



Quantitative study of the food flavoring spice mixtures used in the traditional markets of District Bannu, Khyber Pakhtunkhwa, Pakistan

Adnan Ali Shah, Lal Badshah, Rainer W. Bussmann, Murad Muhammad, Abdullah, Farman Ullah, Sumbal Khan, and Naushad Khan

Correspondence

Adnan Ali Shah¹, Lal Badshah¹, Rainer W. Bussmann², Murad Muhammad¹, Abdullah¹, Farman Ullah³, Sumbal Khan¹, and Naushad Khan¹

¹Phytoecology lab, Department of Botany, University of Peshawar, Khyber Pakhtunkhwa, Pakistan.

²Department of Ethnobotany, Institute of Botany, Ilia State University, Tbilisi, Georgia.

³Department of Forest Resources Management, Nanjing Forestry University, China.

*Corresponding Author: adpirzada233@gmail.com

Ethnobotany Research and Applications 23:206(2022)

Databases and Inventories

Abstract

Background: The use of spices is as old as humanity itself, with spice production and trade often having influenced global politics and altering and modeling the very basics of our culture.

Methods: This study offers the first documentation of the market value of spice taxa and associated spice recipes, based on interviews and group discussions with 120 participants (12.50% women and 87.50% men), using both semi-structured and open-ended questionnaires.

Results: A total of 15 spice mixtures were reported in which 26 spice taxa were used in various proportion, and the prices of each spice taxon were found different in different markets. The highest price per kg was asked for *Syzygium aromaticum* in Masala Mandi market (PKR 2200, US\$ 14.1), while the lowest price per kg was for *Allium cepa* in Chuk market (PKR 75, US\$ 0.4). The prices of each one spice mixtures at each market vary from each other. There was a clear-cut difference between the composition and in prices. Laki gate market was the most expensive market where 10 spice mixtures out of 15 had the highest market value. Chuk market was most inexpensive because 11 spice mixtures out of 15 had their lowest market price. The Biryani masala recipe is known to be the heaviest recipe with the highest number of spice taxa (14) followed by Qeema and Machli masala recipes with 11 spice taxa each. Rosh masala was the simplest spices mixture comprising only 5 species out of 26 spice taxa. The market-to-market comparison showed strong correlation between Tanchi and Masala Mandi markets ($r = 0.97$) and Laki Gate and Masala Mandi markets ($r = 0.95$). Spice mixtures to spice mixtures correlations showed strong correlation between Kabuli Pulao and Qeema masala recipes ($r = 0.99$) and Haleem and Garam masala recipes and Achar gosht and Haleem masala recipes ($r = 0.98$) each.

Conclusion: The study highlighted the consistent strong correlation between various markets i.e., Tanchi and Masala Mandi markets and spice mixture to spice mixture e.g., Kabuli Pulao and Qeema masala recipes. The study provides a base line for the sustainable use of recipes, and young researchers.

Keywords: Spice taxa, spice mixtures composition, market value, correlation of markets, correlation of spice recipes, Bannu, Pakistan.

Background

Since ancient times humans used spices for food flavoring and for preparing different perfumes (Gupta, 2010; Sachan *et al.*, 2018; Rathore and Shekhawat, 2008). From the 15th to 17th century the Portuguese, English, Dutch, and Spanish traders participated in the trade of spices from the Far East. The first millionaire of America made his money in the trade of spices (Hertzler, 1980). It was discovered that already around 50,000 B.C., spices were used for flavoring meats (Deman *et al.*, 1999; Kaefer and Milner, 2008) and around 6300 B.C. humans used plants for winemaking (Kaefer and Milner, 2008). During the second century A.D., the spice trade was expanded, and the trade routes ("Silk Road") connected the East and the West (Kaefer and Milner, 2008; Arger and Arger, 2015; Anderson, 2009). In ancient and medieval times spices were considered one of the most valuable trade items (Rathore and Shekhawat 2008). In the United States, half of the spices were used in manufactured products such as luncheon meats, sausage, condiments, baked products, and pickles (Hertzler, 1980; Hanas, 1994; Hui, 2007). In ancient times the cultivation of spices was started in India, which was famous throughout the world and attracted invaders, explorers, and traders from various lands to Indian shores (Peter and Shylaja, 2012). In 2013 the production of spices was estimated to be 8,730,271 tons throughout the world, with India, Thailand, USA, and China being considered the major producing countries (DeMan *et al.*, 1999).

