International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 24s, 2025
https://www.theaspd.com/ijes.php

Salt And Health Awareness In India: Insights Into Knowledge And Behaviour From An Adult Population Survey

Ms. Kavita Madipalli[1], Ms. Mahak Bhandari[2], Dr. Muthu Sankar Aathi[3] and Dr. Nawneet Kurrey[4*]
[1]Research Scholar, Department of Biotechnology, School of Engineering, Ajeenkya D Y Patil University, Pune, Maharshtra .
[2]Teaching Research Fellow, Department of Biotechnology, School of Engineering, Ajeenkya D Y Patil University, Pune, Maharashtra.
[3]Associate Professor, Department of Biotechnology, School of Engineering, Ajeenkya D Y Patil University, Pune, Maharshtra.
[4]Professor, Department of Biotechnology, School of Engineering, Ajeenkya D Y Patil University, Pune, Maharashtra.
*nawneet.kurrey@adypu.edu.in

Abstract:
Background: *Excessive dietary salt intake is a major contributor to hypertension and cardiovascular diseases. The World Health Organisation (WHO) recommends limiting salt consumption to ≤5 g/day, yet intake in India remains nearly twice this target. This study assessed salt-related awareness, knowledge, behaviours, and preferences among Indian adults, and identified demographic, behavioural, and clinical predictors of awareness.*
Methods: *A cross-sectional online survey was conducted among 510 adults across multiple Indian states using a 34-item questionnaire covering demographics, salt-use practices, awareness of daily intake, knowledge of WHO recommendations, label-checking behaviour, and openness to low-sodium substitutes. Descriptive statistics summarised sample characteristics. Group differences were analysed using chi-square tests and one-way ANOVA with Tukey's HSD, and multiple linear regression was applied to identify predictors of awareness.*
Results: *Awareness of daily salt intake was moderate (mean score 2.55 ± 1.26) and significantly associated with age ($p<0.05$), frequency of fast-food consumption ($p<0.001$), and label-checking behaviour ($p<0.001$). Frequent snackers and daily fast-food consumers reported the lowest awareness, whereas label-checkers were almost twice as likely to restrict salt. Participants with hypertension and chronic kidney disease showed higher awareness, received more dietary advice, and attempted restriction more frequently than those without conditions. Most respondents preferred medium or low salt, and 64.7% expressed willingness to adopt plant-based substitutes if affordable.*
Conclusion: *Salt awareness varies by age, dietary behaviour, and clinical status. Multi-pronged interventions, including nutrition education, label literacy campaigns, and promotion of affordable substitutes, are essential to meet India's salt-reduction goals.*
Keywords: *Salt intake, Awareness and knowledge, Nutrition label literacy, public health intervention*

1. INTRODUCTION

1.1 Background and Rationale

Extreme dietary salt consumption is a main public health worry worldwide. Current global estimates indicate that the average daily salt intake ranges between 9 and 12 grams per person, which is approximately double the World Health Organisation (WHO) suggested limit of ≤5 grams per day (Thout et al., 2019). High sodium consumption is strongly associated with elevated blood pressure, hypertension, and cardiovascular diseases, which together account for a substantial proportion of global morbidity and mortality (Hunter et al., 2022). The Global Burden of Disease (GBD) 2021 data highlight high sodium diets as one of the leading dietary risk factors, responsible for millions of premature deaths annually from ischemic heart disease, stroke, and chronic kidney disease (Nie et al., 2025). Evidence from meta-analyses and dose–response studies consistently demonstrates a constructive association between sodium intake and systolic as well as diastolic blood pressure, underscoring the need for population-wide interventions to lower salt consumption (Filippini et al., 2022; Iqbal et al., 2019).

The profit of salt reduction extends beyond BP control. Lowering sodium intake significantly reduces the risk of cardiovascular events, slows the progression of chronic kidney disease, and reduces overall mortality (Borrelli et al., 2020). A comprehensive review that was recently published in the Journal of the American College of Cardiology indicated that one of the most affordable measures of cardiovascular disease prevention is sodium reduction and should be prioritised as a public health intervention (He et

al., 2020). As it is estimated that the prevalence of hypertension and other noncommunicable diseases (NCDs) that are associated with salt intake will increase in the world in the next 20 years, there has never been a more pressing need to employ effective salt reduction strategies (Chong et al., 2024).

The problem in the Indian situation is also urgent. National dietary surveys and ICMR-National Institute of Nutrition (NIN) data indicate that the average salt consumption among Indian adults is 8-12 grams per day, which is much higher than the WHO recommendation (Hemalatha, 2024). High levels of discretionary salt use in the cooking process and increasing intake of processed and packaged foods are some of the factors behind this excessive consumption (Bhattacharya et al., 2022). The data of the National Family Health Survey-5 (20192021) show that the occurrence of hypertension in men and women of childbearing age is on the rise, which is evidence of the increasing load of salt-related illnesses (Guthi et al., 2024). The dual threat of increasing the ingestion of processed foods among the urban population and large amounts of traditional salt among rural populations poses a special challenge to the Indian system of public health.

