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Prevalence and consumption of Millets in various districts of Himachal Pradesh - A Survey Study

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ABSTRACT

Millets are a group of small seeded grains that are widely grown around the world as cereal crops and used both for human food and fodder. Millets are an important crop of semi-arid area like Asia and especially of India. They are favoured due to its productivity and short growing season under varying weather conditions. In Ayurveda Millets are classified under *Ksudra Dhanya*. The UN general assembly has declared Year 2023 as the International Year of Millets because it is an ideal solution for countries to increase self-sufficiency and reduce reliance on imported cereal grains. This is an opportunity to raise awareness of and direct policy attention to nutritional and health benefits of Millets. The present study is planned to assess the ground reality of mass awareness about cultivation, consumption of Millets in Himachal Pradesh. About 500 participants from different districts of Himachal Pradesh were selected randomly for survey study and data collected was analyzed. The results of study reflect that population of Himachal Pradesh is fairly aware about Millet's cultivation and consumption. Though lot of policies to promote cultivation and commercialization of Millet crops are in pipeline by Government of Himachal Pradesh, yet a concerted effort is still required to achieve the desired goal.

Key words: *Millets, future crop, nutrition, Siridhanya, Shreeanna, Kshudradhaanya.*

INTRODUCTION

Millets are one of the oldest foods known to humans & possibly the first cereal grain to be used for domestic purposes. Millets are termed as 'yesterday's coarse grains and today's nutri-cereals.[4] Millets are considered to be "future crops" as they are resistant to most of the pests and diseases and adapt well to the harsh environment of the arid and semi-arid regions of Asia and Africa. India is the largest producer of Millets in the world with share of around 41% of the total global production in 2020. India produces around 12 million tons of Millets annually. Government of India observed Year 2018 as a year of Millets to encourage and promote the millet production. The UN Food and Agriculture Organization is endorsing India's proposal to declare 2023 as the International Year of Millets. India is the fifth largest exporters of Millets worth dollar 26.97 million against dollar 28.5 million in 2019-20. The top three importers of Millets from India in 2020-21 were Nepal (Dollar 6.09 million) the UAE (Dollar 4.84 million) and Saudi Arabia (Dollar 3.84 million).[5] Based on grain size, Millets are classified as Major Millets (Sorghum, Pearl Millet) and Small Millets (Finger Millet, Little Millet, Kodo Millet, Foxtail Millet, Barnyard Millet, Proso Millet, Browntop Millet). Millets are a highly nutritious crop and contain considerable number of vitamins and minerals. Rich in niacin, which

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helps the body to manage 400 enzyme reactions. Millets boost immunity, reduce inflammation that causes chronic diseases. They serve as good source of protein, dietary fiber and phytochemicals. High dietary fiber provides multiple health benefits such as improving gastrointestinal health, blood lipid profile, and blood glucose clearance. Millets are comparable to rice and wheat or rich in some of minerals as well as fatty acids. Millets have a larger proportion of non-starchy polysaccharides and dietary fiber compared to staple cereals and comprise 65–75% carbohydrates. The abundant nutrients of Millets provide multiple benefits such as reducing gastrointestinal disease, detoxification, migraine and cancer. Millets have different varieties. Their properties are as follows:

Pearl millet or *Bajra* is widely distributed in the drier areas. It is well adapted to growing areas characterised by droughts, low soil fertility and high temperatures. Because of its tolerance to adverse growing conditions, it can be grown in areas where other cereal crops such as maize, wheat would not survive.[4]

Finger millet i.e., *Ragi* is a cereal grass grown mostly for its grain. It is a staple food in many South Asian Countries including India. It is easily digestible, highly nutritious and versatile and can be cooked like rice, ground to make porridge or flour. Sprouted grains are recommended for infants and elderly people.[4]

Sorghum Millet (*Jowar*) is suitable for the population suffering from chronic disorders. It helps in preventing and controlling the lifestyle disorders. It contains slow digestible starch (SDS) in good amounts which prolongs digestion and absorption of carbohydrates in intestine therefore it is favourable for dietary management and also for metabolic disorders such as diabetes and hyperlipidaemia. Sorghum also contains good amount of dietary fibre and plays the role of bulking agent, binding agent of cholesterol and retards carbohydrates absorption which has a significant positive effect on preventing and managing the diseases like constipation, irritable bowel syndrome and obesity. Sorghum lipid has potential to lower the cholesterol.[4]

Kodo millet is indigenous cereal of India. It forms the main stay of the dietary nutritional requirements. It has high protein content, low fat and very high fibre content. Kodo millet is very easy to digest as it contains a high amount of lecithin and is excellent for strengthening the nervous system. Kodo Millets are rich in B vitamins, especially niacin, B6 and folic acid, as well as the minerals such as calcium, iron, potassium, magnesium and zinc. Kodo Millets contain no gluten and is good for people who are gluten intolerant. Regular consumption of Kodo millet is very beneficial for postmenopausal women suffering from signs of cardiovascular disease, like high blood pressure and high cholesterol levels.[4]

Barnyard millet is a multi-purpose crop which is cultivated for food and fodder. It is a good source of protein, which is highly digestible and is an excellent source of dietary fibre with good amount of soluble and insoluble fractions. The carbohydrate content of barnyard millet is low and it is slowly digestible. In barnyard millet the major fatty acid is linoleic acid followed by palmitic and oleic acid. It also shows a high degree of retrogradation of amylase, which facilitates the formation of higher amounts of resistant starches. Hence it can be potentially recommended for the patients with cardiovascular disease and diabetes mellitus. Barnyard millet is most effective in reducing blood glucose and lipid levels.[4]

Small Millets have many health benefits due to their high levels of insoluble dietary fibre, phytates, phytochemicals catechins, flavonoids etc. They are rich source of minerals like copper and iron. They release glucose steadily without affecting the metabolism of the body. The incidence of diabetes is rare among the population which consumes small millet in their diet. As it is rich in its protein content it can be used as protein supplement too.[4]

