

Consumption pattern of nuts-the noble antioxidants sources

■ PRACHI AVINASH AND KUSUM MITTAL

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■ **ABSTRACT** : Epidemiological studies have provided evidence of an inverse association between plants based diets and degenerative diseases. The content and concentration of antioxidants in nuts suggest the beneficial role they play in health promotion and disease prevention. These benefits though evident to scientists and the other handful of people, the knowledge among the customer population might not be sufficient in order to modify their dietary habits and patterns. Thus, there was a felt need of assessing the consumption practices of consumers regarding the utilization of nuts. The present study was therefore conducted in the Udaipur city of Rajasthan (India). The sample comprised of 100 respondents who were homemakers, actively involved in household cooking, who could provide crisp and authentic information. A questionnaire was prepared and the respondents were contacted personally. In conclusion, results revealed that though consumption of nuts was noteworthy among the population, the use was largely attributed to taste and flavor and the therapeutic or medicinal value (antioxidants) of nuts was not recognized by majority of respondents, which is of concern. Hence, it was understood that new strategies are required to make aware the consumers about the therapeutic benefits of nuts and thus popularize the use. Future public health initiatives should be mindful of these consumption patterns.

■ **KEY WORDS**: Antioxidants, Nuts, Utilization, Medicinal value, Awareness

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See end of the paper for authors' affiliations →

PRACHI AVINASH

Department of Home Science, Govt.
Meera Girls College (M.L.S.U.),
UDAIPUR (RAJASTHAN) INDIA
Email : prachiabhatnagar@
gmail.com

Lifestyle diseases such as cardiovascular diseases, diabetes mellitus type 2 and cancer are among the leading causes of death worldwide. Since an unhealthy eating behaviour contributes significantly to their formation, a deliberate choice of foods with either prophylactic effect or the ability to improve symptoms of existing diseases are of great importance (Fischer *et al.*, 2013). These diseases require the administration of synthetic medicinal remedies. But, owing to the known side/ after effects of these medicines, consumers rather opt for natural products for improving their health. It has been studied that diseases can be prevented by natural

antioxidants in our diet, plant foods being one of the most beneficial sources. These natural antioxidants are becoming increasingly important not only in the food industry, because they retard oxidative degradation of lipids and thereby improve the quality and nutritive value of foods, but also in medicine, for the prevention and cure of diseases associated with oxidative damage. Epidemiological studies have provided evidence of an inverse association between a vegetable-rich diet and degenerative diseases. Together with their presence in cereals, fruits, and vegetables, the content and concentration of phytochemicals in nuts suggest they

significantly add to the beneficial role of plant foods in health promotion and disease prevention (Chen and Blumberg, 2008). While many of the bioactive constituents remain to be fully identified and characterized, broad classes include carotenoids, polyphenols, and phytosterols.

Nuts have been shown to improve serum cholesterol levels (Brown *et al.*, 2016 and Sabate *et al.*, 2010), lower blood pressure (Djousse *et al.*, 2009 and Estruch *et al.*, 2006; Myers and Champagne, 2007 and Welty *et al.*, 2007), lower the risk of diabetes (Jiang *et al.*, 2002), improve weight loss (Bes-Rastrollo *et al.*, 2007), improve inflammation (Jiang *et al.*, 2006) and lower the risk of cardiovascular mortality (Brown *et al.*, 2016 and Albert *et al.*, 2002). Nuts have been used since ancient times in alternative medication, aromatherapy and massage therapy. Preliminary findings from an ongoing study presented at the Experimental Biology 2016 meeting in San Diego, CA, indicated that the daily consumption of walnuts had a positive effect on cholesterol levels, without increasing body weight (Cowen, 2016). The powerful nutrient package of almonds—low on the glycemic index and providing six grams of plant-based protein, four grams of filling dietary fibre, 13 g of unsaturated fats and important vitamins and minerals including vitamin E (35% DV), magnesium (20% DV) and potassium (6% DV) per one ounce serving—makes them an ideal fit for heart-healthy, weight-wise diets and a deliciously easy way to snack smarter (Almonds, 2015).

Botanically, nuts are ‘one seeded indehiscent fruits’. They are obtained from trees and have a specific taste and flavour corresponding to each nut. They are either fruits or seeds and consist of an edible fat containing kernel surrounded by a hard or brittle shell (Janick and Paull, 2008 and Srilakshmi, 2002).

As per the agricultural classification of plants based on primary use, nuts have been categorized as the Pomological or fruit crops as they are grown primarily for their edible fruits or closely related structures which, as a rule, are consumed raw (Bareja, 2010). Depending on the composition, Manay and Shadaksharaswamy (2008) have classified nuts into three main categories *viz.*, Oil and fat rich nuts (containing on an average 50 per cent fat, like cashew nut, walnut, pine nut), Protein rich nuts (containing about 15-30 per cent protein, like almond, pistachio, groundnut) and Starch (carbohydrate) rich nuts (containing about 50 per cent carbohydrates,

like chest nut). Nut species contain mono and poly unsaturated fat, ranging from about 70 – 50 per cent (Vaughan and Judd, 2006). They are concentrated sources of energy.

