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Determinants of Dietary Diversity Score for the Rural Households of Uttar Pradesh State

Indresh Kumar[1], Madhulika Gautam[2]

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Abstract

Good nutrition is a prerequisite for a healthy and active life, especially for an agriculture-dependent rural population. Inadequate food and nutrition affect human well-being, particularly for populations living in rural areas.However, diets in most rural households lack diversity because the intake of fruits, meat, poultry, fish, and green vegetables was low. This study estimates the factors influencing dietary diversity of the household and individual levels. The 248 sample households for surveys were determined by a stratified random sampling method. Household Dietary Diversity Score and individual dietary diversity score was assessed through the standard questionnaire developed by the food and agriculture organization of the United State, with 12 food groups and 9 food groups, respectivel pearson correlation coefficient was used to determine the relationship between the household diet diversity score or individual dietary diversity score with different studied variables. The findings show that the most consumed foods within the household are cereals, tubers, oils and fats, spices, and condiments. Females have low dietary diversity score compared to males in the households.The majority of the households and individuals had low diet diversity scores and foods from animal sources were rarely included as diets, particularly in households with low dietary diversity scores. The studies have shown a strong positive correlation between the level of education, the awareness status of homemakers and the attitude about food and nutrition. The nutritional knowledge, awareness, attitude, and educational status of the head of HH were also positively correlated with household dietary diversity score but the relationship was weak.

Keyword: Dietary Diversity Score; Rural Households; Food diversity; Food security; Food availability.

Introduction

Uttar Pradesh (UP) is the most populous state in India and has some of the highest rates of malnutrition as well as micronutrients deficiency.[1] Nutrition is a basic human need and a prerequisite to a healthy life.[2] The World Health Organization (WHO) has suggested that at least 20, perhaps as many as 30, biologically distinct variants of foods should be consumed each week for a healthy diet.[3] The promotion of diverse diets is one of several approaches to improving micronutrients in the habitual diet.[4]

According to Food and Agriculture Organization (FAO), Dietary diversity (DD) is defined as the number of food groups consumed over a reference period.[4] It reflects the concept that increasing the variety of foods and food groups in the diet helps to ensure adequate intake of essential nutrients.[1] Sufficient income resources, agrobiodiversity, heterogeneity within the landscape, and livelihood diversity all supported their ability to consume a varied diet and achieve good nutritional status. Other variables affecting diet and DD included seasonality, Household (HH) size, and gender.[5,6] As DD promotion becomes an increasingly common component of nutrition education, understanding local nutrition knowledge systems and local

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concepts about DD are essential to formulate efficient messages.[5] As it has been revealed in many types of research, the social and economic condition of the HHs affects Household Dietary Diversity Score (HDDS).[6] Similarly, efforts have been made to find out the relationship with other factors in a better way in the rural area of Uttar Pradesh state. DD can be measured at the HH or individual level through the use of the questionnaire.[4,7] Most often it is measured by counting the number of food groups rather than the food items consumed. At the household level, DD is usually considered as a measure of HHs capacity to access costly food groups; while at the individual level it reflects dietary quality, mainly the micronutrient adequacy of the diet. Although the reference period can vary, it is most often the previous day or week.[8]

Methodology

This was a cross-sectional study, which was structured based on the WHO & FAO's dietary diversity questionnaire that was revealed in 2013.[9,10] Also, we used the FAO's third version of the guidelines for measuring HDDS and Individual Dietary Diversity Score (IDDS). To assess the influencing factors of HDDS and IDDS studies in the following manner: (I) Demographic and socio-economic factors (II) Food availability and accessibility(III) Utilization and distribution (IV) Nutritional knowledge and attitude.

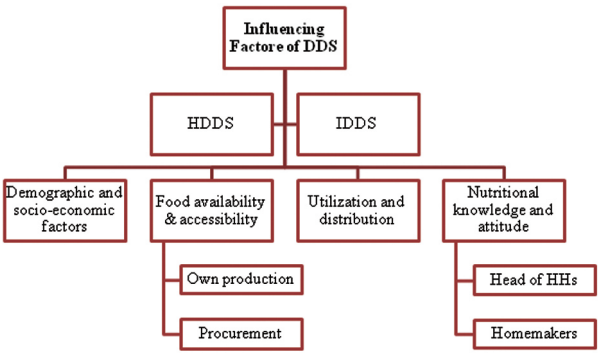

Fig. 1: Studied influencing factors of DDS.

Sample selection: A total of 264 HHs was randomly selected from Banda and Kannauj district of Uttar Pradesh state and 491 individuals from the selected HHs were selected to assess the IDDS and influencing factors.

Inclusion and exclusion: Only ≥13 to <60 years aged male and female individuals were included; pregnant and lactating women were excluded.

Study tools: In the present study's quantitative data was assessed, six standard tools were used after local adaptation. (I)Enumeration schedule, (II)HH schedule, (III) Procurement & utilization schedule, (IV)The nutritional knowledge and attitude assessment questionnaire, (V) HDDS questioner, and (VI) IDDS questioner were used. All these tools were standard tools, which were translated into regional language by proper method before using it.

Data Collection: All the tools were administered by the researcher, interviews techniques were used for the quantitative data collection, anddata was collected in March 2018.

Variables: HDDS and IDDS were dependent variables in this study; which depended on the independents' variables: level of education, family type, family size, family income, religion, caste, sex, occupation of the head of HH, food availability, and accessibility, source of food procurement, utilization and distribution of food produced, nutritional knowledge, awareness, and attitude.

Data Analysis: Microsoft Excel data pack was used for the data analysis, in which the given functions were used to find the average, percentage, Standard Deviation (SD), t-test, and Pearson correlation (r-value). The strength of the association, for absolute values of r, 0-0.19 is regarded as very weak, 0.2-0.39 as weak, 0.40-0.59 as moderate, 0.6-0.79 as strong, and 0.8-1 as very strong correlation.

Measurement of HDDS: 12 food groups used suggested by the FAO during the Food and Nutrition Technical Assistance (FANTA) project 9(A) Cereals & millets (B) White tubers and roots (C) Vegetables (D) Fruits (E) Meat (F) Eggs (G) Fish and other seafood (H) Legumes, nuts, and seeds (I) Milk and milk products (J) Oils and fats (K) Sweets (L) Spices, condiments, and beverages. It is the sum of consumed food groups consumed with the reference period in the HHs (last day). A to L food groups have been used to measure the HDDS, with the potential score range is 1-12.

HDDS = Sum of consumed food groups (A+B+C+D+E+F+G+H+I+J+K+L)

Measurement of IDDS: 9 food groups was suggested by FAO for the measuring of IDDS[10] (A) Starchy staple (B) Pulses, legumes, nuts, and seeds (C) Organ meat and fish (D) Roots and tubers (E) Dark green & leafy vegetables (F) Other vitamin-A rich food & vegetables (G) Eggs (H) Milk and milk products (I) Fat and oil-based items. It is the sum of consumed food groups consumed with the reference period (previous day). A to I food groups have been used to measure the IDDS, with the potential score range being 1-9.

IDDS = Sum of consumed food groups (A+B+C+D+E+F+G+H+I).