Different spices might be produced from any plant part, e.g. root (garlic, onion, and ginger), bark (cinnamon), berry (black pepper), buds (saffron, cloves), the fruit (paprika, allspice) or seeds (yellow mustard, sesame, poppy) of the tropical plants (Hertzler, 1980; Brown, 2009; Chi and Wu, 2014; Ceylan and Fung, 2004). The natural spices are available in dried, fresh, whole, or ground form (Brown, 2009; Kaefer and Milner, 2008; Chomchalow, 2001). Spices are often used in small quantity for food color, flavor or as a preservative (Sachan *et al.*, 2018; Padakatti and Meti, 2020; Gokoglu, 2019). Sometimes spices are also defined as the dried parts of aromatic plants (Sellami *et al.*, 2011; Ndukwu *et al.*, 2021; Peter and Shylaja, 2012). The word "spice" was derived from "species," which was applied in the Middle Ages to different exotic foodstuff groups (Gupta, 2010; Padakatti and Meti, 2020). **Aroma** is the ancient Greek word for spice (Rathore and Shekhawat 2008).

Originally marjoram and fennel were sourced from Egypt and highly expensive (Shylaja and Peter, 2004). Spices consist of fat, carbohydrates (gum, sugars, and fiber), ash, and protein and contain volatile as well as nonvolatile oils. These oils consist of alcohols, aldehydes, sugars, esters, phenols, and alkaloids (Balasubramanian *et al.*, 2016; Nadeem and Riaz, 2012). The volatile oils were used for flavor and aroma in food. Nonvolatile oils (oleoresins) were also known as flavor compounds (Brown, 2009). In spices, alcohols, phenols, alkaloids, and aldehydes were considered effective antimicrobial components (Ceylan and Fung 2004). Spices also act as antioxidants, which prevents rancidity and changing the flavor and color of the food (Embuscado, 2015). Phenols (flavonoids), vitamins, carotenoids, terpenoids, minerals were strong antioxidants found in many spices (Suhaj, 2006). Spices contain chemical compounds which provide health benefits including anti-inflammatory and antioxidant effects, and reduce the risks of diabetes and cardiovascular diseases, improve the overall health (Butt *et al.* 2013). They also had pharmaceutical and nutritional properties. In western countries, spices were used to produce more delicious foods with reduced levels of sugar, salt, and fat (Peter and Babu, 2012). Onion was considered one of the seven major agricultural crops produced throughout the world (Sehrawat and Nema, 2018). Garlic holds about 89.4% share in the global market, which was one of the important crops of Asian countries (India, Republic of Korea, China, etc.), (Majumder *et al.*, 2021). The USA imports large amounts of spices throughout the world its value was about US\$ 597 million in 2007. Other importing regions are Africa and Middle East (Peter and Shylaja, 2012). Spices play a great role in our lives, it was used as ingredients in food, medicine, alcoholic beverages, cosmetics, perfumery, coloring, (Peter and Babu, 2012) incense and soaps (Onyenekwe and Ogbadu, 1995). In ancient Rome and Greece spices were used as food preservatives (Sackewitz, 1956) and delay the spoilage of food, and as colorants (Peter and Babu, 2012; Gupta, 2010). In ancient Egypt and Assyria, spices were used for medicinal purposes (Sackewitz, 1956). Many herbs and spices are used as essential ingredients in face packs, toothpaste, freshness sachets, hair oils and skin toners, lotions, moisturizers, cleansing agents, eye lotions, infusions, shampoos, bathing oils, cosmetic creams, hair conditioners, antiseptics and anti-tanning creams and lotions, and used as an improvement of complexion and purifying blood (Peter and Babu, 2012). They also have therapeutic properties such as appetizer, carminative, digestive, analgesic, antipyretic, hepatoprotective, blood purifier, hypolipidemic, anti-diabetic, antioxidant, anti-inflammatory, antimicrobial, etc. (Peter and Babu, 2012). Spices possess antioxidant activity that can be applied for the preservation of lipids and reduce lipid peroxidation in biological systems (Gupta, 2010). Turmeric was useful in the prevention of cancer (Aggarwal and Shishodia, 2006).