The use of Millet is mentioned in Ayurvedic texts under *Kudhanya Varga*. *Acharya Charaka* mentioned that *Kordhush* and *Shyamaka* have *Madhur Rasa* and *Laghu Guna*. Both these are *Vata* aggravating, pacifies *Kapha* and *Pitta, Sheeta Virya, Dhatu Shoshak. Hasti Shyamak, Niivaar, Jalparni, Gavedhuk, Prshantika, Jalsanva, Lohitanu, Priyangu, Mukund, Jhinti, Gamuurti, Varuk, Arak, Shibir, Utkat and Jurna*, all these Millets are

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having properties similar to *Sanva*.[1] *Chakrapani* and *Sushruta* both enumerated these *Dhanya* as *Kudhanya*. *Madhuli* and *Nandimukhi* are sweet, cold and unctuous.[2]

Acharya Bhav Prakash mentioned it in *Dhanya Varga* as *Kshudrdhaanya, Kudhanya* and *Trinadhanya* all are synonyms. *Kshudrdhaanya* are *Ushna* (hot), *Kashaya* (astringent) and *Madhur* (sweet) in *Rasa*, *Laghu* (light), *Lekhan* (emaciating), *Katuvipak, Ruksha* (dry), *Kleda Shoshak* (drying), *Vata* vitiating, constipating and destroys *Pitta, Raktavikaar* and *Kapha*. *Kangu* and *Priyangu* both are feminine. *Kanguni* has four types - black, red, white, yellow. Among these yellow *Kanguni* is the best. *Shyamaaka, Shyamak, Shyam, Tribeej, Avipriya, Sukumar, Rajdhanya, Trinbijottam* all are synonyms. *Savan* is *Shoshk* (drying), *Ruksh* (dry), *Vata* vitiating and *Kapha* - *Pitta* pacifying. *Kodrava* and *Korduush* are synonyms. While *Uddala* and *Vanakodrava* are synonyms. *Kodo* - *Vata* vitiating, *Grahi*, cold and *Pitta* and *Kapha* pacifying. *Vanakodo* - hot, *Grahi* and extremely *Vata* aggravating. It unifies broken bones, *Vata* vitiating, *Brimhana* (increases *Rasa* and *Rakta* etc, *Guru* (heavy), *Ruksha* (dry), *Kaphanaashka* and very much beneficial for horses. *Chiinaak* are *Kakkangu, Sushlakshn, Shlakshnka. Chiinaak* is the type of *Kangu*. It is the type of *Kangu* that is why its properties resembles *Kanguni*. *Gavedhuka* and *Gavedhu* are feminine, told by two scholars. It is having *Katu Rasa*, palatable, emaciation causing and *Kapha* pacifying in action. *Yaavnala* is tasty, having *Kashya* (astringent) *Rasa*, *Shitala* (cold), *Avrishya*, *Ruksh* (dry), *Kledakarka* (unctuous), *Laghu* (light), cures *Raktvikara*, and pacifies *Kapha* and *Pitta*.[3] Ayurvedic *Ksudradhanya* is named as following in today's context - *Madhulika* - *Ragi* or Finger millet, *Kanguni* - Foxtail millet, *China* - Proso millet, *Savan/ Shyamaka* - Barnyard Millet, *Kodo/ Vankodo* - Kodo millet, *Gavedhuka* - Adlay millet, *Bajra* - Pearl millet, *Yavnala/ Jowar* - Sorghum

The UN general assembly has declared Year 2023 as the International Year of Millets because it is an ideal solution for countries to increase self-sufficiency and reduce reliance on imported cereal grains. This is an opportunity to raise awareness of and direct policy attention to nutritional and health benefits of Millets and their suitability for cultivation under adverse and climate changing conditions. Hundreds of events and activities are being organised worldwide to promote the International Year of Millets. Keeping this in mind, the following survey study was conducted in Himachal Pradesh, India to understand the importance of these magical grains and to bring the ground problem related to their cultivation and consumption into the foreground so that amendments can be made accordingly in order to make Millets the part of the mainstream grains. Study was designed to assess the ground reality of cultivation and consumption of Millets in Himachal Pradesh and the mass awareness in Himachal population about the benefits and drawbacks of millet consumption. The results of survey can be helpful to formulate new policies about millet cultivation and raising awareness about its health benefits among general masses.

Materials and Methods

Participant Selection

About 500 participants from different districts of Himachal Pradesh were selected randomly. After obtaining the consent as well as making them aware about the purpose of survey study.

Survey Design

It is Analytical Cross-sectional study.

Plan of Study

- Literature pertaining to Millet both in Ayurveda and modern reviewed critically to understand the concept of promotion of millet consumption and cultivation.
- Development of questionnaire to understand the ground reality of millet consumption and cultivation in Himachal Pradesh.
- Survey done in different districts of Himachal Pradesh.
- Data collected is statistically analyzed and conclusion drawn.

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Questionnaire

The participants were asked to fill a google form about "Prevalence and Consumption of Millets in Various Districts of Himachal Pradesh" having a pre-tested questionnaire as follows:

1. Demographic Profile (Name, Occupation, District of residence, E-mail ID)
2. Which millet is cultivated in your district other than grains like maize, rice and wheat?
3. In what percentage of mainstream grains Millets are grown in your area?
4. How Millets are used in your district?
5. For human consumption, in which form (dishes) Millets are used?
6. Is the millet restricted to growing season or used for whole year in your district?
7. Is millet easy to store?
8. If no, then what are the difficulties you are facing in storage?
9. Purpose of millet cultivation?
10. Do you find cultivation of Millets lucrative for commercial purpose as compared to mainstream grains?
11. Any new recipes of Millets tried in your district besides roti and beverage?
12. Are millet preparations liked by kids?
13. Are millet preparations palatable for old people?
14. Are you aware of any popular medicinal/nutritional benefits of Millets? Kindly explain.
15. Have you noticed any kind of harmful effects of consumption of Millets?
16. Do you suggest there should be any kind of government support for cultivation and distribution of Millets? Explain.
17. Should Millets be distributed at government depots like other grains with due subsidy?