Ethical Issues: Permission was taken from the Ethics Committee constituted by the institute and written consent with participants was also taken after explaining the study proposal in detail.

Results and Discussion

(I) Demographic and socio-economic factors

Demographic and socio-economic status is a major determinant of healthy diets, according to available literature, the high socioeconomic status may be associated with overall better dietary patterns and diet quality.[9] Several types of research have shown that DD is a good proxy indicator of dietary quality among communities living in rural areas.[10] HHs in low and middle-income groups typically base their diets on rare other food groups than their staple foods, which results in less DD.[11]

Table 1: HDDS according to the type of family.

Type of family	n	Mean HDDS	SD
Nuclear	120	5.61	1.90
Extended nuclear	54	5.33	1.95
Joint	64	4.95	1.81
Collectively	256	5.30	1.94

HDDS of nuclear families was the highest (5.61), the extended nuclear and joint families had HDDS of 5.33 and 4.95, respectively (Table 1) in the present research. Type of family has an impact on dietary intake as a proximal food environment and family structures are changing and becoming more diverse.[12]

Table 2: HDDS according to family size.

Number of family members	n	Mean HDDS	SD	r-value
1 – 4	98	5.68	1.77	-0.33
5 – 7	144	5.20	1.87	-0.35
≥ 8	14	4.45	2.14	-0.48
Collectively	256	5.30	1.94	-0.47

A family with 1-4 members had HDDS 5.68 (highest), while the family with more than 8 members had a 4.45 (lowest) HDDS (Table 2). Pearson's correlation (r-value)-0.47 shows a negative weak negative correlation between family size and HDDS. According to a study, the number of grossing members in the family has a positive effect on the food group's intake.[14] Whereas the relation between the number of dependent members in the family and food groups in the HHs was found a negative effect. Current research has proved that small family size is responsible for good HDDS.

Table 3: HDDS according to different income groups.

Income groups	n	Mean HDDS	SD	r-value
High	--	--	--	--
Upper-middle	66	6.16	2.01	0.12
Lower-middle	112	5.26	1.84	0.38
Low	78	4.48	2.41	0.40
Collectively	256	5.30	1.94	0.42

HDDS was directly influenced by family income and it's positively correlated (Table 3) with r-value 0.42; the highest HDDS (6.46) was from the upper-middle-income group and the lowest(4.48) score was obtained by the low-income group. Evidence from many kinds of researches showsthat HDDS is strongly associated with HH per capita income.[13,14]

Pearson's correlation r-value 0.42 was showing a weak positive correlation between family income and HDDS. An improvement in family income has also improved the buying capacity of food items, but weak the relationship between HDDS family income was indicating that other factors were alsoinfluencing the score.

The level of education of the head of the HH had influenced the HDDS with an r-valueof 0.34 was showing a positive but weak correlation (Table 4). The education level of homemakers was showing a strong positive correlation between HDDS with

Table 4: HDDS according to the education status of the head of HHs and homemakers.

Educational status	Head of HHs				Homemakers			
	n	Mean HDDS	SD	r-value	n	Mean HDDS	SD	r-value
Illiterate (0)	14	4.62	2.21	0	10	4.12	2.43	0
Read & write (1)	19	4.44	2.02	0	17	4.24	2.11	0
2 – 4 standards	88	5.21	2.34	0.11	94	5.02	2.42	0.14
5 – 8 standards	100	5.04	1.88	0.14	112	5.49	2	0.26
9 – 12 standards	23	5.73	1.54	0.18	25	5.92	1.45	0.31
College (13-15)	12	6.75	2.12	0.24	8	6.92	1.23	0.42
Collectively	256	5.30	1.93	0.34	266	5.30	2.05	0.71

an r-value of 0.71. In numerousresearches, the education level of homemakers and food intakes were associated.[17,18] Many recent studies have been conducted to evaluate the education level of homemakers with food frequency, use of food groups and food preferences are sowing education level of homemakers as an effective factor.[18,19] The effect of women on the food selection is more than the head of HH, while the head of the house is more concerned about the income of the HH, current research has proved the positive impact of women's education on HDDS.

Table 5: HDDS according to the major occupation of the head of HHs.

The major occupation of the head of HH	n	Mean IDDS	SD
Service	20	6.81	2.62
Business	12	6.31	2.71
Owner cultivator	98	5.30	1.9
Landlord + tenant cultivator	34	5.20	1.77
Others	4	5.15	1.68
Other labor	24	5.12	2.11
Artisans	12	4.32	1.88
Agricultural labor	52	4.18	1.97
Collectively	256	5.30	1.94

The data showing the impact of occupation of the head of HHs on HDDS, the score was highest among the head of HHs whose occupation was service and business, which was 6.81 and 6.31 respectively (Table 5). The head of HHs worked as agriculture labor had their HDDS lowest (4.18). The findings suggest that considering the unique characteristics of occupations and their related background factors with HDDS.[19] Food diversity in the population related to farming and its allied work in India was less than that of the population involved in the other occupations.[20] An occupation that is responsible for visiting the nearest city or town every day has to maintain a market link, which encourages shopping.

Table 6: HDDS and cast status.

Community	n	Mean HDDS	SD
Others (general)	62	5.61	1.74
SC	52	5.29	2.42
OBC	140	4.99	1.94
ST	0	--	--
Collectively	256	5.30	1.94

HDDS was found (Table 6) to be the highest (5.61) among the other (general) cast HHs, whereas the lowest score (4.99) had found in the Other Backward Cast (OBC). The exact score (5.29) of the ScheduledCast (SC) was better than the OBC. These results confirm that the casting status of studied HHs and HDDS are different in this area. Most of the people of SCs were going for the te paid work in the nearby town, due to which they had daily access to the market was resulting in better purchasing capacity compression to OBCs.[21]

Table 7: HDDS and religions.

Religion	n	Mean HDDS	SD
Hindu	226	5.21	1.91
Muslim	30	5.39	2.08
Christian	0	--	--
Others	0	--	--
Collectively	256	5.30	1.94

Only two types of religions were found in the study area, and the HDDS was found to be higher in Muslim HHs than Hindus, which were HDDS 5.18 and 5.48, respectively (Table 7). Indian diets are strongly impacted by religion and all of these groups have different food habits and different food restrictions that impact their cuisine.[22] For example, Hindus are mostly prohibited from eating beef; Muslims do not eat pork. A vast number of Hindus are vegetarians, fresh meat, poultry, eggs, and fish are often excluded from the diet. Religious beliefs hinder the full utilization of available food items.[23]

Table 8: IDDS according to sex and age groups.

Sex	Group	n	Mean IDDS	SD
Male (18-59 years)	Sedentary workers	17	4.56	1.77
	Moderate workers	90	4.46	1.83
	Heavy workers	26	4.40	1.64
Female (18-59 years)	Sedentary workers	77	4.22	1.87
	Moderate workers	98	4.36	1.88
	Heavy Workers	11	4.20	2.02
Boys	13-15 years	46	4.41	1.92
	16-17 years	26	4.27	1.89
girls	13-15 years	59	4.12	2.32
	16-17 years	41	4.03	1.81
	Collectively	491	4.31	1.72

The lowest IDDS 4.03 was of girls (16-17 years), and the highest IDDS 4.56 was of sedentary men (Table 8). The overall women's IDDS was 4.26 which was

more than the mean (4.31), while the men's IDDS was 4.43 which was higher than the mean score. The highest SD in girls 13 to 15 years aged was 2.32, which showed the most disparity in scores, the same SD in the group of men heavy worker with age 18 to 59 years old was 1.64, which was the lowest disparity in scores. In much important research, the nutritional intake of women was found to be worse than that of men in India.[1,26]

Table 9: IDDS and educational status.

