RESEARCH PAPER

Consumer Perception and Practices of Nutritional Labels on Industry-Fortified Staple Foods Among Working Adults of Mohali City

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ABSTRACT

Background: "Hidden hunger," or micronutrient deficiency, is a considerable public health issue in India and affects billions of vulnerable people. Fortification of staple foods represents a low-cost strategy to address this problem; however, the effectiveness of this intervention hinges heavily on consumers' knowledge of, confidence in, and use of nutrition labels.

Materials and Methods: This cross-sectional, mixed-method study assessed perceptions and practices related to nutrition labelling of industry-fortified staple foods among working adults in Mohali District, Punjab. A structured questionnaire was administered to a stratified sample of 500 working adults, comprising 250 respondents from the urban area of Kharar and 250 from the rural villages of Khanpur and Chaparchiri. Descriptive statistics, Chi-square tests, independent t-tests and Spearman's rank correlation were used to analyse the data.

Results: A statistically significant urban-rural divide was observed for each measure assessed. Urban consumers had greater awareness (44% vs. 24%), comprehension (56% vs. 20%) and full trust (52% vs. 28%) in label information than rural consumers. Urban residents reported reading labels more often (52% always) than rural residents, among whom 46% rarely or never read labels. Spearman's correlation confirmed a stronger perception-practice link in urban consumers (rho = 0.55) than in rural consumers (rho = 0.32), both statistically significant at $p < 0.01$. Targeted, culturally sensitive and literacy-appropriate interventions are essential to bridge the rural awareness gap and ensure equitable outcomes from India's national fortification programmes.

Keywords: food fortification, nutritional labelling, consumer perception, FSSAI, micronutrient deficiency.

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INTRODUCTION

Micronutrient deficiencies, or "hidden hunger," are a major global public health concern that affects over 2 billion people worldwide.[1] When compared with other nations, India has a disproportionately high percentage of micronutrient deficiencies. According to the National Family Health Survey (NFHS-5), 58% of children under five and 53% of women aged 15-49 years have anaemia.[2] Furthermore, 263 districts have reported iodine deficiency problems. About half of all maternal deaths among women of reproductive age are caused by iron deficiency anaemia.[3]

Fortification of foods, that is, adding micronutrients to staple foods such as rice, wheat flour, salt, milk and oil, has been identified by the Food and Agriculture Organization of the United Nations and the World Health Organization as one of the most effective, scalable and cost-efficient ways to address population-level micronutrient deficiencies.[4] A systematic review and meta-analysis of studies evaluating large-scale food fortification demonstrated improvements in micronutrient status and health outcomes among people in low- and middle-income countries; large-scale food fortification led to a 34% reduction in the prevalence of storage iron deficiency and a 74% reduction in the risk of goitre.[5] As outlined in the Food Safety and Standards Act of 2021, certified fortified products bear a +F mark to indicate fortification.[6] India's National Food Security Act has established a policy for rice fortification to provide food to more than 800 million people through the Public Distribution System.[7]

Generally, the success of fortification depends on consumers' knowledge of how to read and use nutrition labels, despite the regulatory support for fortified foods. Scoping reviews focused on India have provided evidence of persistent gaps between consumers' knowledge of food product labels and their actual purchase behaviour. Recurring challenges include functional illiteracy, technical terminology, small print and limited familiarity with nutrients, particularly in rural areas.[8] In addition, previous research has shown that rural Indian households do not have access to nutrient-adequate diets on a regular basis, with affordability continuing to be a significant barrier.[9]

OBJECTIVES

The objectives of this study were to study consumer perception and practices of nutritional labels on industry-

fortified staple foods among working adults in Mohali District and to assess the statistical association between perception and practice across urban and rural populations.

MATERIALS AND METHODS

Study Design

A cross-sectional, mixed-method study was conducted in Mohali District, Punjab, India, encompassing three distinct localities: Kharar (urban), and Khanpur and Chaparchiri (rural). This district was selected purposively for its unique geographic composition, which includes rapidly urbanizing semi-urban zones alongside predominantly agricultural rural villages, thereby enabling meaningful intra-district urban-rural comparisons within a common policy environment.

Participants and Sample Size

A stratified random sampling approach was employed. The study population comprised working adults aged 20-39 years who were primary food purchasers for their households. The sample was stratified into two groups: urban (Kharar, n = 250) and rural (Khanpur and Chaparchiri, n = 250), yielding a total sample of 500 respondents. Participants were recruited from public spaces including local markets, shops and community areas to ensure demographic diversity across age, gender, education and occupation.