Data collection

After completion of the survey, the data was carefully collected on Google Forms. Primary and secondary resources were reviewed in the light of hypothesis and plan of study and necessary materials were compiled. Compiled materials were thoroughly studied, rearranged and critically analyzed to provide the logical base for survey study.

Statistical Analysis

Cross-sectional study - prevalence will be published in terms of frequency and percentage.

Sub analysis - Kruskal- Wallis test

Observations and Results

The results obtained are as follows:

Table 1: Participants from different districts of Himachal Pradesh

SN	Districts of Himachal Pradesh	No. of Participants		Total participant in each District	Percentage		Total %
		Male	Female		Male	Female	
1.	Kangra	112	78	190	58.9 %	41%	38%
2.	Mandi	46	42	88	52.2 %	47.7 %	17.6 %
3.	Chamba	23	27	50	46%	54%	10%
4.	Hamirpur	18	20	38	47.3 %	52.6 %	7.6 %
5.	Solan	17	10	27	62.9 %	37%	5.4 %
6.	Shimla	11	12	23	47.8 %	52.1 %	4.6 %
7.	Una	9	12	21	42.8 %	57.1 %	4.2 %

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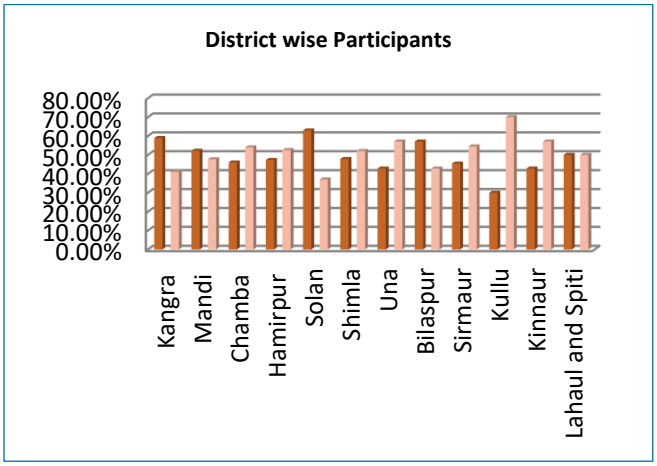
8.	Bilaspur	12	9	21	57.1 %	42.8 %	4.2 %
9.	Sirmaur	5	6	11	45.4 %	54.5 %	2.2 %
10.	Kullu	3	7	10	30%	70%	2%
11.	Kinnaur	3	4	7	42.8 %	57.1 %	1.4 %
12.	Lahaul and Spiti	1	1	2	50%	50%	0.4 %

Graph 1: District wise Participants



Here it can be observed, that maximum participants i.e. 38% are from Kangra district of Himachal Pradesh followed by 17.6 % from Mandi and 10% Chamba. Only 0.4 % of the total participants belonged to the district Lahaul- Spiti.

Table 2: Prevalence of millet in different districts of Himachal Pradesh

SN	Districts of Himachal Pradesh	Prevalent millet in that district
1.	Kangra	Pearl Millet (Bajra) followed by Sorgum Millet (Jowar), Barley (Jo), Finger Millet (Ragi), Kodo Millet
2.	Mandi	Finger Millet (Ragi), Pearl Millet (Bajra), Sorgum Millet (Jowar), Kodo Millet
3.	Chamba	Barley (Jo), Kodo Millet, Pearl Millet (Bajra), Sorghum Millet (Jowar),
4.	Hamirpur	Pearl Millet (Bajra), Barley (Jo), Kodo Millet, Sorghum Millet (Jowar), Kangani (Foxtail Millet)
5.	Solan	Barley (Jo), Sorghum Millet (Jowar)
6.	Shimla	Finger Millet (Ragi), Pearl Millet (Bajra), Barley (Jo), Kodo Millet, Sorghum Millet (Jowar), Kangani (Foxtail Millet), Proso Millet
7.	Una	Pearl Millet (Bajra), Sorghum Millet (Jowar), Little Millet (Swank), Finger Millet (Ragi)
8.	Bilaspur	Pearl Millet (Bajra), Finger Millet (Ragi), Barley (Jo), Sorghum Millet (Jowar), Kodo Millet
9.	Sirmaur	Pearl Millet (Bajra), Barley (Jo), Kodo Millet, Finger Millet (Ragi), Sorghum Millet (Jowar)
10.	Kullu	Pearl Millet (Bajra), Kodo Millet, Finger Millet (Ragi), Sorghum Millet (Jowar)
11.	Kinnaur	Kodo Millet, Barley (Jo)
12.	Lahaul- Spiti	Barley (Jo)

From the survey study, it was observed that the Pearl Millet i.e., *Bajra* is the most popular millet in Kangra, Hamirpur, Una, Bilaspur, Sirmaur and Kullu districts of Himachal Pradesh. Sorghum Millet (*Jowar*) is the prevalent millet in district Chamba whereas Barley (*Jo*) is grown in Solan and Lahaul- Spiti districts. Finger Millet i.e., *Ragi* is grown in Mandi and Shimla region and lastly, Kodo Millets are found in Kinnaur District of HP.

Table 3: Occupation

SN	Occupation	No. of Participants	Percentage
1.	Doctors	148	29.6%
2.	Farmers	129	25.8%

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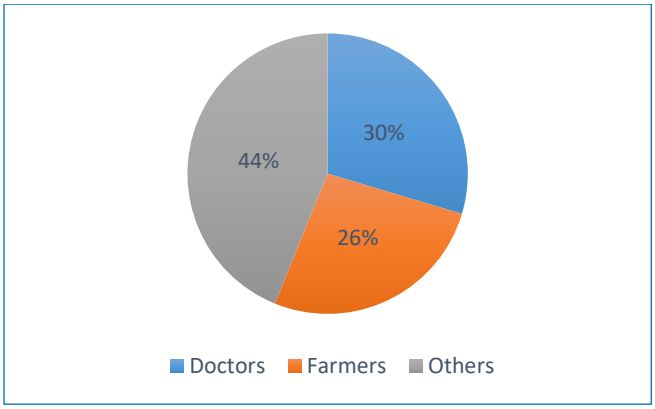
3.	Others	223	44.6 %

Pie chart 1: Occupation wise participants



It was observed that maximum participants i.e., 44.6% belonged to different professions followed by 29.6 % who were doctors and remaining 25.8% of the total participants were farmers by profession.