Educational Status	n	Mean IDDS	SD	r value
Illiterate	24	4.64	2.00	–
Read & write	8	4.44	2.13	–
1 – 4 standards	176	4.23	2.01	0.54
5 – 8 standards	154	4.11	1.78	0.44
9 – 12 standards	87	4.23	1.88	0.57
Graduate/ diploma	42	4.96	2.03	0.53
Collectively	491	4.31	1.72	0.61

The staus of education among people increases the understanding and awareness of food[16], this impact is being displayed in this research with the moderate positive relationship between IDDS and the education status of individuals as r-value 0.61 (Table 9). The highest IDDS, 4.96 was in the group of graduate/diplomapassed respondents; the lowest IDDS was found at 4.11 in the 5-8 class passed respondents with the lowest SD 1.78 (Table 9).

(II) Food availability and accessibility

The literature suggests that Indian agriculture has a range of important influences on HDDS. The evidence on agriculture linkages to diverse diets is relatively weak.[15] While dairy animal ownership was found to be associated with improved dietary quality, larger HHs were in a better position to adopt dairy animals, which, in turn, might contribute to better HH nutrition.[17]

In the current research, the relationship of that food group's availability from its own production with the HDDS was found (Table 10). Green leafy vegetables, milk, and other green vegetables food groups production was showed a strong positive correlation with the HDDS, wherer-value were 0.88, 0.83, and 0.79 respectively.

There was no correlation of availability of fish, meat, and millets, from own production with HDDS, wherer-value were zero. Fruits, pulses, root & tubers, eggs and sugar, and honey showed a weak positive correlation with the HDDS, where r-value were 0.47, 0.26 and 0.24, 0.21, and 0.12 (very weak correlation) respectively.

Table 10: Agriculture production as different food groups and HDDS.

Food Groups	Per HHs availability in g/day	r-value
Cereals	970.26	0.06
Millets	33.67	–
Pulses	81.18	0.26
Fishes	12.34	–
Roots and tubers	394.3	0.24
Green Veg.	11.46	0.79
Green leafy veg.	16.72	0.88
Eggs	6.25	0.21
Milk & milk products	649.46	0.83
Fruits	124.48	0.45
Oil and fat	21.28	0.03
Meat & Poultry	37.78	–
Sugar & Honey	27.89	0.12
Condiments & spices	14.31	–

A systematic review was undertaken to identify the impact of vegetable production and consumption status. Out of 140 studies, 116 (83%) studies reported to increase intake of vegetables after that improvement in the production of vegetables after intervention.[27]

Procurement of food and HDDS

Table 11: Mostly source used for food procurement.

Most Procurement Source	n	%	HDDS
From the own Cultivation/Kitchen Garden/Livestock/ common source	112	42.42	5.50
Purchased through PDS/ other government relief	43	16.29	4.60
Purchased from the local market/local shops	32	12.12	5.14
Purchased from the main market/weekly market	77	29.17	6.00
Collectively	264	100.00	5.30

The highest HDDS 6.00 was in HHs procuring the food items from the main market, while HHs have their own production like cultivation, kitchen, garden, livestock, andthe common source had a second highest HDDS 5.50. HHs that were mainly procured from a PDS or other government source had the lowest HDDS of 4.60. Production of all required foodstuff at own state (land, kitchen

garden, livestock) has a positive impact on the nutritional status of the HH.[22]

Utilization and distribution of own production

Proper utilization of the food produced becomes essential to maintain the diversity in diet.[5] Effective food utilization depends in large measure on knowledge within the HH of food storage and processing techniques and basic principles of nutrition.[23]

Table 12: HDDS and utilization of production.

Distribution	Percent of total production	r-value
Retained for human consumption	26.00	0.22
Sold	63.00	0.06
Use for animal feed	08.00	0.00
Share to other HHs	02.38	0.26
Spoilage during storage	00.62	0.00

In the current research, the Pearson correlation between the HDDS and the utilization of food produced has been assessed. Five types of distributions were studied for the utilization of food, out of which a weak positive relationship between three distributions.

HHs sharing food produced with other HHs was found to have the highest correlation with HDDS, where the r-value was 0.26 when the relationship between retained for human consumption were r-valuewas 0.22. HHs that sold more food produced had the same increase in HDDS, but the association was very weak, with anr-value of 0.06. No relationship was found between the amount of food produced used for animal feed and HDDS, similarly, no association was found between the spoiled amount of food produced and HDDS, where is the r-value for the booth was zero.

Nutritional knowledge, awareness, and attitude

Nutrition knowledge and a positive attitude are known to influence dietary practices.[24] There is a paucity of information on nutrition knowledge, awareness attitude, and HDDS of rural HHs.

The impact of knowledge, awareness attitude in the HDDS for homemakers was 0.66, 0.70, and 0.75 respectively while for same value for the head HH was 0.36, 0.40, and 0.55 respectively. There was a positive effect on the HDDS of women's awareness and attitude was showed, the HDDS were also higher where women had higher awareness and higher attitude about food and nutrition. It has been proved in many research that the awareness level of women is responsible for good nutrition.[25,5,23] The head of the HHs had an effect on the HDDS but was a weak positive correlation. Nutritional knowledge, awareness, and attitude had a significant relationship with HDDS, but attitude had more correlated out of knowledge and awareness.

Table 13: Nutritional knowledge, awareness, and attitude of homemaker.

Components	Homemaker		Head of HHs	
	Mean score of the scale	r-value	Mean score of the scale	r-value
Knowledge	4.73	0.66	5.33	0.36
Awareness	5.02	0.70	5.22	0.40
Attitude	4.44	0.75	4.24	0.55

Conclusion

The mean HDDS of the study population was 5.30 out of 12, while the mean IDDS was 4.31. Mainly grains, roots, and cooking oil was consumed by the HHs or individual levels. The majority of the HHs had low HDDS or IDDS and foods from animal sources were a rare component in the HHs diets, particularly in HHs with low DDS. The studies have shown a strong positive correlation between the level of education, the awareness status, and the attitude about food and nutrition of homemakers with r-values 0.71, 0.70, 0.75, respectively.

The nutritional knowledge, awareness, attitude, and educational status of the head of HH were positively correlated with DDS but the relationship was not strong. There was a weak negative correlation between family size and HDDS was recognized with an r-value -0.47. Religious beliefs increase in eating all types of food, as a result, the score of Muslims was higher than that of Hindus. In additionally gender, age, occupation of the head of HHs, type of family, caste, religion, food availability, procurement of food, utilization or distribution of produced food were also linked with the DDS.

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Review Article

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The Science of Browning: Useful or Dangerous?

