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Nutritional Evaluation of Legume based Traditional foods of Palampur Region of Himachal Pradesh

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ABSTRACT

Background: The present investigation was undertaken with the objectives to document the traditional food recipes, process/ preparation, nutritional evaluation and development of protocols for the standardization of the recipes to minimize the nutrient losses.

Methods: Three blocks *viz*. Baijnath, Panchrukhi, Bhawarna and Palampur itself were selected. A questionnaire was used to collect the relevant information on traditional foods from 120 respondents. Legume based traditional foods were also analyzed for their nutritional component with standard methods.

Result: In legumes black gram contained highest crude protein content (26.26%). Moisture content was highest in kidney beans (12.65%), whereas in bengal gram *dal* it was lowest (9.69%). Fat content was highest in Bengal gram whole (6.07%) whereas it was lowest in Black gram (2.20%). Protein content highest in black gram (26.26%), whereas it was lowest in Bengal gram *dal* (22.35%). Crude fiber was highest in kidney beans (5.37%) and lowest in black gram (0.99%). chickpea had highest total ash content (5.19%) whereas it was lowest in Bengal gram whole (2.73%Recipes analysis result showed that *pakodu* contained high crude protein content *i.e*. 27.44 per cent, whereas Crude fat content was highest in *mukund badi madra* (22.17%). Kidney beans had highest phytic acid content (96.74 mg/100 g), whereas it was lowest in Bengal gram dhal (37.99 mg/100 g). Total phenols were highest in chick peas (117.16 mg TAE/100 g), where as lowest was in kidney beans (92.95 mg TAE/100 g). Oxalates were highest in kidney beans (0.91 mg/100g) whereas, lowest was chick peas (0.24 mg/100 g).

Key words: Cuisine, Dham, Ethnic, Medicine, Nutrition.

INTRODUCTION

Indian cuisines in the form of various foods consist of a wide range of foods which are divided into regional and traditional foods native to Indian subcontinent. Traditional foods are the foods which are based on sound foundations of knowledge, culture; custom, natural environment and these foods are consumed by people over long time. The knowledge of traditional processes, methodologies and technologies involved in production of these foods has been transferred from one generation to another. Traditional foods have been developed through ages and further invented, modified, utilized and evolved to overcome the monotony in the diet (Inamdar *et al.,* 2005). It also plays an effective role in strengthening social bonds. The difference in accessibility of raw materials, environmental conditions combined with time tested traditional knowledge have made the people of different regions of this hill states to create, develop and continue the consumption of a wide range of traditional foods and beverages unique to its places since ages. Among modified foods *Bhatooru, sidu, chilra, manna, aenkadlu, sepubari, patande, baari, Babroo, bedvin roti, madrah, churpa, sura, chhang, angoori, lugdi, chukh* and many more are the popular traditional products that are unique to the tribal and rural belts of Himachal Pradesh (Savitri and Bhalla, 2007).

It is a well known fact that consumption of traditional diets have many beneficial effects such as prevention of some age related degenerative diseases, arteriosclerosis, stroke, *etc* (Linderberg *et al*., 2003). The *dham,* a local term for lunch/traditional feast prepared in Himachali style and served during different ceremonies which provide an opportunity to be familiarized with the delicacies of the state. It is very hard to separates Himachal Pradesh and *dham* as it forms an integral part of Himachali traditions. Himachali *dham* is not just an insignia of tradition but also a mark of practical "*Vedic*" knowledge and is, thus, not only popular in Himachal Pradesh but also loved across the world. It is believed that initially *dham* was served in the temples as "*Prasad"* and hence, the entire meal is *satvik*. However, eventually *dham* is now served during every auspicious

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occasion and gathering such as marriages, family events and religious events in Himachal Pradesh. Another unique aspect of *dham* is that usually no vegetables are used in any of the dishes. It is purely made from various types of lentils and dairy products. The typical menu for *dham* would start with rice, *moong dal* and a *madra of Rajmash* (red kidney beans) or *chole* (chick pea) which is cooked in yoghurt and prepared in unique style by adding approximately twenty spices. This is followed by *mash dal*, topped by *Khatta* (sweet and sour sauce) made of tamarind and jaggery, the dham ends with the *Mitha* (dessert), sweet rice or *mithdee* (made of boondi or bread crumbs) (Tanwar *et al.*, 2017).