Estimation of usual intake by a population is essential in the process of establishing the protective effects of nutrients against the development of certain diseases and assessing nutrient intake adequacy. The consumption practices of the Indians are effected by a number of factors like growing income levels resulting in more disposable income with individuals, changing attitudes towards consumption, increased literacy and awareness, introduction of new products, rising aspiration levels, rapid urbanization, etc. However, the consumption patterns regarding nuts at the ground level need to be assessed for material information. Hence, the purpose of this study was to gain knowledge regarding the existing consumption frequency and type of use of nuts among the families of Udaipur City. The prevailing purchase and storage practices were also assessed.

■ RESEARCH METHODS

The present investigation was undertaken within the municipal limits of Udaipur City of Rajasthan (India). A pre-tested semi-structured questionnaire competent in collecting information regarding the consumption practices of nuts followed by the subjects was used. The components of the questionnaire consisted of the following:

- General information including name, age, educational status, occupation, address and family profile (monthly family income, family type, caste and food habits).
- Consumption practices of nuts in respect of frequency of consumption and seasonal variations in consumption
 - Reason, form and purpose of consumption
 - Purchasing pattern and storage practices including temperature and packaging.

Subjects:

Homemakers from 100 household were selected using the purposive sampling technique. Active involvement of subjects in daily household cooking and willingness of respondents to participate formed the basis for selection of subjects. The data was collected by face-to-face interaction. The data obtained was consolidated

and statistically analyzed for interpretation of results for the variables studied.

RESEARCH FINDINGS AND DISCUSSION

The findings obtained from the present study have been discussed under following sub-heads:

Demographics of study population:

The general information of the subjects selected for survey as per the inclusion criteria was collected and tabulated. The distribution of subjects on basis of their age revealed that a majority of the respondents (34 %) selected were in the age range of 41-50 years and 25 per cent were in 31-40 years of age. As per a survey on consumer trends in the savory snacks market in India (2011), the consumption of nuts is highest among older consumers, many of which are traditional users. It was further quoted that the proportion of heavy frequency users tends to increase with age among adults. Since, in present investigation, majority of the subjects are older adults, this may be supported. Information on the educational status of subjects depicted that all the respondents were literate with 35 per cent under graduates and 33 per cent post graduates. On the basis of occupation results showed that the widely held profession among the subjects was housewife (75 %) and ten per cent were in teaching profession. When classified on the basis of their monthly family income, it was recorded that of the selected respondents, 28 per cent were belonging to Rs. 11,000 to Rs. 20,000 income range and 20 per cent to the Rs. 21,000 to Rs. 30,000 range. The data further depicted that most of the homemakers belonged to nuclear type of families (77 %). Most of the selected respondents were reported to be having vegetarian food habits (83 %).

Frequency of consumption of nuts among under

survey families:

The Table 1 gives a picture of variation in consumption of nuts among the respondent families. It can be seen from the data that almond and ground nut were consumed by all of the selected families (100 %) and cashew nut by 93 per cent of the families. The seasonal variation in frequency of consumption of nuts shows that consumption of all the nuts was mostly all-round the year irrespective of season. Although almond, cashew nut and ground nut consumption was fairly distributed among all seasons with almonds being consumed daily during winter by 14 per cent of the families; it is evident that 33 per cent families consumed ground nut, 24.7 per cent consumed cashew nuts and 22 per cent consumed almonds weekly though out the year. Pine nut, pistachio nut and walnut were among the not often consumed. Sabate (1999) quoted that peanuts and peanut oil are prominent part of the Indian diets. Other nuts namely walnut, pistachio nut and pine nut were among the less commonly consumed.

Pattern of consumption:

The pattern of nut consumption was studied under 4 sub-heads:

Reason of consumption of nuts:

The percentage distribution for reason of consumption of nuts is given in Table 2. Ground nut (46.62 %), cashew nut (32.14 %), pistachio nut (29.75 %) and almond (28.95 %) were reported to be consumed by the respondents for the reason of taste. It was seen that only 28.29 per cent of the families consumed almonds for availing the medicinal benefits. Bolling *et al.* (2010) stated that data from large observational studies shows regular nut consumption is associated with a reduced risk of several conditions in which oxidative stress may play a role.