Table 4: In what percentage of mainstream grains Millets are grown in your area?

Zones of Himachal Pradesh	Districts and parts of districts	n	Name of district	% area	Mean %
Sub-mountain low hills sub-tropical (Zone-I)	Una, Bilaspur and Hamirpur districts and parts of Sirmaur, Kangra, Solan and Chamba districts	7	Una	50	30.71
			Bilaspur	37	
			Hamirpur	18	
			Parts of Sirmaur dist.	45	
			Parts of Kangra dist.	37	
			Parts of Solan dist.	8	
			Parts of Chamba district	20	
Mid-hills sub-humid (Zone-II)	Palampur and Kangra tehsils of Dist. Kangra, Rampur tehsil of Shimla district and parts of Mandi, Kangra and Sirmaur Districts	8	Palampur tehsil	29	26.71
			Kangra tehsil	32	
			Rampur	27	
			Mandi	34	
			Sirmaur	47	
			Shimla	23	
			Kullu	16	
			Solan	8	
High hills sub temperate wet (Zone-III)	Shimla district (except Rampur tehsil) Parts of Kullu, Solan, Chamba, Mandi, Kangra and Sirmaur districts.	7	Shimla district except Rampur Teh.	21	24.86
			Parts of Kullu district	14	
			Solan	6	
			Chamba	16	
			Mandi	38	
			Kangra	36	
			Sirmaur	43	
High hills temperate dry (Zone-IV)	Kinnaur, Lahaul, Spiti, Parts of Chamba district, Parts of Kullu district	5	Kinnaur	17	21.41
			Lahaul	16	
			Spiti	14	
			Parts of Chamba districts	18	
			Parts of Kullu district	17	

Maximum percentage of area of arable land i.e. 30.71% of Sub- Mountain low hills /sub-tropical (Zone-I) is used to grow millets followed by 26.71% of Mid-hills/ sub humid (Zone- II), High hills/ sub temperate wet (Zone-III) 24.86%, High hills temperate dry (Zone- IV) 21.41%.

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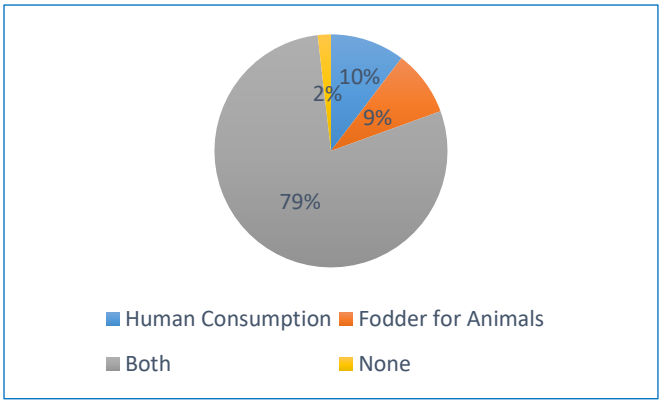
Table 5: How are Millets used in different Districts of Himachal Pradesh?

SN	Usage of Millets	No. of Participants	Percentage
1.	Human Consumption	51	10.2%
2.	Fodder for Animals	45	9%
3.	Both	388	77.6%
4.	None	16	3.2%

Pie chart 2: Usage of Millets

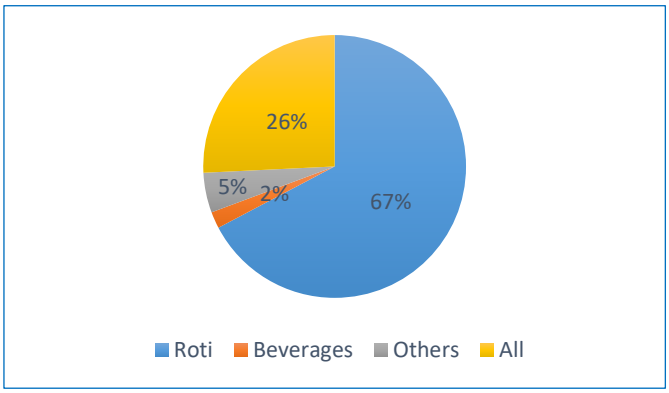


Based on the survey and conclusions drawn from it, it was found that 77.6% of the total participants responded that they prefer using Millets both for the human consumption and as fodder for animals followed by 10.2% participants who prefer using Millets only for human consumption. About 9% responded in favors of usage of Millets as fodder for animals only. Remaining 3.2% participants chose neither of them.

Table 6: For human consumption, in which form (dishes) Millets are used?

SN	Dishes/Form	No. of Participants	Percentage
1.	Roti	334	66.8%
2.	Beverages	12	2.4%
3.	Others	25	5%
4.	All	129	25.8%

Pie chart 3: Dishes of Millets



66.8% of the total participants chose *Roti* as their preferred form of consumption of Millets followed by 25.8% who preferred consuming them in all the forms be it roti, beverage or any particular regional dishes. 5% of the participants chose other forms over roti and beverages for consumption. Remaining 2.4% preferred to consume them as beverages only.

Table 7: Is the Millets restricted to growing season or used for whole year in your district?