The state of Himachal Pradesh has varied agro-climatic zones, which influence the types of crops grown, occupation of the persons as well as and food habits. It also has a number of communities, races and cultures and all these are delicately interwoven as a rich cultural heritage. Himachal Pradesh has a rich heritage of tradition and culture endows in numerous traditional foods of diverse sensory qualities. A number of traditional foods are prepared and consumed by people in the state for decades and these form a part of socio-cultural life of hill people. Himachal Pradesh has a rich culture of traditional foods and these foods are in use since ages. The literature is lacking on the aspects of nutritional profile. Keeping in mind the inadequacy in literature the present study was taken to document the recipes as well as processes involved in the preparation of ethnic foods that are consumed in this region.

MATERIALS AND METHODS

Study area

The study was conducted in three blocks *viz*., Panchrukhi, Bhawarna and Baijnath of Palampur Tehsil of Kangra district of Himachal Pradesh. Three villages from each block were selected for the study purpose. Palampur Tehsil was selected purposely for the study. It represents the cosmopolitan population all over the state. The study was carried out in the 2017-2019 in community college of CSKHPKV Palampur in the Department of Food Science, Nutrition and Technology.

Sampling design

Two stage stratified random sampling design was used for the selection of households. In the two-stage sampling design the population is partitioned into groups, like cluster sampling, but in this design new samples are taken from each cluster sampled. Two-stage sampling is used when the sizes of the clusters are large, making it difficult to observe all the units inside them. In order to collect the relevant information, one twenty households thirty from each Panchrukhi, Baijnath and Bhawarna blocks of Palampur Tehsil and thirty households from Palampur of Kangra district of Himachal Pradesh were selected.

In order to achieve objectives of the study and arrive at proper conclusions different mathematical and statistical tools, such as average, mean, percentage, standard deviation and variance were considered in the study.

Data collection

The selected population was interviewed by using a compendious questionnaire to gather the relevant information specifically to the objectives of the study. The information was collected on following aspects:

- Commonly consumed legume based food recipes.
- Methods of preparation of different food products.

Procurement of materials

All the material required to prepare the recipes were procured from market and appropriate local sources. The legumes *i.e*. bengal gram whole, kidney beans, bengal gram dhal, chickpea, black gram all were procured from appropriate sources.

Analysis of raw material and prepared food recipes

The raw material used and different food recipes were analyzed using different chemical standardized method (AOAC, 2010).

Sensory evaluation of modified recipes

The sensory evaluation of modified food recipes was done using nine point hedonic scales. The developed products were organoleptic ally evaluated by semi- trained panel of 10 judges from department of Food Science Nutrition and Technology, College of Home Science, CSKHPKV, Palampur. Each product was prepared and tested twice. The judges were served each preparation with one control and ten test samples.

Statistical analysis of data

Appropriate statistical design was used for statistical analysis of data. The t-test was used to check variations in average food intake and nutrient intake of families. The nutrient intake of respondents of all four regions was compared with Recommended Dietary Allowances (ICMR, 2010). The experiments were carried out in triplicate and the data so obtained were subjected to Analysis of Variance (ANOVA) using SPSS software. The obtained data were interpreted at 5 per cent level of significance ($p \leq 0.05$).