Table 1 : Seasonal variation in frequency of consumption

Sr. No.	Name	n	Summer				Winter				Rainy				All round the year			
			D	W	F	M	D	W	F	M	D	W	F	M	D	W	F	M
1.	Almonds	100	1.00	2.00	2.00	1.00	14.00	8.00	7.00	0	0	1.00	1.00	1.00	17.00	22.00	7.00	16.00
2.	Cashew nut	93	0	4.30	1.08	1.08	8.60	7.53	6.45	0	0	0	2.15	2.15	10.80	24.70	15.10	16.10
3.	Pine nut	15	0	0	0	0	0	0	6.67	20.00	0	0	0	0	13.30	40.00	20.00	
4.	Ground nut	100	1.00	3.00	5.00	0	2.00	6.00	6.00	0	1.00	2.00	2.00	1.00	17.00	33.00	16.00	5.00
5.	Pistachio nut	61	0	0	1.64	4.92	1.64	6.56	6.56	13.1	0	0	1.64	1.64	0	9.84	11.5	41.00
6.	Walnut	65	0	0	0	3.08	3.08	4.64	9.23	12.3	0	1.54	0	1.54	3.08	9.23	13.80	38.50

n = Number of respondent families consuming the nut D – Daily, W – Weekly, F – Fortnightly, M – Monthly

*Values depict percentage

It is further evident from table that almonds and cashew nut were also consumed for their energy dense characteristics (21.05 and 22.86 %, respectively). Due to the effect of nuts on health, usual consumption is recommended for most of the population, apart from subjects who require a caloric restriction, due to high energy density of nuts. Nonetheless, nut consumption is desirable for individuals with greater energy requirements like for those in childhood, adolescence and physically active (Aranceta *et al.*, 2006).

Consumption according to food item:

Desserts were the food item of choice by most of the subjects in view of addition of nuts as shown in Table 3, namely almond (37.41 %), cashew nut (35.61 %) and pistachio nut (28.30 %). It is also evident that ground

nut (51.09 %) was reported to be consumed mostly in snack items. The use of groundnut was also accounted by 25.55 per cent respondents in vegetable preparations.

Form of consumption of nuts:

Table 4 depicts that use of nuts was mainly in whole form namely ground nut (52.34 %), almond (43.80 %) and cashew nut (31.03 %). Also, the use of almond (33.58 %), ground nut (32.03 %) and cashew nut (31.01 %) in form of small pieces can be observed from the table. Brown *et al.*, 2016 suggested that the mean grams consumed by the population studied were relatively low for whole nuts (2.8 g/d), nut butters (0.9 g/d), nuts from hidden sources (1.5 g/d) and total nuts (5.2 g/d). Nuts function as ingredients in various recipes in fresh, raw, roasted, boiled, salted or fried forms; function as

Table 2 : Reason of consumption

Sr. No.	Reason	Nuts					
		Almond	Cashew nut	Pine nut	Groundnut	Pistachio nut	Walnut
1.	Taste	28.95	32.14	6.00	46.62	29.75	26.72
2.	Traditional practices	6.58	5.00	1.00	7.52	4.96	2.59
3.	Medicinal use	28.29	15.71	2.00	7.52	4.96	9.48
4.	Satiety value	0.00	0.00	0.00	0.00	0.00	0.00
5.	Recipe ingredient	6.58	8.57	0.00	18.05	6.61	5.17
6.	Rich food	6.58	8.57	1.00	5.26	7.44	5.17
7.	For energy	21.05	22.86	3.00	11.28	7.44	16.38
8.	Variety in food	1.97	2.14	2.00	3.76	6.61	4.31
9.	No answer	0.00	5.00	85.00	0.00	32.23	30.17

*Values depict percentage

Table 3 : Consumption according to type of food item

Sr. No.	Food item	Nuts					
		Almond	Cashew nut	Pine nut	Ground nut	Pistachio nut	Walnut
1.	Beverage: Hot	5.04	2.27	0.00	0.00	3.77	0.96
2.	Beverage: Cold	3.60	3.03	0.00	0.00	0.94	0.96
3.	Health drinks	17.99	10.61	0.00	2.92	5.66	5.77
4.	Desserts	37.41	35.61	7.07	6.57	28.30	23.08
5.	Snacks	26.62	30.30	7.07	51.09	22.64	29.81
6.	Vegetables	4.32	4.55	0.00	25.55	0.00	0.96
7.	Pulses	0.00	0.00	0.00	1.46	0.00	0.00
8.	Curries	0.72	3.03	0.00	5.84	0.94	0.00
9.	Salads	0.00	0.00	0.00	0.00	0.00	0.00
10.	Bakery and confectionery	0.72	0.76	0.00	0.00	0.94	4.81
11.	Indian breads	0.00	0.00	0.00	0.00	0.00	0.00
12.	Rice	3.60	4.55	0.00	6.57	0.00	0.00
13.	Other	0.00	0.00	0.00	0.00	0.00	0.00
14.	No answer	0.00	5.30	85.86	0.00	36.79	33.65

*Values depict percentage

thickening agents in preparation of gravies, used in chutney and sweet preparations, in beverages and for garnishing. Nuts are favoured as ingredients in salads, preserved in sugar syrup or crystallized as ingredients of puddings, cakes, biscuits, ice creams and sweetmeats of all kinds. Nut butter is commonly used made by

grinding roasted kernels (Avinash and Sankhla, 2013).

