1.33, absence of any comorbidities OR 2.61, without any previous surgeries OR 1.11, with no drug usage for comorbidities OR 1.38 and not using alcohol and its products OR 4.76 participants had higher FoPL knowledge. Multiple Logistic regression was used to identify study participants knowing FoPL based on different variables with entry and removal probabilities of 0.05 and 0.2, respectively, was used. On adjusted knowledge of FoPL was positively associated with the age of study participants OR 0.178 (95% CI: 0.178 to 0.856) with *P* value = 0.02.

**Table 1: Sociodemographic distribution of study participants (*n*=208)**

| Variable | Category | *n* | % |
|---|---|---|---|
| Gender | Female | 111 | 53.37 |
| | Male | 97 | 46.63 |
| Age in years | ≤40 | 55 | 26.44 |
| | >40 | 153 | 73.56 |
| Occupation | Working | 122 | 58.65 |
| | Not working | 86 | 41.35 |
| Education status | 10 standard or more | 107 | 51.44 |
| | Less than 10 standards | 101 | 48.56 |
| Socioeconomic status | Upper Middle or higher | 145 | 69.71 |
| | Lower Middle or lower | 63 | 30.29 |
| Tobacco product used | No | 191 | 91.83 |
| Alcohol product used | No | 177 | 85.10 |

**Table 2: Distribution of participants based on morbidity (*n*=208)**

| Morbidity | *N* | % |
|---|---|---|
| Diabetes Mellitus, Hypertension | 29 | 13.9 |
| Diabetes Mellitus | 93 | 44.7 |
| Hypertension | 13 | 6.3 |
| Hypothyroidism | 23 | 11.1 |
| Diabetes Mellitus, Hypothyroidism | 8 | 3.8 |
| Hypertension, Diabetes Mellitus, Hypothyroidism | 3 | 1.4 |
| Hypertension, Hypothyroidism | 2 | 1.0 |
| Others | 16 | 7.7 |
| None | 21 | 10.1 |
| Total | 208 | 100.0 |

## Discussion

To our knowledge, this is the first of its kind study in India to quantify the knowledge of FoP labeling using Nutri-Score-based fictional food labels among chronic gastritis patients between 20 to 60 years of age in a tertiary care hospital in south India. In the present study, more than half (59.1%) of participants are facing difficulty in reading English and almost three-fourths (74.5%) of participants are comfortable in reading Telugu. More than three-fourths of the participants have a perception that they eat a healthy diet, which might be one of the major reasons behind the fact that only 46.6% of the participants see the FoPL before purchasing the product. Over half (52.4%) of participants are somewhat knowledgeable about nutrition and finally, almost half (46.6%) of participants are not seeing the FoP label during food purchases. These results were notably less compared with that of a similar study conducted across 14 states in India[5] in 2022 in which awareness of FoPL was widely held by almost

**Table 3: Summary of dietary intake of study participants by food groups in g/day (*n*=208)**

| Category | | *N* | Min | Max | Mean | SD | Median | IQR |
|---|---|---|---|---|---|---|---|---|
| Group 1 | Grains | 207.00 | 15.00 | 301.00 | 123.21 | 123.00 | 123.00 | 63.00 |
| Group 2 | Vegetables | 168.00 | 9.50 | 910.00 | 125.20 | 166.84 | 74.50 | 70.00 |
| Group 3 | Fruits | 58.00 | 1.92 | 160.00 | 59.79 | 54.77 | 40.00 | 80.14 |
| Group 4 | Protein-rich food | 139.00 | 16.08 | 208.90 | 93.94 | 49.97 | 80.00 | 82.49 |
| Group 5 | Milk and Milk Products (ml/day) | 169.00 | 2.00 | 546.00 | 122.27 | 95.42 | 99.00 | 121.50 |

**Table 4: Distribution of participants based on their language skills, their knowledge of nutrition and diet and in interpreting FoPL (*n*=208)**

| Variable | Category | Frequency | Percent |
|---|---|---|---|
| Can read English | Yes | 85 | 40.9 |
| Can read Telugu | Yes | 155 | 74.5 |
| Self-perception can interpret FoPL | Yes | 119 | 57.2 |
| | No | 63 | 30.3 |
| | May be | 26 | 12.5 |
| Self-estimated diet quality | I eat a mostly healthy diet | 161 | 77.4 |
| | I eat a mostly unhealthy diet | 18 | 8.7 |
| | I eat a very healthy diet | 22 | 10.6 |
| | I eat a very unhealthy diet | 7 | 3.4 |
| Perception about their nutrition knowledge | I am not very knowledgeable about nutrition | 32 | 15.4 |
| | I am somewhat knowledgeable about nutrition | 109 | 52.4 |
| | I am very knowledgeable about nutrition | 18 | 8.7 |
| | I do not know anything about nutrition | 49 | 23.6 |
| The proportion of Participants who see FoP labels during food purchase | No | 97 | 46.6 |
| | May be | 19 | 9.1 |
| | Yes | 92 | 44.2 |
| Total | | 208 | 100.0 |