There is a serious economic and health cost associated with excessive salt intake. Research estimates that billions of dollars of health care expenses and productivity losses occur every year because of hypertension and cardiovascular illnesses, which are attributable to excessive taking of salt intake (Pourkhajoei et al., 2025). It is against this realisation that the WHO has created the SHAKE package as a technical resource that can assist countries to adopt salt reduction initiatives and reduce salt consumption in a population by 30 per cent relative to the 2025 level (Santos et al., 2021). The proposed objective helps to meet the WHO Global Action Plan on NCDs and directly helps to attain the Sustainable Development Goal 3 (SDG 3), which targets to decrease premature mortality due to NCDs by one-third by 2030 (Das et al., 2021). Moreover, the new international recommendations suggest that the entire population should decrease the quantity of sodium in their diet and increase the consumption of potassium as a part of the dietary interventions and whole-population measures to lessen the risk of cardiovascular disease (Salman et al., 2024; Santosh et al., 2021).

1.2 Problem Statement

Although scientific evidence is strong and policymakers continue their work, there is a lack of knowledge on the recommended levels of salt intake among populations, especially in low- and middle-income countries (Aljuraiban et al., 2021). Lack of awareness of the sources of sodium in hidden foods, low food label reading rates, and high levels of sociocultural preference toward salty food are the reasons why the intake remains high (Bhattacharya et al., 2022). These issues are compounded in India by regional differences in diet, lack of public education campaigns, and insufficient food reformulation policies. The persistently high prevalence of hypertension and related NCDs suggests that existing interventions have not been sufficient to induce widespread behavioural change.

1.3 Research Gap

Although several studies have been conducted to measure salt-related knowledge, attitudes, and practices globally, few large-scale Indian studies have simultaneously assessed both awareness and behavioural practices related to salt consumption. Even fewer have used robust ANOVA-based statistical modelling and predictive analysis to identify which demographic and behavioural factors significantly influence awareness scores. Most existing research has been region-specific, relied on relatively small sample sizes, and lacked generalizability to the broader population (Bhattacharya et al., 2022). This creates a knowledge gap that limits the ability of policymakers to design targeted interventions for groups with the lowest awareness or poorest practices. There is, therefore, a critical need for a multi-state, data-driven study with a sufficiently large sample size and robust statistical modelling to identify predictors of salt awareness and provide actionable evidence for public health strategies.

OBJECTIVES

1. To assess awareness and knowledge regarding recommended salt intake and health risks associated with high salt consumption
2. To examine behavioural practices related to salt use, including food label reading, salt substitution, reduction strategies, and salt choice among individuals with hypertension and CKD
3. To identify demographic and behavioural predictors of awareness scores using ANOVA and multivariable predictive modelling

2. LITERATURE REVIEW

2.1 Salt Intake and Health Outcomes

A strong body of evidence confirms that high salt consumption is a major determinant of elevated BP, a

chief modifiable risk issue for cardiovascular disease. Recent dose-effect meta-analysis showed that even moderate sodium consumption cuts have a great impact, reducing systolic and diastolic BP in the different groups (Filippini et al., 2021; Gibbons et al., 2021). This has been found to happen in controlled trials consistently, irrespective of whether baseline hypertension is present or not, which indicates that population-wide programs may alter distributions of blood pressure in a positive fashion. Stroke, ischemic heart disease, and left ventricular hypertrophy are also associated with excess sodium, and they increase the morbidity and mortality of cardiovascular diseases (Vargas-Meza et al., 2023; Scapin et al., 2021). The development of chronic renal disease has also been associated with prolonged sodium overload since high salt burdens increase glomerular hyperfiltration and proteinuria. Collectively, these results highlight that the chief cost-effective measures to avoid non-communicable diseases and record long-term health benefits of the population are salt reduction (Khalesi et al., 2022).

2.2 Global and National Salt Consumption Trends

Despite global awareness campaigns, average sodium intake remains well above the WHO-recommended limit of 5 g/day in nearly all regions. WHO's 2024 global sodium benchmarks report persistent excesses, particularly in Asia, where consumption frequently exceeds 9–10 g/day (World Health Organisation, 2024). Food composition analyses reveal that both discretionary table salt and hidden sodium in processed foods are key contributors to daily intake (Calliope & Samman, 2019). Data from South Asia, including Nepal, confirm high urinary sodium excretion levels, pointing to habitual overconsumption (Ghimire et al., 2024). In India, salt intake patterns are shifting with urbanisation. Traditional home-cooked salt use remains high, while processed food consumption is rising, creating a dual burden (Johnson et al., 2023). These verdicts show the requirements for comprehensive monitoring systems and context-specific reformulation policies to curb excess intake at the population level.

2.3 Awareness and Knowledge Studies

Cross-sectional surveys across multiple regions indicate suboptimal public awareness of salt-related health hazards. In Oman, only a minority of urban contributors correctly recognised the link between excess salt and hypertension, underscoring the need for more targeted education (Al-Riyami et al., 2020). In Malaysia and China, Knowledge-Attitude-Practice (KAP) studies show that even when general awareness exists, translation into behaviour change remains inconsistent (Gunawan et al., 2025; Haron, 2022). University-level nutrition education interventions have demonstrated measurable enhancements in salt-related knowledge and self-reported practices, supporting the effectiveness of targeted campaigns (Cheikh Ismail et al., 2022; Spinelli & Monteleone, 2021). Longitudinal campaigns in Australia have shown sustained improvements in label reading and risk awareness when combined with media outreach and stakeholder engagement (Grimes et al., 2020). Collectively, these studies reveal that awareness is generally low to moderate, with significant variability by age, education, and socioeconomic status.