SN	District	Usage of Millets w.r.t. season (No. of Participants)		
		Seasonal	Whole Year	No response
1.	Kangra	129	53	14
2.	Mandi	57	26	05
3.	Chamba	39	10	07
4.	Hamirpur	21	11	06
5.	Solan	20	05	02
6.	Shimla	11	10	02
7.	Una	16	03	02
8.	Bilaspur	12	09	00
9.	Sirmaur	08	02	01
10.	Kullu	08	02	00
11.	Kinnaur	06	01	00

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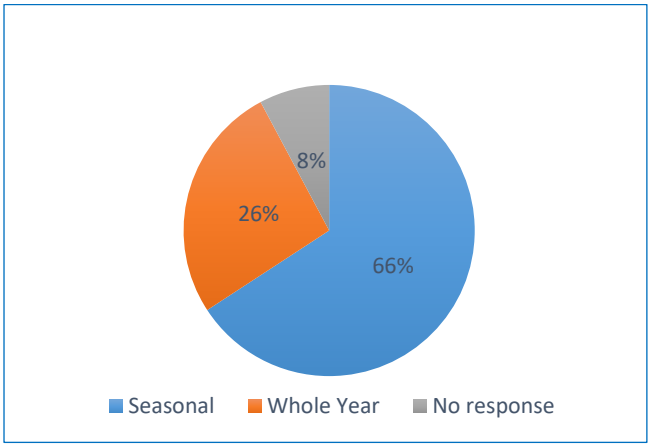
12.	Lahaul and Spiti	02	00	00
Total respondents		329 (65.8%)	132 (26.4%)	39 (7.8%)

Pie chart 4: Time wise use of Millets

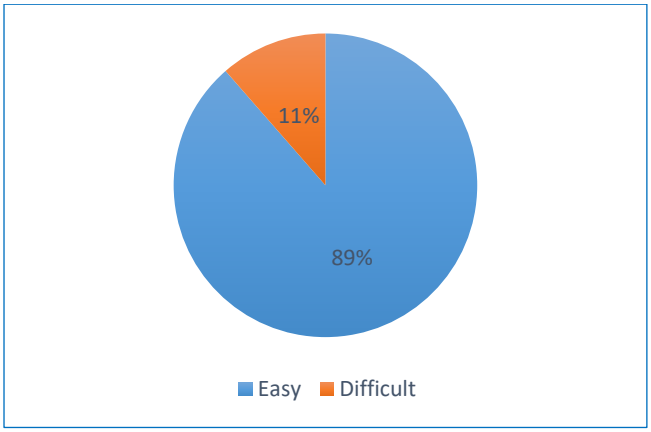


65.8% participants prefer seasonal use of millet, whereas 26.4% advocated whole year use of millet. 7.8% participants were unaware of its use.

Table 8: Is millet easy to store?

SN	Storage	No. of Participants	Percentage
1.	Easy	434	86.8%
2.	Difficult	56	11.2%
3.	Chose not to answer	10	2%

Pie chart 5: Feasibility of storage of Millet

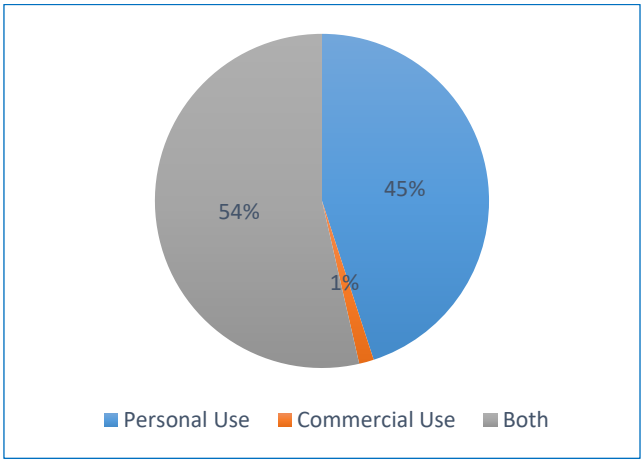


It was observed that about 86.8% participants responded that Millets are easy to store followed by 11.2% who found their storage difficult. 2% of the total respondents chose not to answer.

Table 9: Purpose of Cultivation of Millets

SN	Purpose of Cultivation	No. of Participants	Percentage
1.	Personal Use	223	44.6%
2.	Commercial Use	9	1.8%
3.	Both	266	53.2%

Pie chart 6: Purpose of cultivation of Millet



About 53.2% of the total participants responded that they cultivate Millets for both personal and commercial use followed by 44.6 % of them who favoured to use them only for personal purpose. Remaining 1.8 % of the participants responded that the prefer using Millets for commercial use only.

Table 10: Is cultivation of Millets lucrative for commercial purpose as compared to mainstream grains?

SN	Cultivation beneficial as compared to other grains	No. of Participants	Percentage
1.	Yes	346	69.2%
2.	No	143	28.6%
3.	Chose not to answer	11	2.2%

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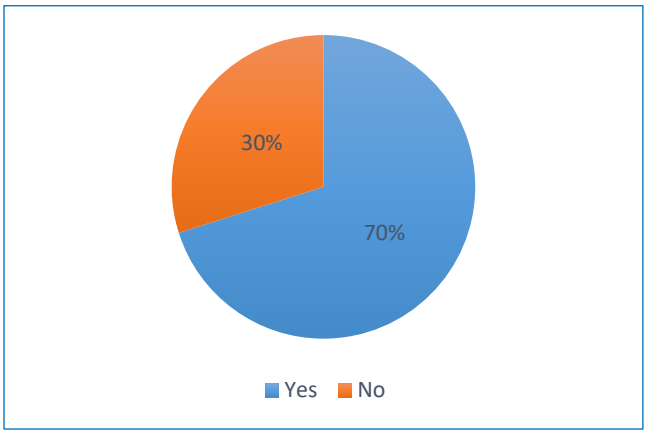
Pie chart 7: Commercial use of Millet

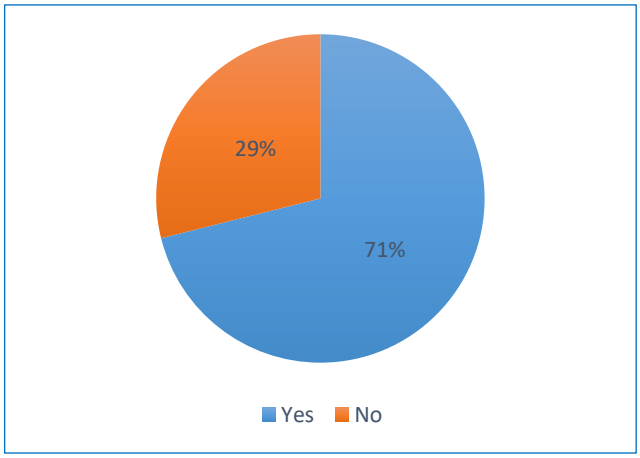


After careful assessment of the responses, it was found that about 69.2% of the total participants agreed to the fact that cultivation of Millets is beneficial as compared to the mainstream grains followed by 28.6% responses suggested they were not as beneficial as compared to other grains. Remaining 2.2 % did not respond.