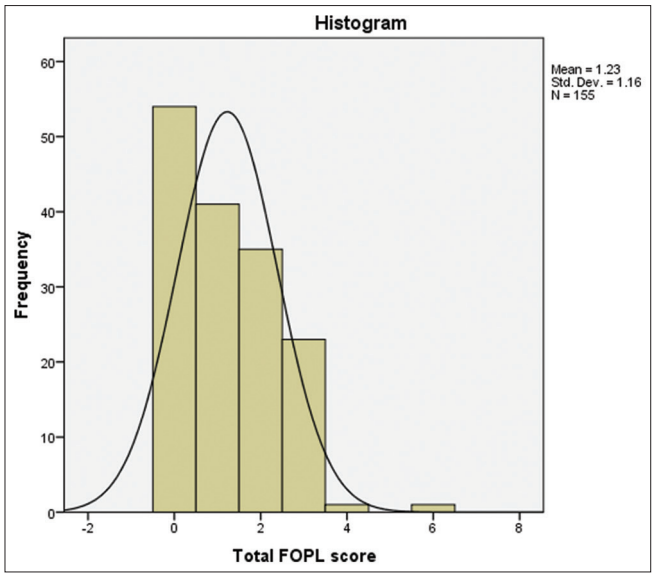


**Figure 1:** Histogram depicting the frequency of knowledge of front-of-package labeling among study participants (*n* = 155)

95% of the participants, France (81.5%),[13] France (97%)[6] using a web-based questionnaire. This difference may be due to the difference in study tools as the present study used mock images of food packages with patient interpretation based on nutrient content. On the contrary, a study from Italy in 2022, recorded that only around 36% of the participants considered the information on FoPL useful, the results of the present study were higher. This may be due to the reason that the acceptance of Nutri-Score as a guide for nutritional choices was seemingly low in the study in Italy.[7]

In comparison with the results of the present study which recorded that, 44.2% always see the FoPL, similar results were obtained in a study conducted in Lebanon in 2022, in which about half (46.5%) of the participants reported to always look at the food label.[11] This similarity may be because both studies majorly involved participants belonging to similar age groups. Only around 40% of the participants involved in the current study could read English, which could be the major reason behind the recorded lower percentage of participants who could interpret FoPL. Most of the participants involved in the study were illiterate and only three-fourths of the participants could read Telugu (the local language), which could be considered a reason for some of the participants, totally not responding to FoPL. Although, there is a clear advantage of FoPL being printed in the local language as it could be understood by a greater population than that of the label being printed in English, however, this too cannot be understood by a part of the population. Hence, there is a compelling need to develop a universal method of FoPLs that could be easily understood and interpreted by any person regardless of his/her educational status. Newer approaches to FoPL-like color coding and Nutri-Score must be implemented as they can be easily deciphered by people of all age groups and all educational categories. Although the primary responsibility for regulating and implementing FoP labeling lies with governmental agencies and food industry stakeholders, family physicians can play a vital role in educating, guiding, and advocating for their

**Table 5: Unadjusted and adjusted odds ratios for factors associated with knowledge on front-of-package labeling among study participants**