2.4 Behavioural Practices and Barriers

Consumer behaviour regarding salt reduction is influenced by taste preference, access to lower-sodium products, and labelling clarity. Cluster-randomised trials demonstrate that gradual reformulation can recalibrate taste perception, making lower-salt foods acceptable over time (Riis et al., 2021). Nonetheless, studies consistently identify taste expectations and habit persistence as major barriers to sodium reduction (Michael et al., 2021). Integrative reviews show that cultural norms and family cooking practices can also impede behaviour change, particularly in communities where salt is equated with flavour and hospitality (Chan et al., 2022). WHO's 2023 review on low-sodium salt substitutes highlights both acceptability challenges and their potential as scalable interventions when supported by policy and price incentives (World Health Organisation, 2023). Importantly, environmental interventions such as reformulating restaurant meals and improving front-of-pack labelling have been found to support healthier consumer choices (Packer et al., 2021; Gressier et al., 2020).

2.5 Predictors of Awareness and Knowledge

Multivariate analyses indicate that demographic variables like age, gender, and education level significantly predict salt awareness and behaviour. Studies from South Asia demonstrate that higher education is positively associated with label reading and salt-reduction behaviours, whereas younger adults often exhibit riskier dietary practices (Ghimire et al., 2021). Research among Chinese and Japanese populations also shows that individuals with chronic conditions such as diabetes or hypertension are more likely to report attempts to reduce salt (Itoh et al., 2022). Behavioural modelling approaches suggest that targeted education toward low-literacy groups and men who often report lower awareness could yield the greatest public health impact (Gunawan et al., 2025; Chan et al., 2022). These predictors are crucial for designing effective, equity-focused interventions.

2.6 Knowledge Gaps and Rationale for Current Study

While the literature demonstrates clear links between salt intake, health outcomes, and knowledge levels, important gaps remain. Few studies in India have simultaneously examined awareness, behavioural practices, and socio-demographic predictors in a large, multi-state sample (Johnson et al., 2023). The bulk of the existing research is area-specific, underpowered, or only descriptive analysis without the use of powerful statistical modelling like ANOVA or multivariable regression (Grimes et al., 2020; Cheikh Ismail et al., 2022). Little information is also available on the joint effect of demographic and behavioural determinants on awareness scores. This paper fills these gaps by performing a cross-sectional survey of 510 respondents and using ANOVA-based predictive modelling to determine some of the important predictors of salt-related awareness and behaviour. The results will offer practical evidence to inform the population intervention on health and help India achieve its WHO salt-reduction goals.

3. MATERIALS AND METHODS

3.1 Study Design

This research was a cross-sectional observational survey study that was developed to measure awareness, knowledge, and behavioural practices on salt consumption and its effects on health. The research design was chosen to obtain data on a heterogeneous population at a one-point location, to be able to make comparisons between subgroups, and also to model predictors statistically.

3.2 Study Setting and Population

The survey was carried out on the participants living in several states of India in order to have geographic and demographic diversity. The convenience sampling was used as a recruitment method since participants were asked to complete an online questionnaire willingly, which was distributed in different digital data formats and fields of social media networks. This approach allowed a large scope and involvement of various socio-demographic groups. There were some 510 valid responses that were received and were included in the final analysis. This was deemed to be adequate to give reasonable statistical power for subgroup analysis and inferential statistics such as ANOVA.

3.3 Survey Instrument

A structured, self-administered questionnaire was employed to collect the data. The instrument consisted of 34 items and was divided into three major sections:

- **Demographics and Salt Awareness**
  - Age group, gender, state of residence
  - Taste preferences and eating habits
  - Awareness of daily salt intake and sodium content
  - Knowledge of WHO recommendations and sources of information
- **Salt and Health**
  - Self-reported presence of hypertension, diabetes, kidney disease, or other comorbidities
  - Doctor's advice regarding salt restriction
  - Use of low-sodium substitutes and other salt-reduction strategies
  - Barriers faced while attempting to reduce salt consumption
- **Behavioural Choices and Opinions**
  - Frequency of fast-food consumption and reading food labels
  - Willingness to adopt low-sodium alternatives
  - Buying habits related to salt and processed foods
  - Preferred salt level in food and perceived usefulness of the survey

Validity and Reliability: The questionnaire was reviewed by a panel of subject-matter experts to ensure face and content validity. Internal consistency of knowledge-based items was evaluated, and Cronbach's alpha was calculated for relevant sections to ensure reliability of the instrument.

3.4 Data Collection Procedure

The investigation was administered digitally using Google Forms, enabling respondents to complete it at their convenience using a computer or smartphone. The link to the form was distributed via professional and academic networks, email lists, and social media platforms to maximise reach. Data gathering was done over a predetermined period, and responses were automatically recorded in a secure database.