Table 11: Are millet preparations liked by kids?

SN	Preparation liked by kids	No. of participants	Percentage
1.	Yes	351	70.2 %
2.	No	142	28.4%
3.	Chose not to answer	7	1.4%

Pie chart 8: Palatability of Millets for kids

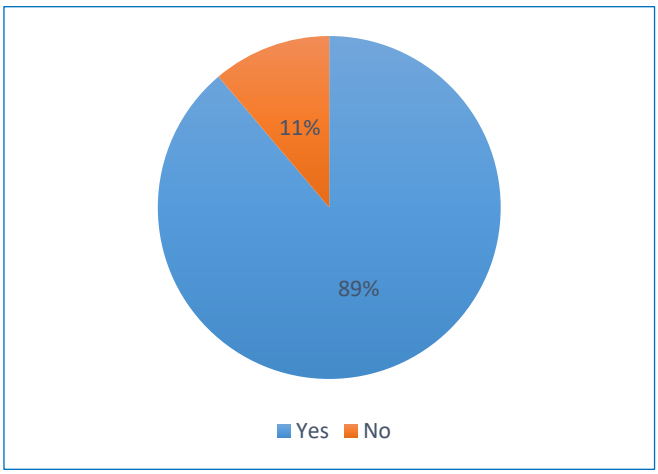


It was observed that 70.2% of the total participants suggested that millet preparations are liked by the kids. 28.4% of the participants had a different opinion. While remaining 1.4% chose not to answer.

Table 12: Are millet preparations palatable for old people?

SN	Palatable for Old People	No. of Participants	Percentage
1.	Yes	439	87.8%
2.	No	57	11.4%
3.	Chose not to answer	4	0.8%

Pie chart 9: Palatability of Millet for old population



87.8% of the total participants responded that the old people find millet preparations palatable compared to the 11.4 % who find it difficult for old people to consume millet preparations. Remaining 0.8 % chose not to answer.

Table 13: Are you aware of any popular medicinal/nutritional benefits of Millets?

SN	Awareness about health benefits of Millets	Participants			Total Number	Total Percentage
		Doctors	Farmers	Others		
1.	Yes	104	83	142	329	65.80%
2.	No	44	46	81	171	34.20%

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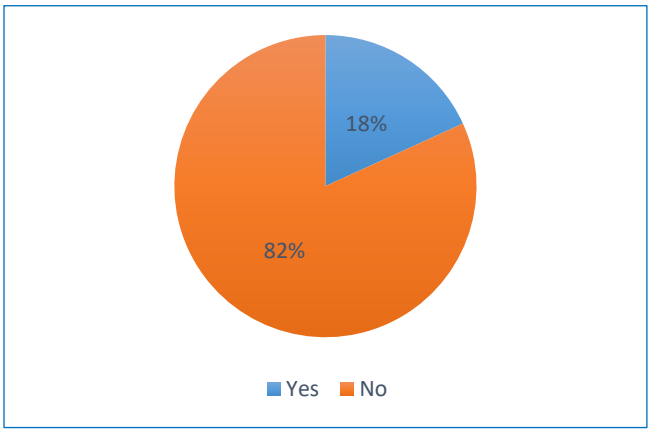
Pie chart 10: Awareness about benefits of Millet

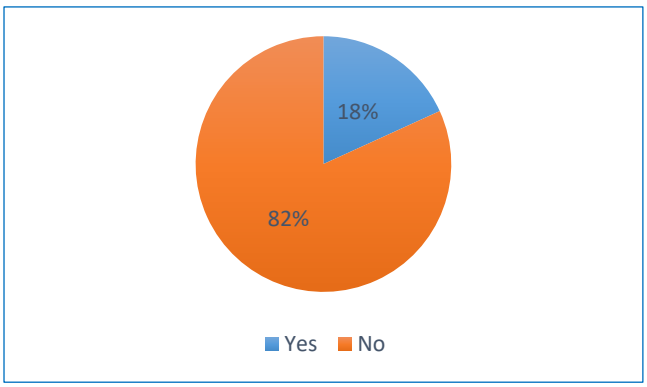


It can be inferred that 65.80% participants were well aware about the health benefits of Millets followed by 34.20% who chose No as their answer.

Table 14: Have you noticed any kind of harmful effects of consumption of Millets?

SN	Awareness about harmful effects of Millets	Participants			Total Number	Total Percentage
		Doctors	Farmers	Others		
1.	Yes	37	16	38	91	18.20%
2.	No	111	113	185	409	81.80%

Pie chart 11: Awareness about harmful effects of Millet

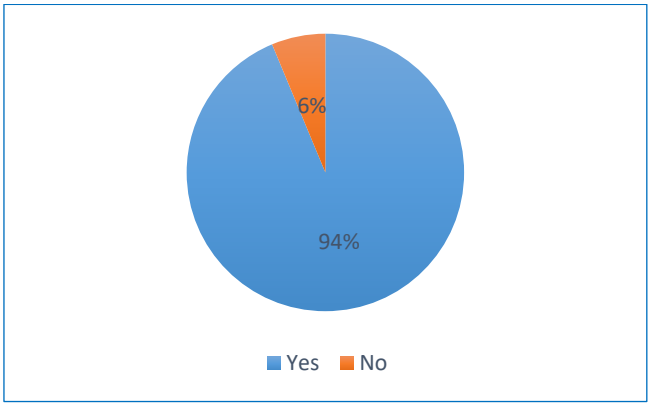


Based on the above analysis, it is observed about 81.80 % participants were not aware about the harmful effects of the Millets followed by 18.20% were aware about the harmful effects of consumption of Millets.

Table 15: Should Millets be distributed at government depots like other grains with due subsidy?

