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ANANALYSIS OF AWARENESS, HOUSEHOLD CONSUMPTION, AND FACTORS INFLUENCING THE USE OF FORTIFIED FOODS

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ABSTRACT

Food fortification is an effective public health strategy for combating micronutrient deficiencies and improving nutritional status among populations. The present study aimed to assess awareness, household consumption patterns, and factors influencing the utilization of fortified foods among consumers. A cross-sectional survey was conducted among 212 respondents using a structured questionnaire to collect information on socio-demographic characteristics, awareness, knowledge, perception, consumption practices, and determinants influencing the use of fortified foods. Data were analyzed using descriptive statistics, Chi-square test, Independent Sample t-test, One-Way ANOVA, Pearson correlation analysis, and Multiple Regression Analysis. The results revealed that 86% of respondents had heard about fortified foods, while 87% recognized the +F logo on food packages. Social media was identified as the major source of awareness (49%). A majority of respondents reported purchasingfortifiedfoodproducts(81%),and72%consumedfortifiedfoodsdaily.Significant associationswereobservedbetweenawarenessandage($p<0.001$)aswellaseducationalstatus ($p=0.001$). Independent sample t-test showed no significant difference in awareness scores betweenmalesandfemales($p=0.843$).Asignificantpositivecorrelationwasobservedbetween awareness and knowledge scores ($r=0.644$, $p<0.001$). Regression analysis indicated that awareness,knowledge,price,andavailabilitysignificantlyinfluencedthepurchaseoffortified food

products. The findings suggest that awareness, education, accessibility, and perceived healthbenefitsplayimportantrolesinshapingconsumerutilizationoffortifiedfoods.
Strengthening nutrition education programmes, improving accessibility, and promoting fortified foods through effective communication strategies may further enhance their acceptance and regular consumption.

KEYWORDS: Food fortification, fortified foods, awareness, household consumption, consumer perception, public health.

INTRODUCTION

Nutritionisessentialforgrowth,development,immunefunction,andthepreventionofdisease throughout life. Adequate nutritional intake contributes to improved health outcomes and overallwell-being.However,malnutritionremainsamajorpublichealthconcerngloballyand includesundernutrition,micronutrientdeficiencies, overweight,obesity,anddiet-relatednon-communicablediseases.Micronutrientdeficiencies,commonlyreferredtoas“hiddenhunger,” occurwhendietsprovidesufficientenergybutfailtomeetrequirementsforessentialvitamins and minerals.[15,16] Micronutrient deficiencies continue to affect populations worldwide, particularly in developing countries. Deficiencies of iron, iodine, vitamin A, folic acid, zinc, andvitaminDareassociatedwithimpairedgrowth,weakenedimmunity,anemia,andadverse maternal and child health outcomes. In India, the persistent burden of anemia, stunting, and other nutrition-related disorders highlights the need for sustainable strategies to improve micronutrient intake and nutritional status.[14,16]

Food fortification is recognized as a practical and cost-effective public health intervention for addressing micronutrient deficiencies. It involves the addition of essential vitamins and minerals to commonly consumed foods to improve their nutritional value. International organizations such as WHO and FAO recommend fortification as an effective approach to enhance nutrient intake at the population level without requiring major dietary changes.[17] Successfulfortificationprogrammesinvolvingrice,wheatflour,milk,edibleoil,andsalthave demonstrated positive impacts on nutritional health in many countries.[11,10]

In India,foodfortificationformsanimportantcomponentofnationalnutritioninitiatives.The Food Safety and Standards Authority of India (FSSAI) has established standards for fortified foods and promotes consumer recognition through the “+F” logo. Fortified staples, including rice, wheat flour, milk, edible oil, and salt, are distributed through both government programmes and commercial markets to improve micronutrient intake among vulnerable groups.[5,6]