RESULTS AND DISCUSSION

Commonly consumed legume based recipes

The pattern of legume based recipes consumed by the respondents was given in Table 1 and Plate 1. The legumes like *rajmah, maah*, *moong dal*, *maah-channa dhal, Kulth* were the commonly consumed by respondents in Panchrukhi, Baijnath, Bhawarna and Palampur. Weekly consumption of *rajmah* was high amongst families in Palampur (66.66%), Baijnath (60.00%), Bhawarna (56.66%) and Panchrukhi (33.33%), respectively.

Families (80.00%) of Baijnath consumed more of *maah* (black gram) weekly as compared to Panchrukhi (73.33%), Bhawarna (66.66%) and Palampur (63.33%) families, respectively. Weekly consumption of *moong dhal* (green gram) by Panchrukhi respondents (90.00%) was higher as compared to Palampur (86.66%), Baijnath (80.00%) and

Bhawarna (70.00%). A mixed pattern of consumption was observed regarding the consumption of *maah-channa* combination. The *maah-channa* dhal was found more popular in Bhawarna (90.00%), Panchrukhi (83.33%), Palampur (76.66%) and Baijnath (73.33%) on weekly diet. The consumption of *Kulth* (horsegram) was popular in all areas of Palampur. *Kulth* was prepared occasionally by respondents in all areas. Preparation and consumption of *Bda* and *Pakodoo* was totally on occasional basis as it was prepared on festivals or on special occasions.

Nutritional characteristics of different raw legume ingredients used for preparation of recipes

Moisture

The values of moisture content of different legumes varied significantly (Fig 1). The highest moisture content was found to be in kidney beans (12.65%). It was followed by Bengal gram whole (10.73%), black gram (10.70%), chick peas (10.17%) and Bengal gram dhal which contained lowest moisture content (9.69%). Qayyum *et al.* (2012) found

Plate 1: Traditional legumes based recipes.

moisture content in different legumes ranged between 8.01 to 12.97 per cent. Gopalan *et al* (2010) reported moisture content in legumes ranged between 9.6 to 65.1 per cent/ 100 g of seeds. Tripathi *et al* (2018) reported moisture content for sixteen genotypes of chickpea that ranged between 8.14 to 9.50 per cent which is in close agreement with present results. Olanipekun *et al* (2015) found moisture content in kidney bean as 7.32 per cent.

Crude protein

Crude protein content was highest in black gram (26.26%) followed bykidney beans (25.78%), Bengal gram whole (23.20%), chick peas (22.53%) and Bengal gram dhal (22.35%). Qayyum *et al.* (2012) reported protein content in Kidney bean as 20.09 per cent which is in close agreement with present study. Gopalan *et al* (2010) reported protein content for Bengal whole gram as 17.10 per cent which is in proximity with present results. Malhotra *et al.* (2008) found that the protein content of raw pulses varied from 12.1 to 26.6 per cent. Olanipekun *et al.* (2015) reported protein content for kidney beans as 20.92 per cent which is comparable with present results. Shaheen *et al.* (2012) reported protein content as 21.30 per cent in black gram and it was in close agreement with present results. The results of present investigation showed slight variations with these studies. This might be due to differences in cultivars and agrotechnical processes.

Crude fat

The value of crude fat varied significantly in different crops and was highest in bengal gram whole (6.26%). It was followed by bengal gram dhal (6.07%); chick peas (6.04%), kidney beans (2.37%) and black gram which had lowest fat content (2.20%). Gopalan *et al.* (1989, 2010) reported fat content of bengal gram whole as 5.3 per cent which is in close agreement with present study. Suliman *et al.* (2006) found fat content in selected legumes ranged between 1 to 2 per cent which is in close agreement with black gram and kidney beans results in present study.

Crude fibre

The results of crude fibre varied significantly among all five legumes and it was highest in kidney beans (5.37%) followed by bengal gram whole (4.52%), chick peas (3.90%), bengal gram dhal (3.51%) and black gram (0.99%). Suliman *et al* (2006) found fibre content in selected legumes ranged between 2 to 4 per cent which is in close agreement with present study. Gopalan *et al.* (1989, 2010) reported fibre content ranged between 0.7 to 6.2 per cent for different legumes.