| Variable | Category | Univariate analysis | | | | | Multivariate analysis | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Unadjusted OR | 95 C.I. for unadjusted OR | | Chi-square | *P* value | Adjusted OR | 95 C.I. for adjusted OR | | *P* Value |
| | | | Lower | Upper | | | | Lower | Upper | |
| Gender | Female* | 0.78 | 0.33 | 1.81 | 0.329 | 0.566 | 0.880 | 0.340 | 2.290 | 0.81 |
| | Male | | | | | | | | | |
| Age in years | ≤40* | 0.86 | 0.37 | 2.08 | 0.087 | 0.768 | 0.390 | 0.178 | 0.856 | 0.02# |
| | >40 | | | | | | | | | |
| Occupation | Working* | 0.61 | 0.26 | 1.42 | 1.330 | 0.249 | 0.891 | 0.429 | 1.851 | 0.757 |
| | Not working* | | | | | | | | | |
| Education status | 10 standard or more* | 4.41 | 1.58 | 12.26 | 9.277 | 0.002# | 0.889 | 0.466 | 1.696 | 0.721 |
| | Less than 10 standards | | | | | | | | | |
| Socioeconomic status | Middle class or higher* | 2.49 | 0.82 | 7.61 | 2.748 | 0.097 | 0.750 | 0.390 | 1.440 | 0.397 |
| | Lower Middle or lower | | | | | | | | | |
| Nutrition status | Normal | 1.33 | 0.36 | 4.91 | 0.186 | 0.666b | - | - | - | - |
| | Overweight/Obesity | | | | | | | | | |
| Comorbidities Present | No* | 2.61 | 0.86 | 7.88 | 3.071 | 0.080b | - | - | - | - |
| | Yes | | | | | | | | | |
| Surgery is done in past | No* | 1.11 | 0.48 | 2.58 | 0.070 | 0.791 | 1.010 | 0.466 | 2.192 | 0.978 |
| | Yes | | | | | | | | | |
| Drugs used for comorbidities | No* | 1.38 | 0.51 | 3.72 | 0.416 | 0.519b | - | - | - | - |
| | Yes | | | | | | | | | |
| Dyslipidemia | Yes* | 1.06 | 0.45 | 2.49 | 0.02 | 0.88 | - | - | - | - |
| | No | | | | | | | | | |
| Tobacco product used | No | 0.61 | 0.16 | 2.28 | 0.554 | 0.456b | - | - | - | - |
| | Yes | | | | | | | | | |
| Alcohol product used | No* | 4.76 | 0.61 | 36.13 | 2.664 | 0.103b | - | - | - | - |

Reference 1, # Statistically Significant, b Fischer's exact test

patients to make informed and healthier food choices based on FoP labeling information.

In the current study, almost everyone consumed (207 participants) grains, only four-fifths of the participants consumed vegetables, only around 27% consumed fruits, around 66% consumed protein-rich food, and milk or milk products were consumed by around 81% of the participants in the last 24 h. National Nutritional Monitoring Bureau (NNMB) surveys indicate that the daily intake of all the food groups except cereals and millets in Indian households is lower than the Recommended Dietary Allowance.[14]

In the present study, almost everyone (207 participants) had grains in the last 24 h with a mean intake of 123. Similarly, studies carried out in Korea in 2015,[15] China in 2019,[16] and Japan in 2003[17] showed a higher risk of occurrence of gastritis patients who consumed a greater amount of starchy food groups. This also reflects the preference for daily intake of grains (especially rice) in Andhra Pradesh, the Rice Bowl of India. The present study recorded that only 168 participants (four-fifths of the participants) consumed vegetables in the last 24 h with a mean intake of 125.2 g/day and only 58 participants consumed fruits in the last 24 h with a mean intake of 59.97 g/day, which shows a notable relationship between vegetable intake and decreased risk of chronic gastritis. These results are consistent with that of a similar study conducted in Hawaii[18] and Japan.[19]

This correlation between dietary intake of different food groups and incidence of gastritis cannot be established as the study used a 24-h dietary recall method, which may not reflect the usual food intake status as it may vary each day according to the interest of the participants. But altogether, it is comprehensible from the findings of the study that dietary intake of different food groups has a huge impact on the incidence of gastritis. So, it is crucial to familiarize the people that mild changes in the diet can remarkably reduce gastritis, which can be highly preferred over a pharmacological approach as this has no risk of any side effects. Family physicians have a pivotal role in promoting and supporting food group-based dietary intake. By integrating nutrition education, counseling, and personalized dietary planning into their practice, they can contribute to improved patient health outcomes and the prevention of diet-related diseases.

The potential limitations are 24-h dietary recall method improved the accuracy of the estimation of food groups based on dietary intake, and the approach to assessing it may not reflect the usual food intake status as it may vary each day. Second, the study design restricts the use of three-dimensional (3-D) mock packages might have led to measurement errors.

## Conclusion

The majority of the participants lack knowledge about the food they consume and hence education methods targeting dietary interventions are the need of the hour to create awareness among the people. English FoP labels may not be useful in certain situations because they are not easily understood by all consumers. Therefore, it is important to have FoP labels that are clear, easy to understand, and accurately convey the nutritional value of the food product. Color-coded FoP labels can be useful because they provide a simple and easy-to-understand way for consumers to quickly identify the nutritional quality of a food product. Family physicians have a critical role in educating and guiding patients on FoP labeling and food-based dietary intake. Their expertise in nutrition, chronic disease management, and patient counseling positions them well to provide valuable guidance and support for individuals and families seeking to make healthier food choices and improve their overall well-being.

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### Conflicts of interest

There are no conflicts of interest.

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