Globally 109 spices are most widely produced, e.g., turmeric, ginger, black pepper, cardamom, and chili are major spices based on economic importance, which hold 75-95% share of the spice trade industry (Majumder *et al.*, 2021). Fifty types of spices are produced in India (Rathore and Shekhawat 2008) due to their variable climate and soil condition. Every year about 3.2 million tons of spices are produced in India, representing about half of the global trade of spices (Thomas *et al.*, 2017). Spices have different flavors such as hot, sweet, bitter, and sour, which give a different taste to Indian food. Spices also have medicinal properties, which cure different diseases. The medicinal value of spices is dependent on the potency of the plant parts. Several factors such as rainfall, soil, method of cultivation, altitude, collection, storage, and transport play a great role in the determination of potency and medicinal value of herbal drugs (Gupta, 2010). Turmeric, cardamom, fenugreek, cumin, pepper, ajwain, cinnamon, clove, ginger, chili, fennel, celery, mace, nutmeg, cassia, and coriander are spices that India offers in large amounts (Rathore and Shekhawat 2008). India is known to be 'land of spices'. In its national economy spices play a great role, 10 % of the spices produced in the country was exported (Peter and Shylaja, 2012). Many spices from India are exported to the USA, followed by the EU, Eastern Europe, East and West Asia and Africa (Walker, 2020). India earns the highest amount from the export of mint products which was about Rs. 169 679.00 lakhs (Peter and Shylaja, 2012). Annually the trade of spices worldwide is estimated to 0.6–0.7 million tones valued at about US\$ 3–3.5 billion (Bouët *et al.*, 2020). Its value depends on the price of pepper as pepper remains the main spices in international trade. Globally 85% of spices were traded (Peter and Shylaja, 2012). It was mostly sold in the form of minced, oleoresin, essential oil, and powder (Deman *et al.*, 1999). From 1970 to 2005, the annual consumption rate of spices was increased from 1.6 to 3.3 pounds. (Peter and Babu, 2012; Kaefer and Milner, 2008). China contributes about 4 % of global spices production followed by Bangladesh (3 %), Pakistan (2 %), Turkey (2 %) and Nepal (1 %) (Peter and Shylaja, 2012). Unseasonable cold, drought or over rainfall affect the availability, quality, and price of spices (Brown, 2009).

The aim of this study was to evaluate the significance and market values of spice recipes mixtures, and objectives of the study are gives as, i.e., i.) to evaluate the spice plants used for spice recipes; ii.) to demonstrate the marketable value of spice plants; iii.) to evaluate the marketable value of spice recipes; iv.) to find the correlation amongst different markets; v.) to find the correlation amongst different spice recipes; vi.) to find out the commonalities, and differences amongst different markets of district Bannu.