Total ash

The values of total ash was highest in chickpea (5.19%) followed by kidney beans (3.97%), bengal gram dhal (3.69%), black gram (3.58%) and bengal gram whole (2.73%). Aurelia *et al.* (2009) observed ash content in chickpea as 3.21 per cent which is in close agreement with present investigation. Suliman *et al.* (2006) found ash content ranged between 2.0 to 3.0 per cent for selected legumes. Shaheen *et al.* (2012) reported ash content in black gram as 3.1 per cent which is in close agreement with present investigation.

Total carbohydrates

Data in Table 1 indicates the values of total carbohydrates of legume based raw ingredients. The value was highest in black gram (66.97%) followed by bengal gram dhal (64.39%) and bengal gram whole (63.30%). It was lowest in kidney beans (62.57%) and chickpea (62.34%). All values varied significantly with each other. The data pertaining to present study are closely associated with work of Gopalan *et al.* (1989, 2010), they present carbohydrate content ranged between 15.9 to 60.9 per cent for selected legumes. Olanipekun *et al.* (2015) reported carbohydrate content for

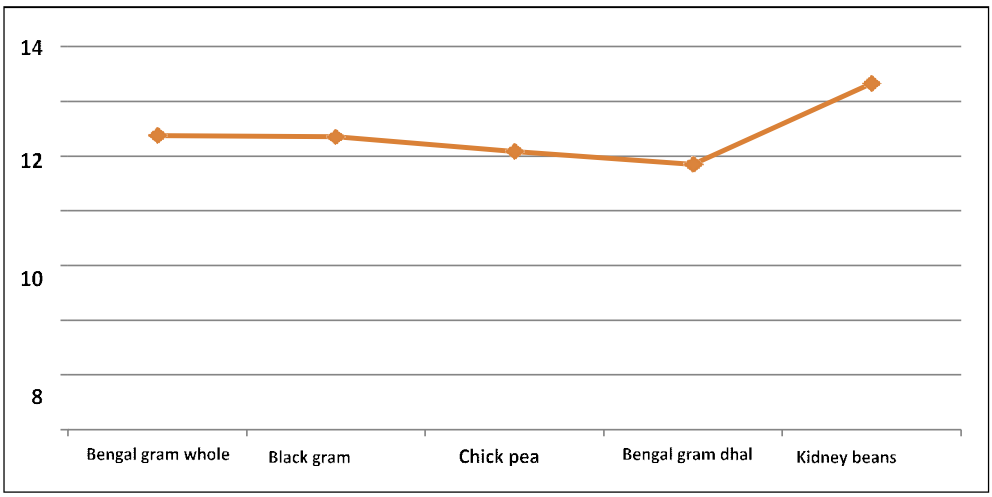

Fig 1: Moisture content of raw ingredients used for preparation of legume based recipes.

kidney beans as 60.09 per cent which is comparable with present study.

Phytic acid

Table 2 showed the results related to the phytic acid content of different legumes. The values of phytic acid of bengal gram whole, black gram, chick peas, bengal gram dhal and kidney beans were 94.35, 93.44, 83.47, 37.99 and 96.74 mg/100 gm respectively. Qayyum *et al.* (2012) reported phytates in chickpea and kidney bean ranged between 1.00 to 21.00 mmol/kg. Phytic acid content for different genotypes of chickpea ranged between 2.27 to 0.65 mg/g. Shemy *et al* (2000) reported phytic acid in soy bean and faba bean seeds without cortex as 342 and 102 mg/100 g and in whole soy bean and faba bean as 21.21 and 70.00 mg/100 g respectively. The difference in phytic acid content with these studies could be due to genetic makeup of the crops used in the study.