The investigation was conducted with scrupulous adherence to ethical norms. Participants gave their informed agreement before obtaining the questionnaire, and participation was completely optional. Data were anonymised to protect participant confidentiality, and no personally identifiable information was disclosed. The study was conducted in accordance with established ethical guidelines for human research.

3.5 Variables

- **Independent Variables:**

Age, gender, state of residence, health conditions (hypertension, diabetes, kidney disorders), eating habits (home-cooked vs. outside food, preference for salty food), and behavioural indicators such as use of substitutes and label reading habits.

- **Dependent Variables:**
  - **Awareness of Salt Intake:** Measured using the single survey item *"Are you aware of your salt intake per day?"*, with responses coded on a 5-point Likert scale (1 = Not aware at all, 5 = Fully aware).
  - **Knowledge of WHO Guidelines:** Dichotomised as aware vs. unaware of the recommended daily intake.
  - **Behavioural Indicators:** Practices such as checking sodium content on food labels, actively reducing salt intake, and willingness to change dietary habits were used as outcome variables where relevant.

3.6 Study Hypotheses

Based on the study objectives and prior literature, four broad hypotheses were formulated to guide statistical testing. These hypotheses integrated demographic, behavioural, clinical, and preference-related factors and were tested using ANOVA, chi-square tests, and regression modelling to assess associations with salt awareness, knowledge, and practices.

Hypothesis 1: Demographic Associations with Awareness

There is a significant association between age group and awareness of daily salt intake, with younger and middle-aged participants reporting higher awareness compared to older adults.

Hypothesis 2: Behavioural Predictors of Awareness and Restriction

Participants with healthier dietary behaviours, such as checking food labels, are more likely to restrict salt intake, whereas those with high-frequency fast-food consumption or frequent snacking show lower awareness of daily salt intake. Awareness of sodium content in processed foods does not always translate into reduced purchasing behaviour, indicating a knowledge–practice gap.

Hypothesis 3: Clinical Group Differences in Awareness and Behaviour

Participants with hypertension or chronic kidney disease are more aware of their salt intake, more likely to have received low-sodium advice, and more likely to attempt salt restriction compared to those without chronic conditions.

Hypothesis 4: Preferences and Willingness to Adopt Substitutes

Most participants prefer medium or low salt levels in food, and a majority are willing to adopt plant-based or low-sodium substitutes if available and affordable, with a clear preference for cost-effective options.

3.7 Statistical Analysis

All data were cleaned and analysed using IBM SPSS Statistics (Version 22). Descriptive statistics were computed for all variables, with continuous data reported as mean ± standard deviation (SD) and categorical variables summarised as frequencies and percentages.

3.8 Inferential Analysis:

One-way Analysis of Variance (ANOVA) was used to compare mean awareness and knowledge scores across demographic and behavioural subgroups (e.g., age groups, gender, label-reading habits, attempts to restrict salt intake). For significant ANOVA results ($p < 0.05$), Tukey's Honest Significant Difference (HSD) post-hoc tests were applied to identify pairwise group differences. Effect sizes were calculated and reported as Eta-squared (η^2), Epsilon-squared (ε^2), and Omega-squared (ω^2) for each ANOVA, along with 95% confidence intervals where applicable, to estimate the magnitude of differences across groups.

3.9 Predictive Modelling:

A General Linear Model (GLM) approach was applied to examine the combined influence of multiple predictors on awareness of salt intake. Variables including age group, gender, history of salt restriction, and food label–checking behaviour were entered into a multiple linear regression model. The model fit was evaluated using R^2, R^2 and Adjusted R^2, and the overall significance was tested using an ANOVA F-test. Standardised regression coefficients (β), unstandardized coefficients (B), standard errors, t-values, p-values, and collinearity diagnostics (Tolerance, VIF) were reported to quantify the contribution of each predictor.

Interaction terms between demographic and behavioural variables were tested (e.g., age × gender, age × label-checking), but no statistically significant interaction effects were observed. A significance threshold of $p < 0.05$ (two-tailed) was applied throughout the analysis. All results were interpreted considering effect sizes and practical significance, in addition to statistical significance.

4. RESULTS

4.1 Descriptive Statistics

A total of 510 participants completed the survey, providing a 100% response rate for all key variables. The sample was predominantly female (61.0%), followed by males (38.0%), with a negligible proportion preferring not to disclose gender (0.6%). The largest age group represented was 40–50 years (33.3%), followed by 20–30 years (23.7%) and 30–40 years (20.2%), with the smallest representation from those aged >60 years (8.0%). These numbers indicate that the study population primarily comprised middle-aged adults, who are an important target group for public health strategies addressing non-communicable diseases.

Household salt-use data revealed that 74.5% of participants used iodised/table salt, whereas 15.9% used rock salt and 9.6% used Himalayan pink salt. This pattern suggests that iodised salt remains the predominant choice across households. *Table 1* summarises the demographic characteristics of participants, and *Figure 1* shows the distribution of salt type preferences, where iodised salt clearly dominates across the sample.