Instrument

Data were collected using a structured questionnaire divided into four sections:

(A) Demographic information - gender, age, location, education, occupation and eating preference.

(B) Knowledge about fortified foods - awareness of the term "fortification," recognition of the +F and FSSAI logos and sources of nutrition information.

(C) Attitudes towards nutritional labels - trust in label information, perceived healthiness of fortified foods and purchase intent.

(D) Practices related to food labels - frequency of label reading, attention to specific nutrients and brand comparison behaviour.

The questionnaire was administered face-to-face by trained enumerators in the local language to ensure comprehension across literacy levels. Informed consent was obtained from all participants prior to interview.

Statistical Analysis

Data were analysed using descriptive statistics, including frequency distributions and percentages, to characterize the study population and summarize key variables. Inferential analysis included the Chi-square test to examine the association between categorical variables, specifically location and fortification awareness; the independent samples t-test to compare label-reading practice scores between urban and rural groups; and Spearman's rank correlation (rho) to evaluate the strength and direction of the relationship between composite perception and practice scores within each group. Statistical significance was set at $p < 0.05$.

RESULTS

Demographic Profile

A total of 500 respondents participated in the study, equally distributed between urban (n = 250) and rural (n = 250) locations. Male respondents constituted the majority in both groups, accounting for 76% of rural and 68% of urban participants. The predominant age bracket was 30-39 years (60% rural; 54% urban), with the remainder falling within the 20-29 age group.

Notable disparities were observed in educational attainment. Urban respondents demonstrated considerably higher educational levels, with 40% holding graduate degrees and 36% possessing professional or honours qualifications. Rural respondents, by contrast, were more concentrated in intermediate/diploma (24.5%) and lower education categories, including 6% with only primary schooling, a category absent among urban participants.

Occupational profiles similarly diverged, with rural respondents predominantly employed in craft, agricultural and fishery sectors (28.4%), while urban respondents were concentrated in technical, associate professional and elementary occupations. Regarding dietary preferences, rural respondents favoured vegetarian (36%) and mixed diets (40%), whereas urban respondents showed a stronger inclination toward mixed (44%) and non-vegetarian diets (32%).

Consumer Perception of Nutritional Labels

Food Fortification Awareness

An awareness gap was identified between urban and rural consumers. Among urban respondents, 44% reported familiarity with the concept of food fortification, with an additional 36% having encountered the term without a clear understanding of its meaning. In contrast, only 24% of rural respondents demonstrated familiarity, while 48% reported having never heard of the concept, nearly double the rate of complete unawareness observed in urban areas.

Ease of Understanding Nutritional Labels

Label comprehension was significantly higher among urban respondents, with 56% finding nutritional labels easy to understand and 28% finding them occasionally comprehensible. Among rural respondents, only 20% reported ease of comprehension, while 44% indicated an inability to understand nutritional labels altogether.

Trust in Label Information

Trust in nutritional label information was considerably higher among urban consumers, with 52% expressing complete trust and 24% indicating partial trust. Conversely, 48% of rural respondents reported some degree of distrust toward label information, with only 28% expressing complete confidence in its accuracy.

Belief in the Healthiness of Fortified Foods

Urban respondents demonstrated a substantially stronger belief in the health benefits of fortified foods, with 44%

affirming that such products are healthier. Among rural respondents, only 16% agreed, while 32% remained uncertain and a significant proportion rejected the claim entirely.

Consumer Practices Related to Nutritional Labels

Label Reading Frequency

Marked differences in label-reading behaviour were observed between the two groups. Among urban respondents, 52% reported always reading nutritional labels prior to purchase, with an additional 28% doing so frequently. In contrast, 28% of rural respondents rarely read labels and 18% never engaged in this practice, indicating that approximately 46% of rural consumers demonstrated minimal or no label-reading behaviour.

Main Factor Influencing Purchase of Fortified Foods

Purchase motivations diverged considerably by location. Health benefits served as the primary purchasing driver for 44% of urban respondents, reflecting a predominantly health-seeking orientation. Among rural respondents, only 19.2% consistently selected fortified foods on this basis; 32.8% indicated willingness to purchase only when price differences were negligible, while 26% either preferred non-fortified alternatives or remained undecided.