Total phenols

Table 2 illustrates the results of total phenols content of different legumes. The values of total phenols of bengal gram whole, black gram, chick peas, bengal gram dhal and kidney beans were 115.37, 67.73, 117.16, 34.78, 92.95 mg TAE/ 100 gm respectively. Jaganathan and Karthiga (2013) reported total phenol content in Bengal gram whole 61.64 and chick pea 93.52 mg GAE/100g. Total phenol content for different genotypes of chickpea ranged between 5.18 to 50.39 mg/g. Tripathi *et al.* (2018) reported total phenols for different cultivars of chickpea ranged between 76.43 to 108.48 mg/100 g. Shemy *et al.* (2000) reported tannin content ranged between 29.3 to 31.2 mg/100 g for whole seeds of soy bean and faba bean respectively. The phenolic content varied with these studies and it might be due to genetic, agrotechnical processes and environmental conditions.

Oxalates

Table 2 showed oxalates content of legume based ingredients. The highest amount of oxalates found in kidney beans (0.91 mg/100 g), followed by Bengal gram dhal (0.71 mg/100 g), bengal gram whole (0.47 mg/100 g) and black gram (0.40 mg/100 g), chick peas (0.24 mg/100 g) respectively.

Nutritional evaluation of legume-based traditional food recipes

As presented in Table 3 the moisture content of *Kadhi* was highest (38.43%) followed by *Khatta* (35.77%), *Rajmashmadra* (28.60%), *Mukund badimadra* (27.88%), *Matar paneer* (26.72%), *Pakodu* (23.31%), *Chana dal* (21.70%), *Taliyemaah* (20.11) and *Chana madra* (18.63%), *Bhalla* had the lowest moisture content (15.40%). Crude fiber values for *Rajmashmadra*, *Chana madra, Matarpaneer, Khatta, Chanadal, Mukund badimadra*, *Taliyemaah, Kadhi* and *Pakodu was* (5.92%), (5.14), (4.17), (3.17%), (2.23), (2.11%), (1.88%), (1.16%) and (1.13%) respectively. Crude

Table 1: Nutritional characteristics of raw ingredients used for preparation of legume based recipes.

Parameters	Bengal gram whole	Black gram	Chick peas	Bengal gramdhal	Kidney beans	CD (P≤0.05)
Crude protein (%)	23.20	26.26	22.53	22.35	25.78	1.17
Crude fat (%)	6.26	2.20	6.04	6.07	2.37	0.61
Crude fibre (%)	4.52	0.99	3.90	3.51	5.31	0.67
Total ash (%)	2.73	3.58	5.19	3.69	3.97	0.41
Total carbohydrates (%)	63.30	66.97	62.34	64.39	62.57	1.65

Table 2: Anti-nutritional factors present in raw ingredients used for legume based recipes.

Parameters	Bengal gram (whole)	Black gram	Chick peas	Bengal gramdhal	Kidney beans	CD (P≤0.05)
Phytic acid (mg/100 gm)	94.35	93.44	83.47	37.99	96.74	35.96
Total Phenols (mgTAE/100 g)	115.37	67.73	117.16	34.78	92.95	17.11
Oxalates (mg/100 g)	0.47	0.40	0.24	0.71	0.91	0.20

Table 3: Nutritional value of legume based traditional recipes.

Parameters	*Rajmash madra*	*Channa madra*	*Channa dal*	*Taliyem aah*	*Mukund badimadra*	*Khatta*	*Bhalla*	*Pakodu*	*Kadhi*	*Matar paneer*	CD (P≤0.05)
Moisture (%)	28.60	18.63	21.70	20.11	27.88	35.77	15.40	23.32	38.43	26.72	0.69
Crude protein (%)	26.89	21.70	21.63	24.53	25.52	18.20	23.46	27.44	7.10	12.12	0.73
Crude fat (%)	11.04	15.18	10.92	16.82	22.17	12.46	12.18	13.35	20.17	21.75	0.38
Crude fibre (%)	5.92	5.14	2.23	1.88	2.11	3.17	1.96	1.13	1.16	4.17	0.27
Total ash (%)	4.42	4.27	3.27	3.52	2.75	4.23	8.47	8.13	1.13	0.94	0.18
Total carbohydrates (g)	23.12	35.07	40.25	33.13	22.56	26.17	38.53	22.63	32.02	22.56	1.05