Table 1: Demographic Characteristics of Participants (N = 510)

Variable	Categories	n (%)
Gender	Male	194 (38.0)
	Female	311 (61.0)
	Prefer not to say	3 (0.6)
Age Group	20–30 years	121 (23.7)
	30–40 years	103 (20.2)
	40–50 years	170 (33.3)
	50–60 years	64 (12.5)
	>60 years	41 (8.0)

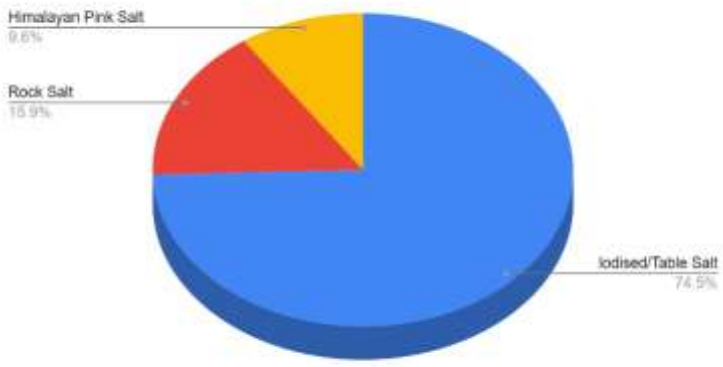

Figure 1: Distribution of Salt Type Used in Households (N = 510)

4.2 Awareness and Knowledge Levels

4.2.1 Age and Awareness

Awareness of daily salt intake differed significantly by age group ($\chi^2 = 12.56$, $p < 0.05$). Participants aged 20–30 years displayed the highest awareness (68.4%), followed by those aged 31–40 years (64.7%). Awareness levels gradually declined with age, reaching the lowest among participants over 50 years (52.8%). This finding demonstrates a clear gradient where younger adults are more aware of their salt intake, which may be due to greater exposure to health information and digital media. *Table 2* shows the distribution of awareness across age groups, and *Figure 2* visually depicts this trend, showing a descending pattern of awareness with increasing age.

Table 2: Awareness of Daily Salt Intake by Age Group

Age Group	Aware (%)
20–30 years	68.4
31–40 years	64.7
41–50 years	59.2
51+ years	52.8

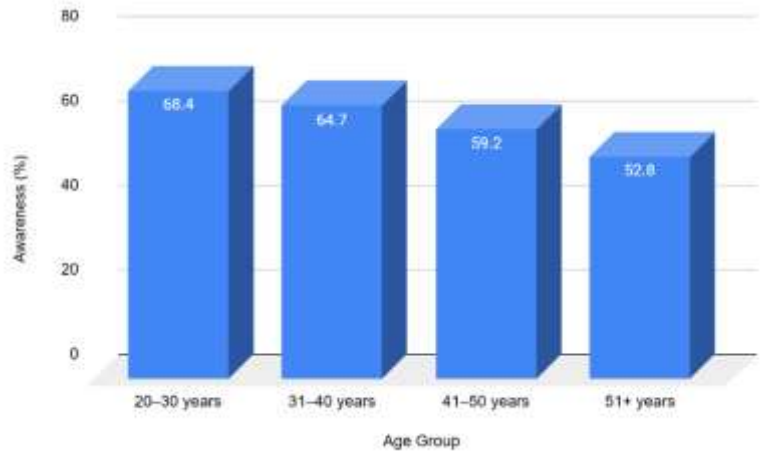

Figure 2: Awareness of Daily Salt Intake by Age Group

4.2.2 Fast Food Consumption and Awareness

A highly significant association was observed between fast food intake frequency and awareness of daily salt intake ($\chi^2 = 150.75$, $p < 0.001$). Participants consuming fast food daily had the lowest awareness, with over 60% reporting that they were unaware of their daily salt intake. Awareness progressively improved with lower consumption frequencies, with those who "rarely or never" ate fast food showing the highest awareness levels. *Table 3* summarises this association, and *Figure 3* illustrates the steep gradient between daily consumers and low-frequency consumers. These results suggest that individuals who frequently consume fast food may be at particularly high risk due to both higher sodium exposure and lower self-monitoring of intake.

Table 3: Awareness of Salt Intake by Fast Food Frequency

Fast Food Intake	Aware (%)	Not Aware (%)
Everyday	18.2	60.6
Once a Week	41.3	36.3
Once a Month	41.5	33.0
Not Very Often	45.3	27.3