SN	Availability at Govt. Depot	No. of Participants	Percentage
1.	Yes	463	92.6%
2.	No	31	6.2%
3.	Chose not to answer	6	1.2%

Pie chart 12: Millet distribution through Govt. Depot



It was observed that 92.6% of the total participants were in favour of distribution of Millets at government depots with due subsidy just like other grains followed by 6.2 % participants who had a different opinion. Rest 1.2% chose not to answer.

Statistical analysis

Data collected by survey study was analysed by using Kruskal-Wallis test

Table 16: Table showing results of statistical analysis

Zone of Himachal Pradesh	n	T value	H statistics	p value	Significance
Zone 1	7	122	3..9843	0.263 (i.e. >0.05)	Nonsignificant
Zone 2	8	120.5			
Zone 3	7	93.5			
Zone 4	5	42			

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By comparing the zone- wise prevalence of millets statistically on Kruskal-Wallis test, it is found that p value is greater than 0.05, which means difference of prevalence of millets in various zones of Himachal Pradesh is non-significant.

DISCUSSION

Millets are well known for their nutritional and health benefits. Based on the analysis of the survey conducted, it was found Millets are one of the most popular cereal crops in different districts of the Himachal Pradesh.

One of the main reasons behind this is that Himachal is known for its rich bio diversity of plants, animals and microorganisms due to their ecological niche and altitudinal variations.

Evidently, the Himalayan lands are important centres of crop plant diversity due to high ecological heterogenicity and high social- cultural integrations. Secondly, about 85% of the Himalayan population is directly or indirectly dependent on traditionally practiced integrated hill agriculture, animal husbandry, agro-forestry and forestry for livelihood.

Thirdly, the agro-climatic zones of the Himalayas vary from hot sub-humid tropical to temperate, alpine and glacial. As Millets are climate resilient, they can be grown readily in different region of Himachal Pradesh.[6]

Occupation

As this was a random digital survey conducted in different districts of the Himachal Pradesh, the maximum responders were from different professions which constituted about 44.6% of the total participants.

Popular Millets of Himachal Pradesh

From the collected data it has been observed that Pearl Millet (Bajra) and Sorghum (Jowar) are the main Millet crops of Himachal Pradesh as compared to Barley (Jo), Finger millet (Ragi) and Kodo.

Prevalence of Millet in different Zones of Himachal Pradesh

Maximum percentage of area of arable land i.e., 30.71% of Sub- Mountain low hills /sub-tropical (Zone-I) is used to grow millets followed by 26.71% of Mid-hills/ sub humid (Zone- II)

Usage of Millets in different districts of Himachal Pradesh

In Himachal Pradesh, in today's times traditional agricultural practices are still used which include cultivation of multiple cereal crops and animal husbandry. Therefore, maximum people i.e., about 77.6% of the total participants prefer using millet crops for human consumption and the remaining portion of the crop as fodder for animals.

Preferred form of Millets for consumption

About 66.8% participants chose *Roti* as their preferred form of Millets for consumption because it is a staple food in every Indian household and is feasible to make.

Time wise use of millets

Most of the participants i.e. 65.8% participants prefer seasonal use of millet.

Storage of Millets

86.8% participants find it easy for them to store Millets as they can be readily stored in the airtight containers. Also, the temperature in the Himalayan region leans more towards the colder side adding to the easier storage of the millet grains. Remaining respondents find it difficult to store millets as there is no sufficient storage space in their area which further leads to moisturization and worm/ pest infestation leading to spoilage of grains resulting in losses.

Purpose of cultivation of Millets

53.2% of the total responders prefer using Millets for both personal and commercial use as agriculture is one of the main source of livelihood for the people in Himachal Pradesh. They are well aware of commercial value of Millets and market demand both in local area and outside Himachal Pradesh.

Benefits of millet cultivation in comparison to mainstream cereal grains

69.2% participants find cultivation of Millets beneficial in comparison to mainstream grains as people in Himachal Pradesh are well aware regarding their

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health and nutritional benefits and consume them as staple foods adding to their market value.

Different recipes of Millets

Millets can be consumed in multiple forms. After conducting this survey study, it was found that Millets can be roasted and eaten. Other recipes include millet *Laddos, Pinjiri, Chilla, Satu, Siddu* (a traditional himachali dish), multigrain *Halwa, Idli, Dosa*, fermented drinks like *Lugdi*, popcorns, *Khichdi, Dalia*, puff Millets with jaggery, barley powder is consumed along with buttermilk/ lassi, fermented dough (*Pindri)* etc. Different districts of Himachal Pradesh have their own traditional recipes for the consumption of Millets. These recipes were suggested by participants during survey from different districts of Himachal Pradesh.

Millet consumption by kids

70.2% of the total participants agree that millet preparations are liked by the kids as these can be made in different types of dishes and snacks such as cookies, chips, *Dosa, Chilla, Laddoo* etc. which are loved by the kids.

Millet consumption by old people

87.8% participants agreed that millet preparations are palatable for old people keeping their health benefits in mind. Also, different dishes such as millet *Khichdi, Dalia, Pinjiri* etc. can be easily eaten by the old people.

Health benefits of Millets

Maximum participants i.e., 65.80 % which included most of the doctors who were active participants of this survey, were well aware about the health benefits of the Millets. Some of them mentioned Millets are quite beneficial in curing and preventing Diabetes Mellitus, Hypertension, Thyroid dysfunction, Cardiovascular ailments, Breast disorders, Renal Calculi, Gastric discomfort etc. They are also found to be helpful in growth and development of the children as they are the rich source of minerals, micronutrients and essential amino acids. They are extremely helpful in relieving constipation due to rich fibre content. They are the immunity boosters too.

Harmful effects of Millets

Some of the participants (18.20%) responded that the Millets can cause bloating and stomach ache if consumed in excess amount. As they are goitrogens, they can also hamper the thyroid function. Some people can also develop millet allergies. Many of the participants i.e., 81.80% which included participants from non- medical backgrounds, were not aware about any harmful effects of the Millets which throws light on the fact that people are not educated enough about the harmful effects of Millets due to their overconsumption therefore proper education is needed while consuming them.