fat was highest in *Mukund badi madra* 22.17 per cent followed by *Matar paneer* 21.75 per cent, *Kadhi* 20.17 per cent, *Taliyemaah* 16.82 per cent, *Chana madra*15.18 per cent, *Pakodu*13.35 per cent, *Khatta* 12.46 per cent, *Bhalla* 12.18 per cent, *Rajmashmadra* 11.04 per cent and *Chana dal* 10.92 per cent. There was loss in protein content due to pressure cooking. Same results were reported by tyagi *et al.* (2015).

Crude protein washighest in *Pakodu* (27.44%) followed by *Rajmah madra* (26.89%), *Mukund badi madra* (25.52%), *Taliye maah* (24.53%), *Bhalla* (23.46%), *Chana madra* (21.70%), *Chana dal* (21.63%), *Khatta* (18.20%), *Matar paneer* (12.12%) and *kadhi* (7.10%). Ash content was highest in *Bhalla* (8.47%) followed by *Pakodu* (8.13%), *Rajmashmadra* (4.42%), *Chana madra* (4.27%), *Khatta* (4.23%), *Taliyemaah* (3.52%), *Mukund badimadra* (2.75%), *Kadhi* (1.13%) and *Matar paneer* (0.94%). Total carbohydrates were highest in *Chana Dal* followed by *Bhalla, Chana madra Taliyemaah, Kadhi, Khatta, Rajmash madra, Pakodu,* Mukund *badi madra* and *Matar paneer* whereas, the corresponding values were (40.25%), (38.53%), (35.07%), (33.13%), (32.02%), (26.17%), (23.12%), (22.63%), (22.56%) and (22.56%) respectively. Kalra *et al*. (1998) analyzed *Mongra* which is a Bengal gram based recipe and reported that the moisture content ranged between 0.18 to 6.9 per cent, protein content between 15.16 to 21.15 per cent and ether extractive between 37.13 to 61.33 per cent.

CONCLUSION

Indian cuisines in the form of various foods consist of a wide range of foods which are divided into regional and traditional foods native to Indian subcontinent. Himachal Pradesh has a rich culture of traditional foods which are based on sound foundations of knowledge, culture; custom, natural environment and these foods are consumed by people over long time and these foods are in use since ages. Three blocks of Palampur Tehsil and Palampur itself were selected for study purposes. Interview was done by using a compendious questionnaire to gather relevant information. Two stage stratified random sampling design was used for the selection of households. Among pulses the moisture content was highest in kidney beans (12.65%), whereas in Bengal gram *dal* contained lowest (9.69%). Fat content was highest in Bengal gram whole (6.07%) whereas it was lowest in black gram (2.20%). Protein content highest in black gram (26.26%), whereas it was lowest in Bengal gram *dal* (22.35%). Crude fiber was highest in kidney beans (5.37%) and lowest in black gram (0.99%). Chickpea had highest total ash content (5.19%) whereas it was lowest in Bengal gram whole (2.73%). Total carbohydrates were highest in black gram (66.97%) and lowest in chickpea (62.34%).

The present study was undertaken with the objectives to document the traditional food recipes, process/ preparation, nutritional evaluation and development of protocols for the standardization and modification of the selected food recipes. From the present study it can be concluded that traditional recipes had better nutritive value with adequate amounts of protein, minerals, vitamins and dietary fiber.

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Declaration

Availability of data and materials

The supporting data for my results mentioned in references. All the supported data also mentioned under results and discussion.

Author's contribution

All the work is done by Rekha Sharma only and YS Dhaliwal was my supervisor during this research.

Competing interest

I have no known competing professional, financial interests or personal relationships that going to influence my wok.

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