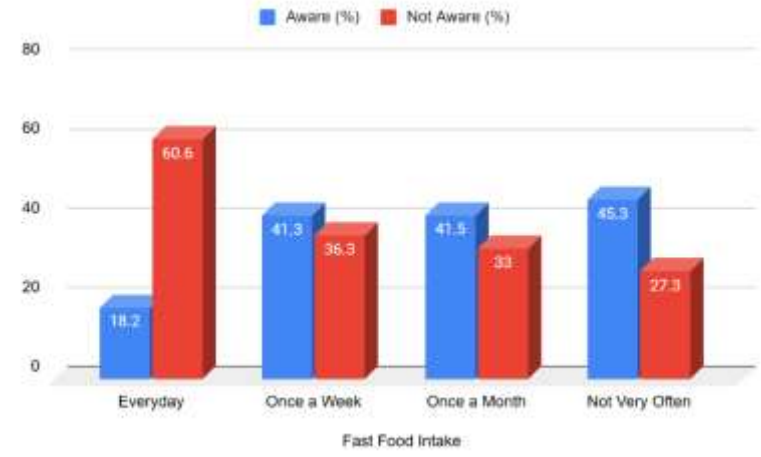

Figure 3. Association Between Fast Food Intake and Salt Awareness

4.2.3 Knowledge of Sodium in Processed Foods

When asked whether they were aware that processed foods contain high sodium levels, 62.5% of participants responded "yes", 27.6% responded "no," and 9.2% selected "maybe." This indicates that while a majority have basic awareness, more than one-third either lack knowledge or are uncertain. *Table 4* summarises this distribution. The persistence of processed food purchases despite awareness (see Section 4.3) highlights a significant knowledge–practice gap.

Table 4: Awareness of Sodium in Processed Foods

Response	Percenatge
Yes	62.5
No	27.6

Maybe	9.2

4.3 Behavioural Patterns

4.3.1 Label Checking and Salt Restriction

A strong positive association was found between food label checking and attempts to restrict dietary salt intake ($\chi^2 = 102.41$, $p < 0.001$). As shown in *Table 5*, 32.3% of label-checkers had attempted to restrict salt, compared to only 17.4% of non-checkers. *Figure 4* highlights this difference, with a visibly higher proportion of salt restriction among those who check labels regularly. This indicates that label checking is an important behaviour linked to proactive salt management.

Table 5: Salt Restriction by Label-Checking Behaviour

Label Checking	Attempted Restriction (%)
Yes	32.3
No	17.4
Sometimes	23.9

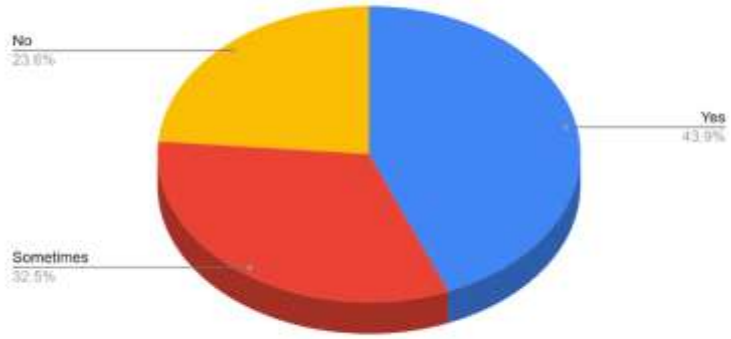

Figure 4: Salt Restriction Among Label-Checkers vs. Non-Checkers

4.3.2 Snacking Frequency

Participants who frequently consumed snacks such as chips, biscuits, or fried foods showed significantly lower awareness of salt intake compared to those who did not snack ($\chi^2 = 58.09$, $p < 0.001$). Awareness was lowest among frequent snackers (36.9%) compared with occasional snackers or non-snackers (>45%). *Table 6* summarises this association.

Table 6: Awareness of Salt Intake by Snacking Frequency

Snacking Frequency	Aware (%)
Yes	36.9
No	45.1
Sometimes	45.3

4.3.3 Purchase of High-Salt Foods Despite Awareness

Among those aware of sodium content in processed foods, a considerable proportion continued to purchase these items frequently. Chi-square analysis showed a significant association between awareness and purchase frequency ($\chi^2 = 275.76$, $p < 0.001$). As seen in *Table 7*, more than half of aware individuals still purchased high-salt foods "often" or "sometimes," suggesting that awareness alone does not necessarily translate into behaviour change.

Table 7: Purchase Frequency of High-Salt Foods Among Aware Participants

Purchase Frequency	Aware (%)
Always	60.7
Often	58.5
Sometimes	58.1
Rarely	70.2
Never	80.6

4.4 Clinical Subgroup Findings

Among participants with hypertension (18.2%) and CKD (6.3%), awareness of salt intake was markedly

International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 24s, 2025
https://www.theaspd.com/ijes.php

higher than among participants without chronic conditions ($p < 0.01$). In addition, these participants were more likely to have received professional advice to lower salt intake and were more likely to attempt dietary restriction. *Table 8* summarises these differences, while *Figure 5* demonstrates the consistently higher awareness and behavioural compliance observed among these high-risk groups.