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Abstract

The last few years in India, have witnessed an upsurge in the barbeque culture which draws youngsters towards grilled and browned foods. It is no wonder that teens are attracted to the special charred aroma and flavor along with the appealing golden brown colored layer on the foods. This special attraction could be attributed to various factors such as the preparation and cooking method involved, the chemical components of the food, and the different chemical reactions that occur while cooking. The effect of these foods on health has been a subject of huge debate. On one side, they are promoted to be a healthy cooking method that reduces fat content and on the other hand, the chemical products released from these foods have proven to be carcinogenic. Limiting the frequency of consumption of grilled foods and increasing the usage of other safe methods such as boiling, poaching, or steaming will be more beneficial in improving individual health status.

Keywords: Grilled foods; Browning; Maillard reaction; Carcinogens; Health.

Introduction

There has been an increasing trend in barbeque restaurants and grilled food outlets in India recently. The distinct color and aroma of grilled foods that are released as a result of Maillard's reaction is the reason behind the temptations for these foods. Maillard reaction is a set of reactions that occur when food is cooked at low moisture and high temperature, which results in the release of a distinct aroma and browning of the food. This reaction is named after Louis Camille who investigated it in the early nineteenth century. The occurrence of the Maillard reaction can either be beneficial or harmful due to the production of various components which are usually not present in food naturally, such as furosine, advanced glycation end products (AGEs), acrylamide, heterocyclic amines, and melanoidins. Research has indicated that the Maillard reaction products have certain beneficial properties such as antioxidant, antimicrobial, antihypertensive properties and can also act as a prebiotic thereby favoring gut health. On the other hand, they also reduce the nutritive quality of foods and are associated with chronic diseases such as diabetes, renal disorders, several types of cancer, and Alzheimer's disease. Hence, the science behind the browning reactions and their pros and cons are discussed in this article to gain a clear understanding of its impact.

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What is Maillard's reaction?

There is always a huge difference in the flavor and aroma of boiled or steamed foods when compared to roasted or grilled foods. Maillard's reaction is the reason behind the browning of foods and the appearance of the special aroma and flavor in grilled foods that make it extra delicious. The Maillard reaction is a series of chemical reactions

that occur simultaneously when the sugars and amino acids present in the foods are exposed to high temperatures. This non-enzymatic browning reaction occurs at temperatures above 285°F/140°C. Important reactions in Maillard process includes three stages. The initial stage includes the production of sugar amine condensation products and Amadori rearrangement products that are colorless.

The intermediate stage includes the production of 5-Hydroxymethylfurfural, reductone, and dicarbonyl compounds that are either colorless or yellow colored. The final stage includes the formation of brown colored compounds called melanoidins. The characteristic color in foods like coffee, malt, bread, cocoa, and other roasted foods is the result of melanoidins, which are brown nitrogen-containing high molecular weight pigments.[1]

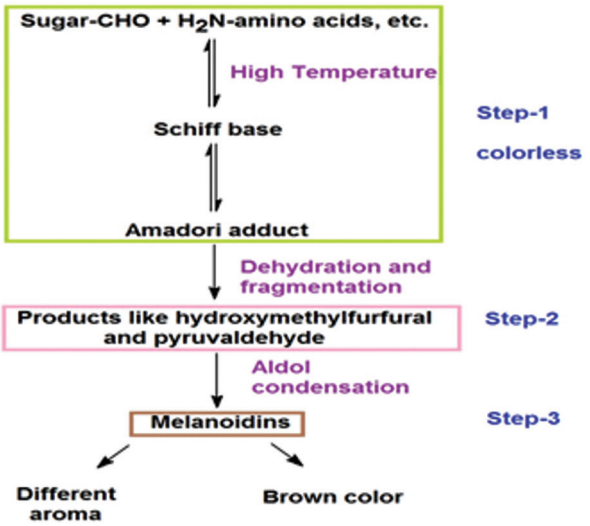

Fig. 1: Diagrammatic representation of "Maillard reaction" in food.[2]

Even though Maillard reaction occurs in various food stuffs, mainly sugars and amino acids produce a distinct aroma. When temperatures reach above the boiling point, it tends to dehydrate the surface more rapidly. Thus temperature and dryness are the most important factors that play a key role in the Maillard reaction. Maillard reactions can produce different types of flavor compounds based on temperature, time of cooking, presence of air, and the chemical constituents of the food.

Food products using Maillard reactions

Maillard reaction occurs in various foods that are prepared using cooking methods such as grilling, roasting, barbecuing, baking, frying, sautéing, broiling, searing, and toasting. Color of beer, coffee, chocolate, maple syrup, baked foods like biscuits, brownies, cakes and cookies, grilled meat, chicken, eggs and vegetables, and roasted peanuts are due to the occurrence of the Maillard reaction.

Important Maillard reaction products

Maillard reaction produces certain end products that are not naturally present in foods. The combination of factors such as time, temperature, and composition results in the production of certain end products that can have beneficial properties such as antimicrobial, anti-inflammatory, antioxidant, and antihypertensive or destructive properties such as carcinogenic, mutagenic, or cytotoxic properties.

Important end products of maillard reaction includes

- Acrylamide
- NεFructoselysine (furosine)
- Melanoidins
- Heterocyclic amines
- 5-Hydroxymethylfurfural (HMF)
- Advanced glycation end products (AGE)

Beneficial effects of Maillard reaction

Certain MRPs such as HMF and melanoidin have been proven to have antioxidant properties. Experimental studies too proved the effect of melanoidin on antimicrobial and antihypertensive properties.[3] The in vitro and in vivo studies observed the prebiotic activity of melanoidins from bread crust and coffee. Reviews on the current state of knowledge of MRPs on health emphasized the need to improve the knowledge on the impact of MRPs in gut microbiota and the metabolites that are derived from the fermentation of MRPs.[4]

Detrimental effects of Maillard reaction

Glycated Maillard products are associated with metabolic diseases including type 2 diabetes mellitus, Alzheimer's disease, acute renal failure ,allergies, polycystic ovary syndrome and oral health. The advanced glycation end products which are also called glycotoxins can increase oxidative stress and its impact on neurodegenerative disorders and early aging is also being explored.[5] Yamagishi et al. 2015[6] studied the impact of AGEs and RAGE receptors in cancer. Increased risk of pancreatic cancer was found to correlate with dietary CML-AGE consumption, particularly in male pancreatic cancer patients.[7] A study conducted with rodents proved that different

levels of acrylamide exposure increase the risk of developing cancer in the pancreas, skin, lung, and thyroid8. Maillard reaction products also tend to alter the nutritive quality of the foods by reducing the protein digestibility of the foods.

Control of Maillard reaction

Several studies have attempted the inhibition of Maillard reaction through methods such as modification of reducing sugars and amines and the use of enzymes. Ohmic heating, encapsulation of metal ions, and high-pressure processing are some of the emerging non thermal processing technologies that help in controlling the Maillard reaction in food. Combination of these methods can be a promising strategy in controlling the Maillard reaction products.[9] Uribarri et al. 2010,[10] reinforce that AGE formation in food occurs with high temperature and low moisture while reducing temperature and heating time, increasing water content and pretreatment of foods with acid tend to reduce these products.