Statistical Analysis

Chi-Square Test: Location and Fortification Awareness

A Chi-square test confirmed a statistically significant association between geographic location and fortification awareness ($p = 0.008$), establishing that rural consumers were significantly more likely to have had no prior exposure to the concept of food fortification. These findings underscore geographic location as a meaningful determinant of nutritional awareness.

Independent Samples t-Test: Label Reading Frequency

An independent samples t-test revealed a highly significant difference in label-reading frequency between urban and rural respondents ($p < 0.001$). Urban consumers engaged in label reading significantly more often, with group mean ranks consistently and substantially higher, rendering the observed difference statistically improbable by chance alone.

Spearman's Rank Correlation: Perception and Practice

Both group correlations exceeded the critical threshold of rho = 0.163 ($n = 250$, $p < 0.01$), confirming statistical significance. The urban group exhibited a strong positive correlation (rho = 0.55), indicating that favourable perceptions toward fortified foods consistently translated into active label reading and health-oriented purchasing behaviour. The rural group, while also yielding a statistically significant positive correlation (rho = 0.32), demonstrated a considerably weaker association. This disparity suggests that even when rural consumers held positive perceptions, the translation into practice was substantially impeded by prevailing barriers, including low trust in label information (48%), limited label comprehension (44%) and pronounced price sensitivity.

DISCUSSION

This study reveals a clear and statistically validated urban-rural divide in consumer perception and practices related to nutritional labels on industry-fortified staple foods in Mohali District, Punjab. The most fundamental gap lies at the level of basic awareness. Nearly half of all rural respondents (48%) had never heard of food fortification, compared to only 20% of urban respondents. This void in rural awareness directly undermines the foundational premise of India's fortification programme, that consumers will actively seek and purchase fortified staples. Without awareness, labelling serves no communicative function regardless of its design quality.

Label comprehension compounded this problem further. Only 20% of rural respondents found nutritional labels easy to understand, compared to 56% in urban areas. This gap is not simply a matter of education level, though education is a contributing factor given that 64.6% of urban respondents held graduate or professional qualifications versus 47% in rural areas. It also reflects a fundamental mismatch between label design, which is typically text-heavy, numerically dense and technically worded, and the literacy realities of rural consumers.

Trust emerged as the third critical barrier. While 52% of urban consumers completely trusted label information, 48% of rural consumers actively distrusted it. This distrust has direct behavioural consequences. Even among rural respondents who held some positive perception of fortified foods, the perception-practice correlation was weak (rho = 0.32) compared to urban consumers (rho = 0.55). This means that in rural settings, positive beliefs do not reliably translate into label-reading or health-oriented purchasing behaviour because structural barriers, including distrust, low comprehension and price sensitivity, disrupt the path from belief to action.

Purchase motivation data further illustrates this divide. Health benefits drove purchasing decisions for 44% of urban consumers, while only 19.2% of rural consumers shared this motivation. The majority of rural respondents conditioned their purchase on minimal price difference (32.8%) or expressed preference for non-fortified options (21.2%). This confirms that price sensitivity and perceived value remain dominant constraints in rural food purchasing behaviour, independent of awareness or attitude.

The Chi-square result ($p = 0.008$) and t-test result ($p < 0.001$) confirm that these differences are statistically significant and not attributable to chance. Taken together, the findings demonstrate that the current fortification communication strategy is effectively reaching urban consumers but failing rural populations across all three dimensions: awareness, comprehension and trust.

CONCLUSION

This study provides clear evidence that a uniform approach to food fortification communication is inadequate for a population as diverse as India's. Working adults in urban Kharar and rural Khanpur and Chaparchiri, though residing

within the same administrative district, inhabit fundamentally different nutritional information environments. Urban consumers are aware, relatively trusting and translate their positive perceptions into active label-reading behaviour. Rural consumers face compounding barriers, including low awareness, poor label comprehension, deep distrust of the fortification process and high price sensitivity, that collectively prevent positive perceptions from becoming positive practices, as confirmed by the weaker Spearman correlation (rho = 0.32) in the rural group. Effective public health action must therefore operate on four fronts simultaneously: raising rural awareness through community-trusted channels such as local health workers and regional media; adopting simplified pictogram-based front-of-pack labelling that bypasses literacy barriers; building institutional trust through visible government endorsement and community-level transparency around the +F certification; and ensuring fortified staples are affordable and consistently available through the Public Distribution System.

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