Theeffectivenessoffortificationprogrammesdependsnotonlyonproductavailabilitybutalso onconsumerawarenessandacceptance.Awarenessenablesindividualstorecognizefortified foods, understand their benefits, and make informed dietary choices. Previous studies havereportedvaryinglevelsofawarenessandknowledgeregardingfortifiedfoods,suggestingthat inadequate understanding may limit their utilization despite increased availability.[2,3,9] Householdconsumptionbehaviourisanotherimportantfactorinfluencingthesuccessoffood fortificationinitiatives.Regularconsumptionoffortifiedfoodscanimprovemicronutrient intakethroughroutinedietarypractices;however,utilizationoftenvariesaccordingto socioeconomic status, education, affordability, accessibility, and purchasing habits. Research hasshownthatthepresenceoffortifiedproductsinthemarketdoesnotnecessarilyensuretheir regularusebyconsumers.[1,12]Consumerperceptions,educationalstatus,incomelevel,cultural preferences,andexposuretonutritioninformationfurtherinfluencetheacceptanceandutilizationoff ortifiedfoods.Positiveperceptionsregardinghealthbenefitsandproductquality are associatedwith greater consumption, whereas misconceptions and limited awareness may hinder adoption.[4,8,13]

Although food fortification has received increasing attention as a strategy to reduce micronutrient deficiencies, limited information is available regarding household awareness, consumption patterns, and factors affecting utilization, particularlyin South India. Therefore, the present study was undertaken to assess awareness regarding fortified foods, evaluate household consumption patterns, and identify factors influencing their utilization among consumers.

MATERIALSAND METHODS

Study Design andSetting

A descriptive cross-sectional study design was adopted to assess awareness, household consumption patterns, and factors influencing the utilization of fortified foods among consumers. The study was conducted among respondents from selected areas, ensuring representation of different socio-demographic backgrounds.

StudyPopulationandSampleSize

The study population comprised adults aged 18 years and above. A total of 212 respondents were selected for the study using a convenient sampling technique.

DataCollection Tool

Astructuredquestionnairewasusedfordatacollection.Thequestionnaireconsistedofsections onsocio-demographicdetails,awarenessregardingfortifiedfoods,knowledgeoffortifiedfood

products, consumption patterns, perception towards fortified foods, and factors influencing purchasing decisions.

DataCollectionProcedure

Datawerecollectedthroughanonlineand/ordirectsurveymethod.Participantswereinformed about the purpose of the study and assured confidentiality of their responses. Consent was obtained prior to participation.

Statistical Analysis

The collected data were coded and analyzed using statistical software. Descriptive statistics such as frequency and percentage were used to summarize the data. Inferential statistics includingChi-squaretest, Independent Samplet-test,One-WayANOVA, Pearsoncorrelation analysis, and Multiple Regression Analysis were applied to determine associations and relationships among variables. A p-value of less than 0.05 was considered statistically significant.

EthicalConsideration

Ethical approval was obtained from the concerned department/institution. Participation was voluntary, and confidentiality and anonymity of respondents were strictly maintained throughout the study.

RESULTS AND DISCUSSION

Socio-Demographic Characteristics of Respondents

Atotalof212individualsparticipatedinthestudy. Participantsaged26–35 yearsrepresented the largest proportion (38%), followed closely by those aged 18–25 years (37%). This distribution indicates that young adults formed the predominant segment of the study population. Female respondents accounted for 69% of the sample, whereas males represented 26%.Intermsofeducationalattainment,postgraduateparticipantsconstitutedthelargestgroup (38%), followed by undergraduates (26%).

TABLE 1-Socio-DemographicCharacteristicsofRespondents

Variable	Category	Frequency (n)	Percentage(%)
Age	18–25 years	78	37
	26–35years	81	38
	36–45years	36	17
	46–55years	15	7
	Above55years	2	1
Gender	Male	56	26
	Female	147	69
	Prefernottosay	9	4

Education	No formal education	8	4
	Primaryschool	24	11
	Secondaryschool	43	20
	Undergraduate	56	26
	Postgraduate	81	38

The predominance of younger and highly educated participants is similar to observations reported in previous nutrition-related surveys, where individuals with higher educational qualifications were more likely to participate in health and nutrition research. Greater educationalexposuremaycontributetoincreasedinterestindietarypracticesandpublichealth interventions

AwarenessRegardingFortifiedFoods

Awareness of fortified foods was high among participants, with 86% reporting familiarity. Recognition of the +Flogo was also strong, with 87%aware ofthesymbol. Socialmediawas the main source of information (49%), followed by healthcare professionals (21%) and television (17%), reflecting the growing influence of digital platforms in health communication.