Conclusion

The different Maillard reaction products have proven to be either beneficial or detrimental to health. There is still a need for further research regarding the maillard reaction products in content of Indian foods and the frequency of consumption of these Maillard products. The safe level of intake of these foods to prevent diseases and the level of intake needed for having the beneficial effects need to be established.

To limit the negative effects and benefit from the positive effects of Maillard reaction products, it is essential to maintain a balance and variety not only in the food but also in the method of cooking. Owing to the increase in chronic diseases in India and to improve the overall health status, it is always advisable to use other safe cooking methods such as steaming, boiling, poaching, simmering, etc. which do not produce any harmful toxic compounds. There is an impending need for creating awareness to the public regarding the effect of Maillard reaction products on health and disease.

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Review Article

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Factors Influencing Consumption Patterns and Choices for Mushrooms in "Mushroom City of India", Solan (HP)

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Abstract

Purpose of the present research work is to study mushroom as a popular food & nutrient option in post COVID-19 era; further the work aim to understand the factors that influence the choices and consumption patterns of mushroom consumers. The responses of a sample of 102 respondents have been recorded using a structured questionnaire. These respondents consisted of the visitors to the points of sales for mushrooms in comprising Municipal Corporation area, Solan, (HP). Percentage, Chi-Square and Pearson correlation method were used to analyse the quantitative data collected. The study clearly indicated that mushroom as vegetable is popular among respondents in the study area. White button mushroom is the first preference followed by oyster and Gucchi for respondents. Shape and size followed by price and color acted as the evaluation criteria for mushroom purchase. Education level had a significant positive Correlation with the mushroom consumption frequency. 'Good for health' followed by 'to add variety to diet' and 'medicinal value/prosperities' are the main reasons for mushroom consumption among respondents. The non availability of fresh mushrooms on regular basis in local market led to mushrooms not being purchased.

Keywords: Consumer behavior; Mushroom Consumption; Food markets in India; Purchasing behavior; Mushroom; Mushroom as super food.

Introduction

Increasing population and shrinking availability of agriculture land is the biggest concern for the future generations. Problem of malnutrition is threatening the food security to be provided to the population worldwide. Goal two in United Nations' agenda 2030 targeted to end hunger, achieve food security, improved nutrition and to promote sustainable agriculture; goal three mentioned to ensure healthy lives and well-being promotion for all as main focus, (UN, Agenda 2030). According to Bringye, B et al. (2021) the UN agendas are related to the potential benefits of producing and consuming mushrooms and further extended it to goal twelve of UN agenda which targeted to ensure sustainability in consumption and production patterns. The population in countries of developing world like India heavily depends on cereals and more on meat as sources of protein. Such a predicament is forcing the stakeholders to work on nutritious vegetables with higher productivity per unit land. According to Bringye, B et al. (2021) mushrooms may provide answer to above mentioned challenges that humankind is facing today; Kumar, H et al. (2021) and Jegadeesh Raman et al. (2020) mushroom is a rich source of important compounds due to their nutritional and functional properties; Aniket Kadam and Roshan Deshmukh (2021) mushrooms are expected to be considered as "super foods" in the future; Das, A.K. et al. (2021) referred mushroom as next-generation healthy food components due to low content of fat, high-quality proteins, dietary fiber and the nutraceuticals present in it, they are preferred as low-caloric functional foods too.

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Jannatul Ferdousi et al. (2019) reported mushroom as nutritious and dietary supplement and also as an income opportunity to farmers with small land holdings, limited capital and technical knowledge. The importance of mushroom cultivation and consumption has been raised further as the evidences form very recent studies supported its antiviral possibilities against the pandemics i.e. SARS-Cov-2 and COVID-19 (Rangsinth P et al. 2021; Hetland G et al. 2020; Shahzad et al. 2020; Murphy EJ et al. 2020; Jayawardena R et al. 2020; Thota S M et al. 2020; Rahman M M et al. 2020; Yanuck S F et el. 2020). Industry ARC (2021) forecasted the Global Market size of mushrooms for period 2020-2025 and suggested that it is growing at a CAGR of 9.7% and will touch $49.7 Billion by 2025.

According to Raman J et al. (2018) India has a strategic geographic location for mushroom production and it produced approximately 0.13 million tons showing a CAGR of 4.3% for a period between 2010 - 2017, production of white button mushroom was at the highest i.e. 73% of the total production. K. P. Mohana Priya, et al. (2021) studied the growth of mushroom production for global and Indian context for the period between 2000-01 and 2018-19 and reported growth of 5.55% at global level and 6.13% for India. Fortune Business Insight (2021) valued global mushroom market at 12.74 million ton (MT), 10.25 million ton in Asia Pacific in 2018 and projected to reach 20.84 million ton (MT) by 2026, exhibited a CAGR of 6.41% in the forecast period. Aniket Kadam and Roshan Deshmukh (2021) the mushroom market size was valued at $33,553.0 million in 2019, and is estimated to reach $53,342.0 million by 2027, registering a CAGR of 9.3% from 2021 to 2027.

Wakchaure G.C. (2011) reminded that efforts to increase the production without solving its marketing problems would be counter productive and the marketing activities would determine the future of mushroom industry in India. He further said that in India there has not been any serious effort to promote the product.

Classical economist Adam Smith had said once that "Consumption is the sole end and purpose of production" hence the role of consumption got noticed by the researcher Boulding, Kenneth E (1945). On the other hand developing economies are still behaving hesitant in mushroom production as lacking the understanding of consumption patterns/trends/preferences and even the choices of mushrooms consumers, the reason to be quoted is that very few studies has been conducted considering these parameters particularly in Indian context. The Pligrim's Model (1957) presented food acceptance as a dependent variable of perceptions. It further described the perception as function of three factors i.e. (i) physiological food effects (ii) perception of sensory attributes, and (iii) environment influences. The model also incorporated the time factor with external influences. The basic stimulus response model of consumer behavior by Kotler (1997), mentioned that individual as consumer exposed to market stimuli (product, price, place and promotion), environment stimuli (economic, political, technological and cultural aspects).

The buyer's metal processes visualization has been referred as Black box and the decision for buying included product choice, brand choice, dealer choice, purchase quantity and purchase timing. As far as the consumption of mushroom is concerned according to the studies such as Elizabeth Adegbenjo et al. (2020) recognized the influence of education and income as an important factor on consumers for their choice regarding food. Bernadett Bringye et al. (2021) indicated that educational levels significantly influenced the consumers' consumption for mushroom.

Anwesha Chakrabarti et al. (2019) find that consumers have no preference for special varieties of mushrooms such Shiitake as compared to traditional mushrooms, and consumers only valued the "locally grown" or "organic" labels while purchasing the same. According to Adejo and Ademu (2018) a highest number of people consumed mushroom as a close substitute to meat or fish and for its medicinal purposes; Gurgen et al. (2018) cultivated mushrooms were preferred over its wild varieties due risk of poisoning. Elisa Boin and João Nunes (2018) age, household size, educational levels, and gender were the factors that influenced mushroom consumption.