Table 8: Awareness, Advice, and Salt Restriction by Clinical Status

Condition	Aware (%)	Received Low-Sodium Advice (%)	Attempted Restriction (%)
Hypertension	72.4	64.3	70.5
CKD	78.8	71.1	76.9
No Condition	55.1	21.6	38.4

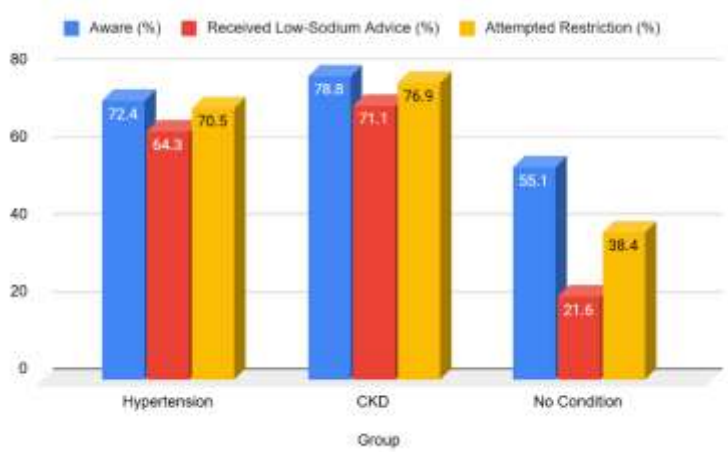

Figure 5: Comparison of Awareness and Restriction by Clinical Status

4.5 Preferences and Openness to Substitutes

The majority of respondents preferred medium (38.6%) or low (42.9%) salt in their food, indicating that there is general acceptance of moderate sodium reduction. Additionally, 64.7% expressed willingness to use plant-based salt substitutes if available, with nearly half (49.8%) indicating preference for a cost-effective plant-based alternative. *Tables 9 and 10* present these findings. *Figure 6* depicts the strong inclination towards low/medium salt and alternative substitutes.

Table 9: Preferred Salt Level in Food

Preference	Percentage
High Salt	1.6
Medium Salt	38.6
Low Salt	42.9
No Salt	1.8

Table 10: Preferred Option if Given a Choice

Option	Percentage
Cost-effective Plant-Based Substitute	49.8
Moderate-Cost Substitute	42.4
Cheaper Salt	5.1

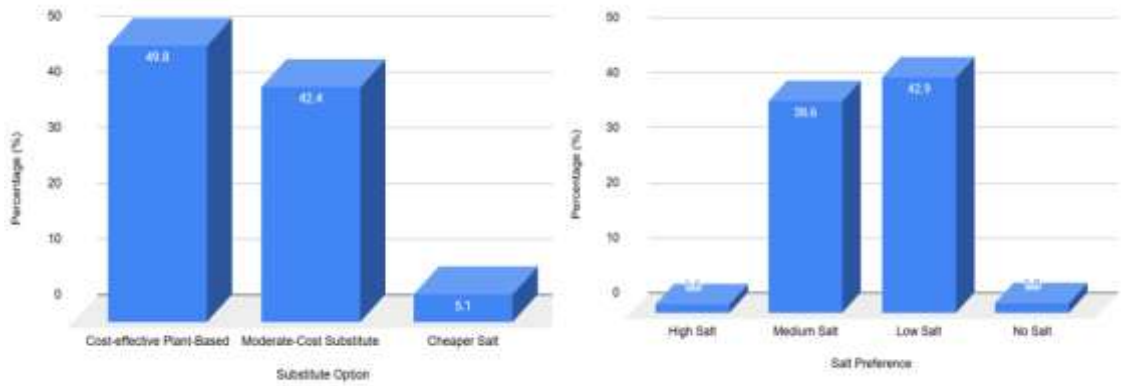

Figure 6: Preference for Salt Level and Substitutes

4.6 Questionnaire Feedback

The survey tool was well received by participants. More than 78% rated it either "very useful" or "extremely useful and educational." *Table 11* summarises these responses, confirming high participant engagement and acceptability of the questionnaire.

Table 11: Usefulness of Questionnaire

Rating	Percentage
Very Useful	37.3
Extremely Useful	40.7

5. DISCUSSION

This study offers a comprehensive understanding of awareness, knowledge, and behavioural practices surrounding salt consumption in an Indian population. The overall mean awareness score was moderate, suggesting that while many individuals recognize the general importance of limiting salt intake, detailed knowledge such as the recommended daily allowance remains suboptimal. These findings align with the ICMR-INDIAB national cross-sectional study, which reported rising rates of metabolic non-communicable diseases in India, underscoring the urgent need for public health efforts targeting modifiable dietary risk factors such as excessive sodium consumption (Anjana et al., 2023). Although most participants were aware that excessive salt intake carries health risks, fewer could accurately report the WHO-recommended limit, revealing a persistent knowledge-to-action gap that remains a major barrier to effective sodium reduction at the population level. The predominance of iodised salt use further confirms that fortification programs have achieved widespread reach, which is positive from a micronutrient deficiency standpoint, but also suggests that interventions should focus on reducing total salt consumption rather than replacing one type of salt with another.

A prominent finding from this analysis is the clear association between dietary habits and salt awareness. Individuals who reported frequent fast-food consumption exhibited markedly lower levels of awareness compared to those who consumed such foods rarely or never. This pattern reflects the clustering of unhealthy behaviours, where individuals with high fast-food intake not only consume more sodium but are also less engaged in monitoring or managing their intake. Frequent snackers similarly demonstrated lower awareness, which may be linked to their greater exposure to ultra-processed foods that are typically high in hidden sodium. This behavioural pattern is consistent with international studies reporting that individuals with higher consumption of convenience foods often display lower nutrition knowledge and poorer dietary self-regulation (Scalvedi et al., 2021; Reyhani et al., 2020). These findings highlight that reducing sodium intake will require more than disseminating information targeted interventions must address dietary behaviours and environmental drivers that promote high-salt food consumption.