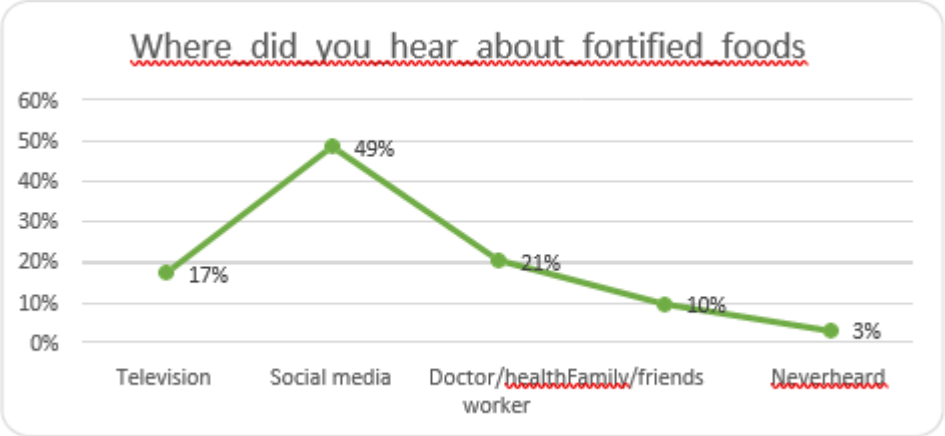

Figure1 –SourcesofAwarenessRegarding Fortified Foods.

Similarfindingswerereportedby Geethaetal.(2023),highlightingtheimportantroleofonline media in spreading nutrition-related information. The high awareness observed in this study mayalsobeattributedtoawarenesscampaignsandfortificationinitiativesbyorganizations such as WHO and FSSAI. Improved awareness is encouraging as it supports informed food choices and better acceptance of fortified foods.

KnowledgeRegardingFortifiedFoods

Participantsdemonstratedsatisfactoryknowledgeregardingthenutritionalpurposeoffortified

foods. Most respondents correctly identified that fortified foods contain added vitamins and minerals (85%). Similarly, 86% recognized that fortified salt contains iodine, 83% correctly identified fortified milk as a source of vitamins A and D, and 75% were aware that fortified wheat flour containsiron and folic acid.

Table2-KnowledgeRegardingFortified Foods.

Statement	CorrectResponse(%)
Fortifiedfoodscontainadded vitaminsand minerals	85
Fortifiedsalt contains iodine	86
Fortified milk contains vitamins A/D	83
Fortifiedwheat flourcontains iron&folic acid	75

These findings indicate that participants have a reasonably good basic understanding of food fortification.SimilarresultswerereportedbyBattalwarandSyed(2017),whofoundthaturban consumers generally had moderate to good knowledge of fortified foods. However, existing gapsinknowledgeaboutspecificfortifiedproductshighlighttheneedforcontinuedconsumer education and awareness programmes.

ConsumptionPatternofFortifiedFoods

Consumptionpracticesindicated substantialincorporation offortifiedfoodsintoroutine diets.