Gurgen et al. (2018) stated that shape of mushrooms has influenced its purchase the most. Yuan Jiang et al. (2017) recorded that decisions to participate or not to participate in the market and consumption frequency are like freshness of available mushroom and awareness about its health benefits. Mohd Zaffrie Mat Amin et al. (2017) presented the factors such as product attributes, health benefits related information, product quality certification and perception of products having great influence on consumers' purchase of mushroom-based products. Sharma et al. (2017); Raman et al. (2017) reported that white button mushroom holds the maximum share of market. Qiulin Wen et al. (2016) reported low purchase frequency and

volume at Bejing; found that smells, residues of pesticide, extent of product understanding, information given by friends and relatives and packaging influence purchase frequency and volume of edible mushroom significantly; purchase frequency was further influenced significantly by health and safety concerns, place of purchase, degree of brand comprehension, presence/absence of kids in the family similarly volume of purchase influenced by family size and color of the product. Boin and Nunes (2016) referred that white button mushrooms were the most preferred mushroom variety and income was least influencing factor in Portugal.

Further the lack of awareness about the other mushroom species like King Oyster, Oyster and Chanterelle mushrooms was reported as significant. Zhang et al. (2016) indicated that consumers' purchase frequency and volume of edible mushroom are generally low in Beijing. The degrees of understanding about mushrooms, family size, colour of the mushrooms and their packaging have significant influence on consumers to choose mushroom.

Yuan Jiang et al. (2015) reported consumption of fresh mushrooms is higher than processed mushrooms, further the factors such as income, household size, race, age, awareness of health benefits mushrooms, physiological attributes of mushroom's were presented as significant determinants of the mushroom consumption among consumers. Shirur et al. (2014) conducted a study in India (Solan, Town) and concluded that mushroom consumption was relatively less, the white button mushroom again proved its dominance as was most preferred variety, and factors such as colour, shape and size have influenced the purchasing of mushrooms in the market.

Nutritional qualities and addition of more variety in diet were important consideration for consumers during mushroom purchase. Further the awareness of mushroom benefits influenced the consumers' choice for mushroom. In addition to the information presented in above paragraph and review Chenarides L et al. (2020) mentioned in their research that consumer shopping behavior has shown significant changes since the CIVID-19 outbreak in early 2020 but the consumption patterns for food seems to stay the same.

In India, there are five mushroom species in commercial cultivation i.e. white button mushroom (Agaricus bisporus), oyster (Pleurotus spp.), paddy straw (Volvariella volvacea), milky (Calocybe indica) and shiitake (Lentinula edodes). Commercial markets are dominated by white button mushroom, oyster and paddy straw varieties as these three mushrooms are contributing about 96% of total mushroom produced in India. Himachal Pradesh has started working on mushrooms during the mid of sixties when Dr. E. F. K. Mental from Germany reached Solan as a FAO consultant and developed the modern spawn laboratory in Himachal Pradesh and introduced the button mushroom cultivation.

In 1961, Indian Council of Agricultural Research (ICAR), New Delhi, started first cultivation of the button mushroom (white button mushroom) at Solan, Himachal Pradesh. Now-a-days Solan city is known as the "Mushroom City of India". In addition the market of Solan is attractive due to high average urban literacy i.e. (90.41%, Census, 2011) and per capita of Rs 3, 94,102 in District Solan (HP Govt. 2018). The review of the literature has highlighted a gap regarding the choice, consumption patterns and factors influencing consumption of different mushroom recipes and types of mushroom among ultimate consumers in general and particularly in study area.

Even no study has been found for last five years which taken into consideration, the factors influencing the consumers behavior towards different recipes of mushrooms. Further in light of the above discussion it is imperative that consumption of Mushrooms in a high potential market like Solan must be revisited in the post-pandemic context, which has seen incomes fall. The insights from study undertaken will help address the challenges of food/ nutritional security from the stand point of marketing/consumer orientation, as it has been observed in literature reviewed above Pligrim's Model (1957), Wakchaure G.C. (2011). Thus, the objectives emanating from the review are:

- To study the frequency of consumption of different mushroom recipes among respondents.
- To identify the most preferred variety of mushroom among respondents.
- To examine the association of income and education levels with the frequency of mushroom consumption.

These translated into the following alternate hypothesis:

H_1: There is a significant difference in the frequency with which different recipes of mushroom are consumed.

H_2: There is difference in the preferences for types of mushroom varieties.

H_3: Higher education among consumers leads to higher frequency of mushroom consumption.

H_4: Higher income among consumers leads to higher frequency of mushroom consumption.

Research Methodology

To establish the research gap and context review of literature has been conducted above. The studies were located form Google Scholar, Research Gate and open access research paper available in databases of Taylor & Francis, Wiley open library and Emerald. The research papers with key words consumer behavior, mushroom consumption, food markets in India and food consumption behavior were reviewed. To locate literature snowball tactic has been used i.e. one research paper was downloaded and the references were searched on the Google Scholar to reach even more studies. The research papers selected for review were those published in English language only. The review of literature included the studies of six years i.e. 2015 to 2021.

This study has been conducted at "Mushroom City of India" in Solan town of Himachal Pradesh as it is a good representative of high potential markets for mushroom given the high literacy rate and high per capita income (Census, 2011) (HP Govt. 2018). The consumers of the town were the research population.

The researcher targeted visitors to the points of sale for mushroom in the city. Convenient sampling has been used to select the sample consisting of hundred and two [102 (64 males and 38 females)] respondents as this study was proposed to be an exploratory study.

The targeted sample was of (100) so structured questionnaires have been administered to (110) respondents. This resulted in 102 complete responses from the respondents hence it was decided to include all in the analysis. The researchers have also tried to introduce the concept of consumer behavior through some earliest theory and model consumption in relation to production and food products.

The gender wise distribution of the sample comprises of more percentage of males (62.75%) as compared to females (37.25%), data reflected that most of the buyers who have visited retailers to purchase mushroom were males as FAO, (2012) reported that male and female both participate in small and big household decisions which affect the welfare of the entire family.

Results and Discussion

Table 1: Demographic Profile of the Respondents.

Demographic Variables	Frequency	Percentage
Gender		
Male	64	62.75
Female	38	37.25
Age		
Below 20 years	6	5.88
20-30	29	28.43
30-40	17	16.67
40-50	34	33.33
50 and above	16	15.69
Marital Status		
Married	67	65.69
Unmarried	35	34.31
Education		
10^{th} std or below	12	11.76
Higher Secondary	15	14.71
Graduation	52	50.98
Post Graduation	20	19.61
PhD and others	3	2.94
Family Type		
Nuclear	84	82.35
Joint	18	17.65
Monthly Income		
Rs. 10,000-25,000	17	16.67
Rs. 25,000-50,000	35	34.32
Rs. 50,000-1,00,000	38	37.25
Rs. 1,00,000 and above	12	11.76

The age group between 40-50 years was the group to represent the highest parentage (33.33%) in selected sample. The majority of the respondents were married (65.69%) and male respondents comprised of (62.75%), while females were (37.25%). Most of the respondents (50.98%) participated in the study were graduates and for (82.35%) the family type was nuclear. The selected sample consisted of almost equal representation for the 25,000 to 50,000 and 50,000 – 100,000 rupees income groups that is (34.32%) and (37.25%) respectively.

The chi-square statistic is 98.1462. The p-value is < 0.00001. The result is significant at $p < .05$, which means that there is a significant variation in the frequency of consumption as per recipes.