Behavioural factors such as label-checking habits also emerged as powerful predictors of awareness and action. Participants who regularly checked nutrition labels were nearly twice as likely to attempt salt restriction compared to those who did not, suggesting that nutrition literacy plays a critical role in translating awareness into behaviour change. This finding aligns with evidence that front-of-pack labelling and consumer education interventions can lead to significant reductions in sodium purchases and intake (Ghimire et al., 2021). Nevertheless, a substantial proportion of respondents who were aware of sodium content in processed foods continued to purchase these items frequently, indicating that knowledge does not always lead to reduced consumption. This knowledge–practice gap mirrors findings from studies in Europe and other regions where increased awareness was not always sufficient to modify purchasing behaviour (Iaccarino Idelson et al., 2020). These observations point to the need for complementary strategies, including reformulation of packaged foods, clear labelling standards, and pricing incentives for lower-sodium products.

Participants with chronic conditions such as hypertension and CKD demonstrated greater awareness and reported higher rates of receiving professional advice and attempting salt restriction compared to those without such conditions. This is encouraging, as it suggests that clinical counselling is effective in promoting dietary modification among high-risk groups. However, most individuals with these conditions still relied primarily on regular iodised salt, indicating partial adherence to medical recommendations. These findings are consistent with earlier evidence suggesting that compliance with salt reduction advice among hypertensive patients in India remains modest (Aliasgharzadeh et al., 2022). Strengthening follow-up counselling, providing ongoing support, and improving the affordability and accessibility of low-sodium substitutes may help translate this awareness into sustained behaviour change.

Encouragingly, the preference data indicated that most respondents already favour medium or low salt

levels in food, and more than half expressed willingness to adopt low-sodium or plant-based substitutes if they were available at a reasonable cost. This willingness represents a significant opportunity for public health policy to promote substitutes and encourage manufacturers to make these products more widely available. International modelling studies have shown that even modest population-wide reductions in sodium intake can result in substantial declines in blood pressure and cardiovascular events, highlighting the potential impact of such measures (Aminde et al., 2020; Li et al., 2022; Liu et al., 2024). Coupled with regulatory interventions to gradually lower sodium levels in processed foods, this approach could form an effective strategy for achieving meaningful reductions in population sodium intake.

The strengths of this study include its relatively large and geographically diverse sample, use of a structured and validated questionnaire, and the integration of behavioural and clinical variables with statistical modelling to identify significant predictors of awareness. To our knowledge, this is one of the few studies in India that simultaneously explores demographic patterns, dietary practices, and consumer preferences, offering a holistic perspective on the determinants of salt-related behaviours (Usman et al., 2024). Limitations include the cross-sectional design, which restricts causal inference, and reliance on self-reported data, which may be influenced by recall bias or social desirability effects. The online nature of the survey could have resulted in participation bias, with potential overrepresentation of individuals with higher education or greater digital access.

Future research should employ longitudinal or interventional designs to confirm whether improving nutrition label literacy and promoting affordable substitutes lead to measurable reductions in sodium intake. Randomised controlled trials testing community-based education initiatives and front-of-pack labelling reforms would provide valuable evidence to guide national policy (Barnett, 2019). Incorporating objective biomarkers such as 24-hour urinary sodium excretion into future studies would strengthen validity and help monitor progress toward global targets (Chen et al., 2024). By prioritising consumer education, food reformulation, and clinical counselling, India can make significant strides toward meeting the WHO 2025 global target for salt reduction and alleviating the growing burden of hypertension and cardiovascular disease (Al-Jawaldeh et al., 2021).

6. CONCLUSION

This study provides comprehensive and contemporary evidence on salt-related awareness, knowledge, and behavioural practices in an Indian population, offering valuable insight for public health action. While general awareness of the health risks of excess salt intake was moderate, a substantial knowledge–practice gap was evident, with many participants unable to correctly identify the WHO-recommended daily limit and a considerable proportion continuing to purchase high-salt processed foods despite awareness. Behavioural factors emerged as powerful determinants of salt awareness, with frequent fast-food consumers and snackers displaying the lowest awareness, while individuals who regularly checked food labels were nearly twice as likely to attempt salt restriction. Participants with hypertension or chronic kidney disease reported greater awareness and more frequent receipt of low-sodium advice, yet continued reliance on regular iodised salt highlights partial adherence to clinical recommendations. Encouragingly, most respondents preferred medium or low salt in their food and over 60% expressed willingness to adopt low-sodium or plant-based substitutes if they were affordable, suggesting a readiness for behaviour change if structural and economic barriers are addressed. These findings emphasise the urgent need for multifaceted interventions, including population-wide nutrition education, mandatory front-of-pack labelling, reformulation of high-sodium processed foods, and affordable availability of salt substitutes. Clinicians should integrate routine sodium-reduction counselling into primary care, particularly for younger adults and frequent consumers of processed food. By combining behavioural, regulatory, and clinical strategies, India can accelerate progress toward the WHO 2025 global salt-reduction target and meaningfully reduce the burden of hypertension and cardiovascular disease.

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