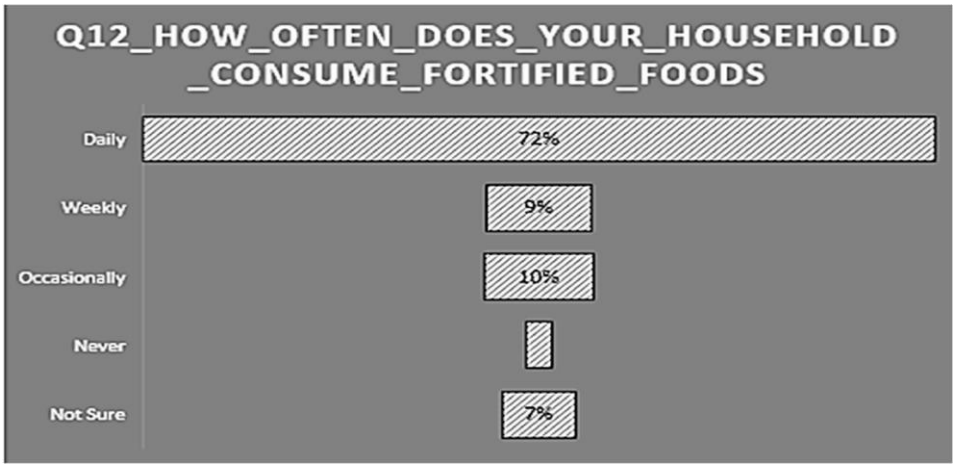

Figure2–Frequencyof Consumptionof FortifiedFoods.

Approximately 81% of respondents reported purchasing fortified food products, while 72% consumed them daily. These findings indicate good acceptance and regular utilization of fortified foods among the study population. Similar observations have been reported in previous studies, where higher awareness and better accessibility were associated with increasedconsumptionoffortifiedfoods(Radhakrishnanetal.,2025).Theresultssuggestthat

fortified foods are becoming an increasingly common component of daily dietary practices.

AwarenessandKnowledgeof FortifiedFoods.

Most respondents demonstrated good knowledge regarding fortified foods. A majority correctly identified that fortified foods contain added vitamins and minerals (85%), and were aware that fortified salt contains iodine (86%), fortified milk contains vitamins (83%), and fortified wheat flour contains iron and folic acid (75%).

Table3- AwarenessandKnowledge of Fortified Foods.

Variable	Response	Frequency(n)	Percentage(%)
Heard aboutfortifiedfoods	Yes	183	86
	No	29	14
Purchasefortifiedfoods	Yes	172	81
	No	11	5
	Not sure	29	14
Consumptionfrequency	Daily	152	72
	Weekly	20	9
	Occasionally	21	10
	Never	5	2

However, some uncertainty was observed regarding specific fortified products such as edible oils.

PerceptionTowardsFortified Foods

Theperceptionofrespondentstowardsfortifiedfoodswasgenerallypositive.Mostparticipants agreed that fortified foods are beneficial for health (76%), important for daily nutrition, and help prevent health problems. Overall attitudes towards fortified foods were positive. Most participants believedthat fortifiedfoods arebeneficialfor health, helpmeet nutritionalneeds, andpreventnutrientdeficiencies.Ahighleveloftrustinfortifiedproductswasalsoobserved. These findings are consistent with Geicu-Cristea et al. (2024), who reported that perceived health benefits significantly influence acceptance of fortified foods