Material and Methods

Study area and topography

Bannu is well known, and an important ancient district of province Khyber Pakhtunkhwa, Pakistan, discovered by S. H. Edward in 1848 (Shah *et al.*, 2020). It has boundaries with Laki Marwat in the southeast, in the southwest with South Waziristan, and North Waziristan and Karak in the northwest and northeast respectively. It is located at 70.22° - 70.57° E latitude, and 32.43° - 33.06° N longitude with an altitude of 371m above the sea level and covers an area of 1,227 km² (Kamran *et al.*, 2020; Ahmad *et al.*, 2020). Several gates (Hinjal, Lakki, Railway, Meryan, Pori, Mandan, Sokari, Paredi, Qasaban, and Hwand gate, etc.) are used for entrance to the main city of Bannu, just because the big wall is surrounded the whole city, it was constructed under the British rule. Although Pashto (Pashto language) is the native language of Bannu people here also can speak and understand Urdu and English. Most of the population is living in rural areas located outside the main city. Because the climate of the area is semi-arid which is very dry and hot in summer, while in winter it remains moderate to cool. In June its highest recorded temperature was 33.6°C, while in January the lowest average temperature was 11.7°C. The area is split by two major rivers i.e., Khurram and Gambila/Tochi which originate from the hills of Waziristan and water is considered a major source of irrigation. The study was carried out on four main markets of the district Bannu which is well known for spices which are discussed below (Figures 1-4).

Local markets of study area

Tanchi Market.

It is well known for the different famous foods of Bannu, with 20-30% of all market stalls selling spices.

Laki Gate Market.

It is well known second-largest market in the district Bannu. The market is well known for herbalists and medicines. The best quality herbalists of district Bannu reside here and about 90% of shops belong to the herbalist.

Masala Mandi Market.

Although it is small it is considered an important spices market. The sellers here have immense experience of spices from all over the district.

Chuk Market.

Chuk Market is considered as one of the largest and ancient markets of district Bannu since time immemorial. It consists of hundred or more shops which are related to different fields such as wedding, ornamental, clothes, educational, foods materials but most of them belongs to spices sellers (60%) and herbalist.