Government support in Millet cultivation

There were many suggestions from the participants. Most of them suggested organising awareness programmes and workshops for the farmers regarding cultivation of the Millets. As farmers were among the participants, they brought many issues to light, what they were facing in millet cultivation such as lack of manpower, insufficient water supply, soil testing, lack of financial support, inadequate storage spaces, lack of transportation facilities of the Millets to the market after harvesting and finally fluctuation in market prices resulting in losses. Government should address these issues raised by the farmers and new policies can be introduced. Modern cultivation techniques can be used along with the use of hybrid Millets so that they can survive well even in adverse weather conditions of Himachal Pradesh.

Availability of Millets at government depots

It was observed that 92.6% of the total participants would like distribution of Millets at government depots with subsidy for their easy availability and cost effectiveness so that it can be easily available for people with different socio- economic backgrounds.

This survey was conducted in the state of Himachal Pradesh to check the awareness regarding the Millets among the people. After the completion of the survey as well as analysis of the data obtained, it was found that many people among the participants were well aware about the cultivation and benefits as well as

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harmful effects of the Millets. Though many of the participants were aware yet there were plenty of them who didn't have much knowledge about these grains. Millets are still not among the mainstream cereals due to this lack of awareness among people.

During the course of this survey study, a visit was also made to the *Kisaan Mela* organised at Agriculture University, Palampur, District- Kangra. A one-on-one interaction was made with the farmers in attendance to know about the difficulties faced by them in millet cultivation. They shed a light on many issues such as lack of financial support, land and soil fertility issues, lack of proper water supply for irrigation, inadequate manpower at the time of harvesting and lack of proper storage resulting in wastage of the hard work put in by them in cultivation. Also, they mentioned the financial losses suffered at the time of sale of the millet grains to middleman/vendors.

All these issues need to be addressed by the Govt. of Himachal Pradesh. Appropriate measures need to be taken to raise awareness about the Millets among the masses by organising workshops and awareness programmes, bring in the new schemes and policies to help the farmers, sanctioning easy farming loans, distribution of hybrid Millet seeds, making more fertile land available for cultivation after soil testing and checking on the water supply and post harvesting marketing strategies to minimise the losses.

Coming to the people of Himachal Pradesh, the workshops can be organised in the school as well as the colleges to raise awareness about Millets among the young minds. Awareness programmes, workshops, *nukkad natak* etc. can be organised to attract attention of the people towards these forgotten grains.

The agriculture department of Himachal Pradesh is making more efforts to produce as well as promote Millets. The thrust remains on providing nutritious food to every individual and supporting farmers in cultivating healthy crops. This initiative aims to address the global challenge of ensuring a balanced and nourishing diet for all, as a nutritious lunch plate is vital for everyone's well-being.

Himachal Pradesh is leading the way in cultivating crops that possess exceptional nutritional value. Kodo millet, *Cholayi, Sawa, Kanguni* etc are renowned traditional crops that boast of high nutritional content. These crops have become a significant part of the local diet due to their richness in essential nutrients. Recognizing their potential, the state government has taken proactive measures to ensure that the farmers have access to the necessary resources and knowledge to cultivate these crops.

The agriculture department has been working to provide guidance, training, and access to modern agricultural practices, allowing farmers to maximize their yield while maintaining the nutritional quality of their produce and focusing on growth of nutrition-rich grains like *Kutki* (Little Millet) and *Cheena* (Proso millet).

To further support the farmers, the state government has constituted a committee that acts as a platform for knowledge-sharing and assistance and playing a crucial role in educating farmers about the cultivation of nutrient-dense crops and on advancements in agrotechnology. This initiative aims to empower farmers and enable them to make informed choices about the crops they grow. A target of covering approximately 4500 hectares of land under millet cultivation was fixed for this year and 35000 free of cost mini kits will be provided to farmers to boost crop cultivation. Besides, the farmers will be provided 80 percent subsidy for Millets seeds production. The State government's initiatives underscore its dedication to the welfare of its farmers and to enhance the immunity-boosting properties and nutritional value of crops by adopting organic practices.

A state level work team of technical officers and farmers has been constituted to encourage production of Millets through awareness thus benefitting small-scale farmers by promoting sustainable agricultural practices. Farmers will receive guidance, training, and access to proper market channels enabling them to connect directly with consumers and obtain fair prices for their crops. The government aims to create a conducive environment that encourages sustainable

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farming practices while ensuring farmers receive the recognition and compensation they deserve.[7]

The state government will prepare a database of millet, district wise identification along with the local and scientific names based on Millets which are conducive to the state's climate with support of experts and different agencies. The concerted efforts of the government, agriculture department reflect Himachal Pradesh's commitment to promote nutrition and support its farming community. These endeavours are expected to create a positive impact on the health and well-being of the region's residents, as well as contribute to the overall development of the state and nation too.[7] By comparing the zone- wise prevalence of Millets statistically on Kruskal- Walllis test, it is found that p value is greater than 0.05, which means difference of prevalence of millets in various zones of Himachal Pradesh is non-significant.

Limitations of Study

The Study should be conducted on one category only i.e. farmers who are directly involved in cultivation of Millets to get more precise information of prevalence of Millets in Himachal Pradesh.

Population studied in various zones of Himachal Pradesh had different number of participants according to the density of population. That may be taken equal in number to get precise knowledge of the ground realities

Conclusion

The survey study conducted in Himachal Pradesh reflects that most of the population well aware of usage and benefits of Millet cultivation and consumption. Paradoxically it was noticed that in certain regions of some districts people were unaware of cultivation and usage of millet in their area. The personnel connected with health sector or agricultural practices were able to throw light on Millet consumption but still a lot of concerted efforts are required by government and agriculture industry in propagation of knowledge about Millet cultivation, storage, transportation to market and commercialization of the produce. Health sector can propagate the benefits and wise consumption practices among masses. Though the Government of Himachal Pradesh has already floated a lot of policies to succour the cultivation and commercialization of Millet yet a lot of awareness derives and hard work is required to implement these policies and get expected outcome.

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