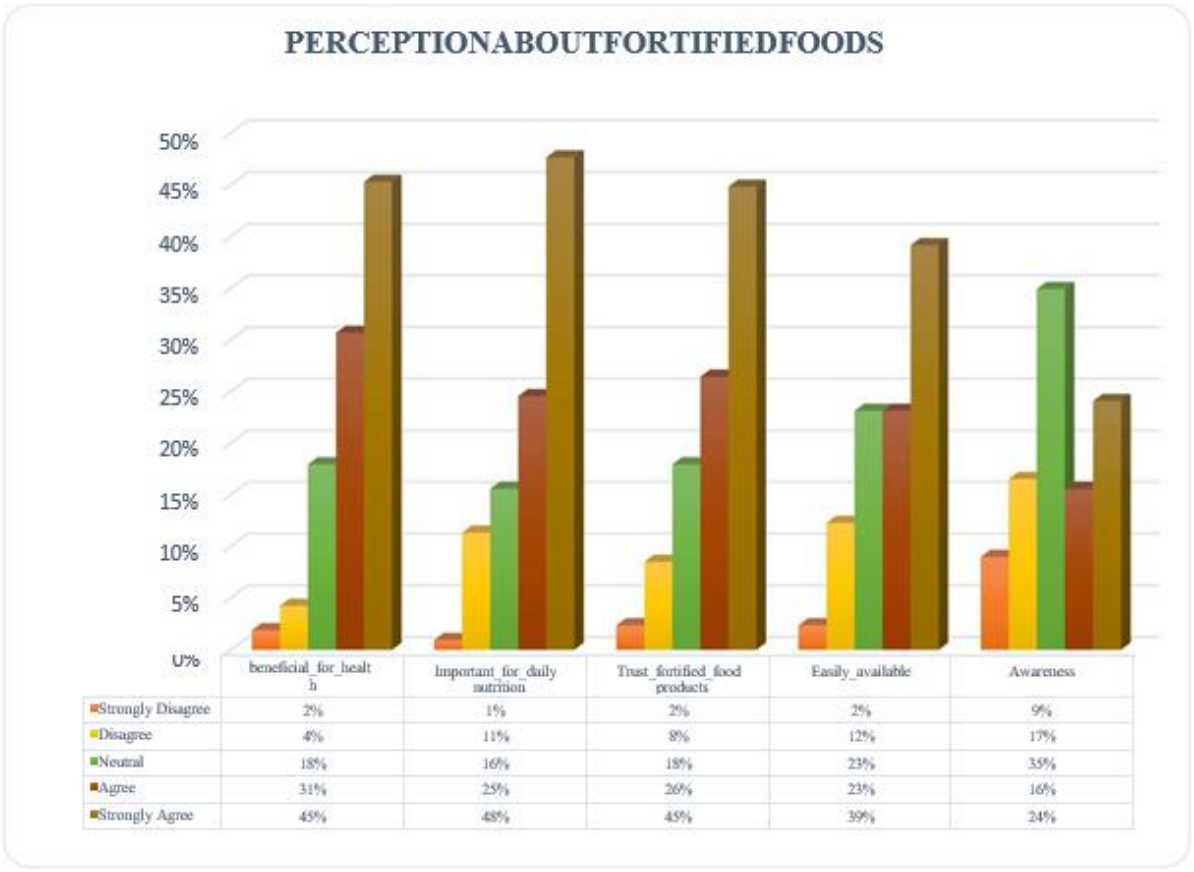

Figure3–PerceptionTowardsFortified Foods

Such positive perceptions are important as they affect purchasing decisions and long-term consumption patterns. The favourable attitudes in this study may be attributed to increased awareness of micronutrient deficiencies and the role of food fortification in improving nutritional status.

FactorsInfluencingUtilization of FortifiedFoods

Healthbenefits(92%)andrecommendationsfrom doctorsorfamilymembers(93%)emerged as the strongest factors influencing the utilization of fortified foods. Availability (78%) and price (67%) were also reported as important considerations during purchasing decisions.

These observations indicate that both informational and economic factors contribute to consumer behaviour. Similar findings have been documented byChaurasia et al. (2025), who reported that perceived health benefits, social influence, affordability, and accessibility significantlyaffect fortified food consumption patterns.The findings highlight the importance of combiningawareness initiatives with strategies thatimprove accessibilityand affordability of fortified products.

StatisticalAnalysis Chi-Square Test

Chi-squareanalysisidentifiedsignificantassociationsbetweenageandawareness($p<0.001$), education and awareness ($p = 0.001$), price and purchasing behaviour ($p = 0.003$), and availability and consumption frequency ($p = 0.005$).

Table4- Chi-SquareTestResults.

Variables	p-value	Result
Agevs Awareness	<0.001	Significant
EducationvsAwareness	0.001	Significant
Price vs Purchase	0.003	Significant
AvailabilityvsConsumption	0.005	Significant

These findings suggest that education, affordability, and accessibility play important roles in awareness and utilization of fortified foods. Similar observations have been reported by Battalwar and Syed (2017) **and** Radhakrishnan et al. (2025)**.**

IndependentSamplet-test

Theindependentsamplet-testshowednostatisticallysignificantdifferenceinawarenessscores between male and female respondents ($t = 0.200$, $p = 0.843$).

Table5 -T-Test Results.