Table 2: Recipes and Frequency of Mushroom Consumption.

Mushroom recipes	Never or Very rarely	Rarely	Occasionally	Most Frequently Or Frequently	Total
Mushroom vegetable	6 (5.88%)	7 (6.86%)	30 (29.41%)	59 (57.85%)	102
					-100
Mushroom curry	23 (22.55%)	29 (28.43%)	38 (37.26%)	12 (11.76%)	102
					-100
Mushroom Soup	23(22.55%)	20(19.61%)	33(32.36%)	26(25.49%)	102
					-100
Pickle or salad	32 (31.37%)	32(31.37%)	14 (13.73%)	24(23.53%)	102
					-100
Other recipe	35 (34.31%)	25(24.51%)	21(20.59%)	21(20.58%)	102
					-100

The majority of responses for mushroom vegetable are accumulated between frequently to most frequently (57.85%) whereas accumulated responses between very rarely to occasionally for mushroom curry are (76.5%) followed by mushroom soup (72.45%), other recipe (64.71%) and by pickle or salad (62.75%).This shows that mushroom vegetable is the only recipe which is consumed frequently/regular basis by the respondents. For all the five listed classes of mushroom recipe, the "most frequently" has received relatively lesser score, this indicates that apart from mushroom vegetable, other forms of mushroom recipes are not popular among populace and frequency of mushroom consumption is also on the lower side. Though, mushroom is an exotic vegetable, its popularity has been rising ever since its introduction of commercial cultivation in India starting from early 1980`s. However it is yet to find regular place in commoner's kitchen.

Table 3: Preferred variety of mushroom among respondents.

Varieties available	1st Preference	2nd Preference
White button mushroom	83 (81.37%)	12 (11.76%)
Oyster mushroom	13 (12.75%)	60 (58.82%)
Paddy straw mushroom	1 (.98%)	7 (6.86%)
Shitake mushroom	3 (2.94%)	7 (6.86%)
Other mushroom	2 (1.96%)	16 (15.69%)

Preferences of respondents for different mushroom varieties (expressed as percentage).

The chi-square statistic is 100.3123. The p-value is < 0.00001. The result is significant at p<.05. The table above depicts the preferences of respondents for different mushroom varieties. The (81.37%) respondents said white button mushroom is their first choice while only (accumulated score, 18.63 %) preferred other varieties as their first choice. Among other preferred varieties as first choice, oyster mushroom received highest response (12.75 %) followed by shitake mushroom (2.94 %). Paddy straw and other mushroom were preferred by very few respondents as first preference. Among the "Other" category, the most preferred mushroom is the one available in local market; which includes Gucchi (Morchella) the naturally grown mushroom. Oyster mushroom scored the highest frequency percentage (58.82%) as the second preference followed by other mushroom such as shiitake mushroom and paddy straw mushroom in that order. Mayett et al. (2006) and Shirur et al. (2014) reported that, white button mushroom was widely consumed.

Table 4: Educational Qualification and Mushroom Consumption Frequency.

Variables		Educational Qualification	Mushroom Consumption Frequency
Educational Qualification	Pearson Correlation	1	0.32*
	(Two Tailed) Sig. (P Value)		0.001
Mushroom Consumption Frequency	Pearson Correlation (Two Tailed) Sig. (P Value)	0.32* 0.001	1

*p<0.01, **p<0.05

Above table shows the association of educational levels of respondents with their mushroom

consumption. The value of correlation coefficient is 0.32 which means there is a positive correlation between educational qualification and mushroom consumption. The p value is 0.001, from which it can be concluded that there is a significant positive association between the education qualification and mushroom consumption. Boin and Nunes (2016) had received the same results for their study. This is implying that it is once again found that higher education level among consumers' results in more frequent consumption of mushrooms.

Table 5: Association between Income and Mushroom Consumption Frequency.

Variables		Income	Mushroom Consu-mption
Income	Pearson Correlation	1.00	0.17
	(Two Tailed) Sig. (P Value)		0.087
Mushroom Consumption	Pearson Correlation	0.17	1.00
	(Two Tailed) Sig. (P Value)	0.087	

*p<0.01, **p<0.05

Table above shows the association of income level of respondents with their mushroom consumption. The value of correlation coefficient is 0.17 which denotes that there is a weak positive correlation between income levels the mushroom consumption. The p value is 0.087 from which it can be concluded that it is not significant.

Conclusion

The study concluded that the mushroom consumption among the respondents is on lower side and it is most frequently consumed as vegetable and other recipes are not that popular, alternate hypotheses (H_1) has been accepted as the different recipes of mushroom are consumed with a significant difference of frequency. The reason behind may be the lack in promotional activities. It is further found that white button is the first choice followed by oyster mushroom for maximum of the respondents; hence hypotheses (H_2) got accepted with its significance.

Research hypotheses (H_3) has also been accepted which assumed that higher education among consumer's leads to higher frequency of mushroom consumption; as the relationship between the two variables was positive and significant. Research hypotheses (H_4) assumed that higher income among consumers leads to higher frequency of mushroom consumption got rejected as income had shown a positive but weak correlation for the tested variables.

Practical Implications: The results will definitely help the mushroom growers, food processors, retailers and small entrepreneurs to make efforts towards popularising the different recipes of mushroom beyond its use as vegetable only. The varieties other than white button mushroom are also needed some specific attention of policy makers, mushroom growers, food processors, retailers and small entrepreneurs in terms of promotional strategies. 'Good for health' followed by 'to add variety to diet' and 'medicinal value/prosperities' can be used as promotional campaign theses to make it interesting and memorable for the consumers.

The positive correlation between educational qualification and mushroom consumption will help the entrepreneurs to decide the target market. All thorough the study reported a weak correlation between incomes levels the mushroom consumption but it is positive, which may be provide a lead to the future researchers in the field and can be used as the second variable for market segmentation and further research.

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Review articles: Up to 2500 words excluding references and abstract and up to 10 references.

Case reports: Up to 1000 words excluding references and abstract and up to 10 references.

Online Submission of the Manuscripts

Articles can also be submitted online from http://rfppl.co.in/customer_index.php.

I) First Page File: Prepare the title page, covering letter, acknowledgement, etc. using a word processor program. All information which can reveal your identity should be here. use text/rtf/doc/PDF files. Do not zip the files.

2) Article file: The main text of the article, beginning from Abstract till References (including tables) should be in this file. Do not include any information (such as acknowledgement, your name in page headers, etc.) in this file. Use text/rtf/doc/PDF files. Do not zip the files. Limit the file size to 400 Kb. Do not incorporate images in the file. If file size is large, graphs can be submitted as images separately without incorporating them in the article file to reduce the size of the file.

3) Images: Submit good quality color images. Each image should be less than 100 Kb in size. Size of the image can be reduced by decreasing the actual height and width of the images (keep up to 400 pixels or 3 inches). All image formats (jpeg, tiff, gif, bmp, png, eps etc.) are acceptable; jpeg is most suitable.

Legends: Legends for the figures/images should be included at the end of the article file.