Purpose of nut served in food:

The highest use of nuts reported by the subjects was for the purpose of garnishing of food as shown in Table 5 (almond 46.23 %, ground nut 43.88 % and

Table 4 : Form of consumption of nuts

Sr. No.	Food item	Nuts					
		Almond	Cashew nut	Pine nut	Ground nut	Pistachio nut	Walnut
1.	Whole	43.80	41.09	10.68	52.34	28.57	32.43
2.	Ground	10.22	8.53	0.97	8.59	1.79	2.70
3.	Small pieces	33.58	31.01	2.91	32.03	18.75	26.13
4.	Flaked	6.57	4.65	1.94	0.00	2.68	3.60
5.	Halved	2.92	5.43	0.97	5.47	10.71	3.60
6.	Desiccated	0.00	0.00	0.00	0.00	0.00	0.00
7.	Essence	2.92	3.88	0.00	1.56	2.68	0.00
8.	No answer	0.00	5.43	82.52	0.00	34.82	31.53

*Values depict percentage

Table 5 : Purpose of nuts served in food

Sr. No.	Food item	Nuts					
		Almond	Cashew nut	Pine nut	Ground nut	Pistachio nut	Walnut
1.	Main ingredient	44.34	42.27	4.95	34.69	25.25	29.90
2.	Supplementary Ingredient	9.43	10.31	2.97	21.43	7.07	6.19
3.	Garnish	46.23	40.21	7.92	43.88	28.28	27.84
4.	No answer	0.00	7.22	84.16	0.00	39.39	36.08

*Values depict percentage

Table 6 : Nuts purchasing practices among families

Wt. (g)	Nuts	
	Bulk (n=40)	As and when required (n=60)
50	0.00	3.33
100	2.50	25.00
250	12.50	43.33
500	30.00	18.33
1000	40.00	10.00
>1000	15.00	0.00

*Values depict percentages

Table 7 : Storage practices of nuts among respondents

Sr. No.	Nuts	
Temperature of storage		
1.	Room temperature	59.00
2.	Refrigeration	41.00
3.	Freezer	0
Packaging for storage		
1.	Glass jar	13.00
2.	Plastic box	55.00
3.	Stainless Steel container	32.00
4.	Paper packet	0

*Values depict percentage

cashew nut 40.21 %).

Purchasing practices among respondents:

Table 6 shows the majority of respondents preferred to purchase nuts as and when required (60 %). The purchase of nuts was most common in 250 g packaging (43.33 %). It is also notable that those purchasing nuts in bulk quantities preferred 1000 g packs (40 %).

Storage practices followed by subjects:

Table 7 depicts the packaging and storage practices of nuts by the selected subjects. It can be seen that nuts are stored at room temperature by the majority of subjects (59.00 %) mostly in plastic boxes (55.00 %).

Conclusion :

Nuts constitute one of the most nutritionally concentrated kinds of food available. They contain numerous types of antioxidants which have protective and preventive roles to play for the human being. Based on the results obtained through the current study, we conclude that the practice of consuming nuts is common among the study subjects of Udaipur City. It can be inferred that almonds, cashew nut and ground nut were the most favored choices, usually consumed all round the year with fewer seasonal variations and mainly used for garnish purpose to enhance the palatability of food prepared. The inclusion of nuts in the diet is through food items like desserts, snack items and vegetable preparation majorly.

However, owing to the medicinal significance of nuts, notable use could not be seen. It is apparent that almonds and cashew nut were given importance by only a few of the respondents as far as the medicinal and energy benefits of the same are concerned. Hence, it can be said that though the consumers at ground level attempt to make healthy choices by utilizing the nuts in their diet, they are precisely unaware of the benefits that these natural noble sources of antioxidants hold, and thus they fail to avail the profits appropriately. India has a rich heritage of natural sources of cures to ailments and to add to the list are nuts proved to be a pool of antioxidants with numerous health benefits. Therefore, measures need to be taken to inform or make aware the public about the antioxidant richness leading to therapeutic benefits of nuts and thus popularize the use. Future public health initiatives should be mindful of these

consumption patterns.

Authors' affiliations:

KUSUM MITTAL, Department of Home Science, Govt. Meera Girls College (M.L.S.U.), UDAIPUR (RAJASTHAN) INDIA

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