Variable	t-value	p-value	Interpretation
Gender vs Awareness	0.200	0.843	Not significant

This suggests that awareness regarding fortified foods was comparable across genders within the study population. Similar findings have been documented in nutrition-related research whereeducationalbackgroundandaccesstoinformationappearedtoexertastrongerinfluence on awareness than gender.

One-Way ANOVA

Analysis of variance revealed significant differences in awareness across age groups ($F = 4.206, p=0.003$)andeducationallevels($F=7.911, p<0.001$).Highereducationalattainment was associated with greater awareness of fortified foods. Similar findings were reported by Battalwar and Syed (2017), who observed that education positivelyinfluences awareness and understanding of fortified foods.

Table6- ANOVA Results.

Variable	F-value	p-value	Result
Agevs Awareness	4.206	0.003	Significant
EducationvsAwareness	7.911	<0.001	Significant
ConsumptionvsAge	2.195	0.071	Not significant

No statistically significant difference was observed in consumption frequency across age groups (F = 2.195, p = 0.071), suggesting relatively similar consumption practices among different age categories.

Correlation Analysis

Correlation analysis revealed a significant positive association between awareness and knowledge of fortified foods (r = 0.644, p < 0.001), indicating that respondents with higher awareness possessed better knowledge. Significant negative correlations were observed between awareness and consumption frequency (r = -0.252, p < 0.001) and knowledge and consumptionfrequency(r=-0.363,p<0.001).Sincelowerconsumptionscoresindicatedmore frequent intake,these findings suggest that greaterawareness and knowledge wereassociated with regular consumption of fortified foods. Similar observations have been reported by Battalwar and Syed (2017), Radhakrishnan et al. (2025), and Chaurasia et al. (2025).

Table7 -Correlation Analysis.

Variables	r-value	p-value	Interpretation
AwarenessvsKnowledge	0.644	<0.001	Significant positive
Awareness vs Consumption	-0.252	<0.001	Significant
Knowledge vs Consumption	-0.363	<0.001	Significant

These findings highlight the importance of strengthening nutrition education and awareness programmes to promote regular consumption of fortified food products.

Regression Analysis

Multiple regression analysis demonstrated that awareness, knowledge, price, and availability significantlyinfluencedpurchasingbehaviour relatedtofortified foods (F= 9.301,p<0.001).

Table8 - Regression Analysis.

Model	R	R^2	F-value	p-value
Full model	0.390	0.152	9.301	<0.001

The model explained 15.2% of the variation in purchasing behaviour ($R^2 = 0.152$), indicating that these variables collectively contributed to consumer decision-making. Although statistically significant, the relatively modest explanatory power suggests that additional factors such as taste preferences, household purchasing habits, brand trust, and marketing exposure may also influence purchasing behaviour. These observations support previous research highlighting the combined importance of awareness, accessibility, affordability, and consumer perceptions in determining utilization of fortified foods.

Summary of Findings

The findings show good awareness, knowledge, perception, and use of fortified foods among participants.Awarenesswassignificantlyassociatedwithageandeducation,whilegenderhad noeffect.Higherawarenessandknowledgewerelinkedtomorefrequentconsumption.Health benefits,trustedrecommendations,availability,andcostwerekeyfactorsinfluencingpurchase decisions. Overall, the results highlight the need to improve nutrition education and ensure better access and affordability of fortified foods.

CONCLUSION

The studyfound ahigh levelof awareness and positiveconsumption offortified foods among respondents.Mostparticipantswerefamiliarwithfortifiedfoods,recognizedthe+Flogo,and reported regular consumption. Awareness was significantly associated with age and educationalstatus, while price, availability, knowledge, and awareness influenced purchasing behaviour. Overall, fortified foods were well accepted, although differences in awareness and utilization were observed across demographic groups.

Recommendations

1. Strengthen nutrition education and awareness programmes at community and school levels.
2. Utilizesocialmediaandmassmediatopromoteaccurateinformationonfortifiedfoods.
3. Improve theavailabilityoffortifiedfoods,especiallyinrural and underserved areas.
4. Encourageaffordablepricingto increaseconsumeradoption.
5. Enhancepromotionofthe+Flogotohelpconsumersidentifyfortifiedproductseasily.

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