If the manuscript is submitted online, the contributors' form and copyright transfer form has to be submitted in original with the signatures of all the contributors within two weeks from submission. Hard copies of the images (3 sets), for articles submitted online, should be sent to the journal office at the time of submission of a revised manuscript. Editorial office: Red Flower Publication Pvt. Ltd., 48/41-42, DSIDC, Pocket-II, Mayur Vihar Phase-I, Delhi – 110 091, India, Phone: 91-11-22754205, 45796900, 22756995. E-mail: author@rfppl.co.in. Submission page: http://rfppl.co.in/article_submission_system.php?mid=5.

Preparation of the Manuscript

The text of observational and experimental articles should be divided into sections with the headings: Introduction, Methods, Results, Discussion, References, Tables, Figures, Figure legends, and Acknowledgment. Do not make subheadings in these sections.

Title Page

The title page should carry

1) Type of manuscript (e.g. Original article, Review article, Case Report)

2) The title of the article should be concise and informative;

3) Running title or short title not more than 50 characters;

4) The name by which each contributor is known (Last name, First name and initials of middle name), with his or her highest academic degree(s) and institutional affiliation;

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7) The total number of pages, total number of photographs and word counts separately for abstract and for the text (excluding the references and abstract);

8) Source(s) of support in the form of grants, equipment, drugs, or all of these;

9) Acknowledgement, if any; and

l0) If the manuscript was presented as part at a meeting, the organization, place, and exact date on which it was read.

Abstract Page

The second page should carry the full title of the manuscript and an abstract (of no more than 150 words for case reports, brief reports and 250 words for original articles). The abstract should be structured and state the Context (Background), Aims, Settings and Design, Methods and Materials, Statistical analysis used, Results and Conclusions. Below the abstract should provide 3 to 10 keywords.

Introduction

State the background of the study and purpose of the study and summarize the rationale for the study or observation.

Methods

The methods section should include only information that was available at the time the plan or protocol for the study was written such as study approach, design, type of sample, sample size, sampling technique, setting of the study, description of data collection tools and methods; all information obtained during the conduct of the study belongs in the Results section.

Reports of randomized clinical trials should be based on the CONSORT Statement (http:// www. consort-statement. org). When reporting experiments on human subjects, indicate whether the procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional or regional) and with the Helsinki Declaration of 1975, as revised in 2000 (available at http://www.wma. net/e/policy/l 7-c_e.html).

Results

Present your results in logical sequence in the text, tables, and illustrations, giving the main or most important findings first. Do not repeat in the text all the data in the tables or illustrations; emphasize or summarize only important observations. Extra or supplementary materials and technical details can be placed in an appendix where it will be accessible but will not interrupt the flow of the text; alternatively, it can be published only in the electronic version of the journal.

Discussion

Include summary of key findings (primary outcome measures, secondary outcome measures, results as they relate to a prior hypothesis); Strengths and limitations of the study (study question, study design, data collection, analysis and interpretation); Interpretation and implications in the context of the totality of evidence (is there a systematic review to refer to, if not, could one be reasonably done here and now?, What this study adds to the available evidence, effects on patient care and health policy, possible mechanisms)? Controversies raised by this study; and Future research directions (for this particular research collaboration, underlying mechanisms, clinical research). Do not repeat in detail data or other material given in the Introduction or the Results section.

References

List references in alphabetical order. Each listed reference should be cited in text (not in alphabetic order), and each text citation should be listed in the References section. Identify references in text, tables, and legends by Arabic numerals in square bracket (e.g. [10]). Please refer to ICMJE Guidelines (http://www.nlm.nih.gov/bsd/uniform_ requirements.html) for more examples.

Standard journal article

[1] Flink H, Tegelberg Å, Thörn M, Lagerlöf F. Effect of oral iron supplementation on unstimulated salivary flow rate: A randomized, double-blind, placebo-controlled trial. J Oral Pathol Med 2006; 35: 540–7.

[2] Twetman S, Axelsson S, Dahlgren H, Holm AK, Källestål C, Lagerlöf F, *et al*. Caries-preventive effect of fluoride toothpaste: A systematic review. Acta Odontol Scand 2003; 61: 347–55.

Article in supplement or special issue

[3] Fleischer W, Reimer K. Povidone-iodine antisepsis. State of the art. Dermatology 1997; 195 Suppl 2: 3–9.

Corporate (collective) author

[4] American Academy of Periodontology. Sonic and ultrasonic scalers in periodontics. J Periodontol 2000; 71: 1792–801.

Unpublished article

[5] Garoushi S, Lassila LV, Tezvergil A, Vallittu PK. Static and fatigue compression test for particulate filler composite resin with fiber-reinforced composite substructure. Dent Mater 2006.

Personal author(s)

[6] Hosmer D, Lemeshow S. Applied logistic regression, 2nd edn. New York: Wiley-Interscience; 2000.

Chapter in book

[7] Nauntofte B, Tenovuo J, Lagerlöf F. Secretion and composition of saliva. In: Fejerskov O,

Kidd EAM, editors. Dental caries: The disease and its clinical management. Oxford: Blackwell Munksgaard; 2003. pp 7–27.

No author given

[8] World Health Organization. Oral health surveys - basic methods, 4th edn. Geneva: World Health Organization; 1997.

Reference from electronic media

[9] National Statistics Online—Trends in suicide by method in England and Wales, 1979–2001. www.statistics.gov.uk/downloads/theme_health/HSQ 20.pdf (accessed Jan 24, 2005): 7–18. Only verified references against the original documents should be cited. Authors are responsible for the accuracy and completeness of their references and for correct text citation. The number of reference should be kept limited to 20 in case of major communications and 10 for short communications.

More information about other reference types is available at www.nlm.nih.gov/bsd/uniform_ requirements.html, but observes some minor deviations (no full stop after journal title, no issue or date after volume, etc.).

Tables

Tables should be self-explanatory and should not duplicate textual material.

Tables with more than 10 columns and 25 rows are not acceptable.

Table numbers should be in Arabic numerals, consecutively in the order of their first citation in the text and supply a brief title for each.

Explain in footnotes all non-standard abbreviations that are used in each table.

For footnotes use the following symbols, in this sequence: *, ¶, †, ‡‡,

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Type or print out legends (maximum 40 words, excluding the credit line) for illustrations using double spacing, with Arabic numerals corresponding to the illustrations.

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Abbreviations

Standard abbreviations should be used and be spelt out when first used in the text. Abbreviations should not be used in the title or abstract.

Checklist

- Manuscript Title
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- Previous publication/ presentations mentioned, Source of funding mentioned
- Conflicts of interest disclosed

Authors

- Middle name initials provided.
- Author for correspondence, with e-mail address provided.
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- Identity not revealed in paper except title page (e.g. name of the institute in Methods, citing previous study as 'our study')

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- Abstract page contains the full title of the manuscript
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- References according to the journal's instructions

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- Uniformly American English
- Abbreviations spelt out in full for the first time. Numerals from 1 to l0 spelt out
- Numerals at the beginning of the sentence spelt out

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- No repetition of data in tables and graphs and in text.
- Actual numbers from which graphs drawn, provided.
- Figures necessary and of good quality (color)
- Table and figure numbers in Arabic letters (not Roman).
- Labels pasted on back of the photographs (no names written)
- Figure legends provided (not more than 40 words)
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- Is the journal editor's contact information current?
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