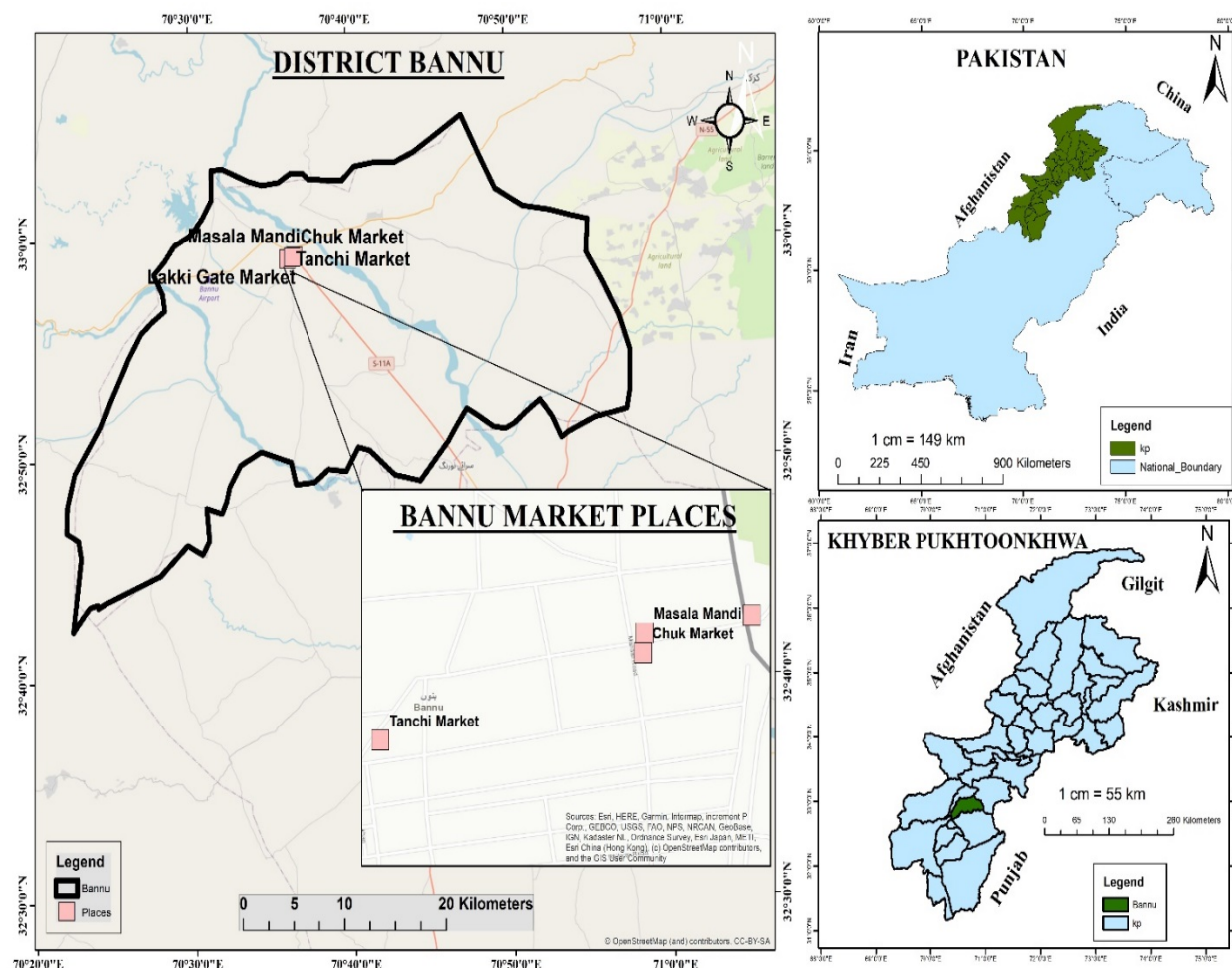


Figure 1. Study area map shows local markets of District Bannu.

Markets survey and data collection

From January 2020 to July 2021, through semi-structured interviews, purposive sampling method, the pattern of price and composition of spice mixtures data were collected. Face-to-face interviews and group discussions were carried out with various individuals like traders, local dealers and collectors of various communities. During data collection, each herbal and spices market was visited several (3-5) times. The collected data included information about the spice recipes, composition of each recipe, market value of each spice plant and each recipe and the communalities and differences existed in the market value of different markets.

Demographic details of respondents

In the present research work, a total of 120 participants from various social backgrounds and occupations participated in the interviews. Amongst the participants, 12.50% (15) were women while 87.50% (105) were men. Due to cultural restriction in an area (barring women from speaking to strangers) the participation of women was limited. The data were collected from various age classes: above 60 years 38.33%, 31.66% from 41-60 years, 22.50% from 21-40 years and 7.50% from less than 20 years. Most of the informants were matriculated (36.66%) followed by illiterate (26.66%) while the postgraduates (4.16%) were recorded few. These included shopkeepers (53.33%), local dealers (33.33%) and large-scale dealer (13.33%). Most of the informants had more than 20 years of experience (53.33%), 24.16% from 16-20 years, 13.33% from 11-15 years and 9.16% had 5-10 years of experience (Table 1).



Figure 2. Four selected markets of District Bannu, (a) Chuk market, (b) Laki Gate market, (c) Tanchi market, (d) Masala Mandi market.



Figure 3. Interviewing about spice mixtures composition. (a) Packed spice mixtures ready to sell at Chuk market, (b) interviewing shopkeeper about the spice mixtures composition at Masala Mandi market, (c) ground form of various spice mixtures at Laki Gate market, (d) Interviewing trader about the spice trade prices.



Figure 4. Grinding of various spices constituents in factory for preparation of various recipes.

Table 1. Demographic statistics of informants of Districts Bannu.

Parameters	Classes	Distribution of frequency in each Market				Participants in each class	Percentage
		Chuk bazar	Tanchi bazar	Masala Mandi bazar	Laki Gate bazar		
Gender ratio	Female	3	3	5	4	15	12.50
	Male	30	22	31	21	105	87.50
Age classes	Above 60	10	14	14	8	46	38.33
	41-60 years	9	10	13	6	38	31.66
	21-40 years	7	4	10	6	27	22.50
	Less than 20 years	2	4	2	1	9	7.50
Educational background	Postgraduate	1	1	2	1	5	4.16
	Graduate	2	4	5	6	17	14.16
	Intermediate	7	6	5	4	22	18.33
	Matriculate	12	10	15	7	44	36.66
	Illiterate	4	2	11	15	32	26.66
Respondents profession	Main dealers (large scale)	4	4	5	3	16	13.33
	Local dealers	10	8	12	10	40	33.33
	Shopkeepers	16	18	17	13	64	53.33
Experience in relevant field	Above 20 years	14	16	11	13	64	53.33
	16-20 years	0	6	11	4	29	24.16
	11-15 years	2	3	2	2	16	13.33
	5-10 years	1	2	2	1	11	9.16

Identification of Plants taxa or species

For identification, the spice plants were collected from different markets, and with the help of available literature and flora of Pakistan, its taxonomy has been identified and photographed at the herbarium of the Department of Botany, University of Peshawar (Pukalchik *et al.*, 2020). Names were verified using the Plant List (<http://www.theplantlist.org> and www.tropicos.org).

Data Analysis**Jaccard Similarity Index (JI)**

The data collected were calculated through Jaccard Index (JI):

$JI = [\text{the number in both sets}] \div [\text{the number in either set}] \times 100$

$$J(Aa, Bb) = \frac{|Aa \cap Bb|}{|Aa \cup Bb|} \times 100$$

Results and Discussion**Marketable values of various spice taxa amongst traditional markets of Bannu**

In this study a total of 26 spice taxa were included in the preparation of 15 different types of spice recipes (Table 2). The prices of each spice species were found different in different markets. The highest price per kg was shown by *Syzygium aromaticum* in Masala Mandi market (PKR 2200, US\$ 14.1), while the lowest price per kg was shown by *Allium cepa* in Chuk market (PKR 75, US\$ 0.4). *Allium cepa* was absent in Tanchi markets while present in other three markets. The Laki gate market showed a higher market value of per kg (85 PKR US\$ 0.5) while the Chuk market showed the lowest market value (PKR 75, US\$ 0.4). *Allium sativum* was present in all markets. The Chuk and Masala mandi market showed a higher market value of per kg (PKR 425, US\$ 2.7) while the Laki gate market showed the lowest market value (PKR 370, US\$ 2.3). *Mangifera indica* was absent in Tanchi and Laki gate markets while present in the other markets. The Masala mandi market showed a higher market value of per kg (PKR 105, US\$ 0.6) while the Chuk market showed the lowest market value (PKR 85, US\$ 0.5). *Trachyspermum ammi* was absent in Chuk market and Laki gate while present in other two markets. The Masala mandi market showed a higher market value of per kg (PKR 195, US\$ 1.3) while the Tanchi market showed the lowest market value (PKR 170, US\$ 1.1). *Coriander sativum* was present in all markets. The Tanchi market showed a higher market value of per kg (PKR 260, US\$ 1.7) while the Masala mandi market showed the lowest market value (PKR 175 US\$ 1.1). *Foeniculum vulgare* was absent in Chuk and Tanchi markets while present in the other two markets. The Laki gate market showed a higher market value of per kg (PKR 235, US\$ 1.5) while the Chuk market showed the lowest market value (PKR 200, US\$ 1.3). *Cuminum cyminum* was present in all markets. The Laki gate market showed a higher market value of per kg (PKR 800, US\$ 5.1) while the Tanchi market showed the lowest market value (PKR 550, US\$ 3.5). *Brassica campestris* was absent in Chuk market while present in the other three markets. The Masala mandi market showed a higher market value of per kg (PKR 215, US\$ 1.4) while the Chuk market showed the lowest market value (PKR 180, US\$ 1.14). *Trigonella foenum-graecum* was present in all markets. The Laki gate market showed a higher market value of per kg (PKR 235, US\$ 1.5) while the Masala mandi market showed the lowest market value (PKR 155, US\$ 1.0). *Mentha piperita* was present in all other markets. The Tanchi market showed a higher market value of per kg (PKR 245, US\$ 1.6) while the Chuk market showed the lowest market value (PKR 185, US\$ 1.2). *Cinnamomum verum* was absent in Chuk market while present in the other three markets. The Laki gate market showed higher market value of per kg (PKR 690, US\$ 4.4) while the Tanchi market showed the lowest market value (PKR 635, US\$ 4.1). *Laurus nobilis* was absent in Masala mandi market while present in the other three markets. The Laki gate market showed a higher market value of per kg (PKR 480, US\$ 3.1) while the Chuk market showed the lowest market value (PKR 450, US\$ 2.9). *Myristica fragrans* was present in all markets. The Masala mandi market showed a higher market value of per kg (PKR 1150, US\$ 7.4) while the Chuk market showed the lowest market value (PKR 1000, US\$ 6.4). *Myristica dactyloides* was absent in Laki gate market while present in the other three markets. The Chuk market showed a higher market value of per kg (PKR 1175, US\$ 7.5) while the Tanchi market showed the lowest market value (PKR 1050, US\$ 6.9). *Syzygium aromaticum* was present in all markets. The Masala mandi market showed a higher market value of per kg (PKR 2200, US\$ 14.1) while the Chuk market showed the lowest market value (PKR 1650, US\$ 10.6). *Piper nigrum* was present in all markets. The Laki gate market showed a higher market value of per kg (PKR 1350, US\$ 8.7) while the Masala mandi market showed the lowest market value (PKR 900, US\$ 5.8). *Nigella sativa* was absent in Chuk market while present in other three markets. The Tanchi market showed a higher market value of per kg (PKR 2150, US\$ 13.8) while the Masala mandi market showed the lowest market value (PKR 1750, US\$ 11.2). *Prunus armeniaca* was absent in Tanchi and Masala mandi markets while present in the other two markets. The Laki gate market showed a higher market value of per kg (PKR 410, US\$ 2.6) while the Chuk market showed the lowest market value (PKR 375, US\$ 2.4). *Prunus domestica* was absent in Chuk and Laki gate markets while present in the other two markets. The Masala mandi market showed a higher market value of per kg (PKR 475, US\$ 3.0) while the Tanchi market showed the lowest market value (PKR 435, US\$ 2.8). *Murraya koenigii* was absent in Laki gate market while present in the other three markets. The Chuk market showed a higher market value of per kg (PKR 1750, US\$ 11.2) while the Masala mandi market showed the lowest market value (PKR 1400, US\$ 9.0). *Capsicum annuum* was absent in Tanchi market while present in the other three markets. The Laki gate market showed a

higher market value of per kg (PKR 875, US\$ 5.6) while the Chuk market showed the lowest market value (PKR 750, US\$ 4.8). *Capsicum frutescens* was present in all markets. The Tanchi market showed a higher market value of per kg (PKR 900, US\$ 5.8) while the Chuk market showed the lowest market value (PKR 550, US\$ 3.5). *Elettaria cardamomum* was absent in Chuk market while present in the other three markets. The Masala mandi market showed a higher market value of per kg (PKR 2100, US\$ 13.5) while the Laki gate market showed the lowest market value (PKR 1700, US\$ 10.9). *Curcuma longa* was present in all markets. The Tanchi market showed a higher market value of per kg (PKR 235, US\$ 1.5) while the Masala mandi market showed the lowest market value (PKR 175, US\$ 1.1). *Amomum subulatum* was absent in Laki gate market while present in the other three markets. The Tanchi market showed a higher market value of per kg (PKR 1800, US\$ 11.5) while the Chuk market showed the lowest market value (PKR 1600, US\$ 10.2). *Zingiber officinale* was present in all markets. The Laki gate market showed a higher market value of per kg (PKR 1250, US\$ 8.0) while the Tanchi market showed the lowest market value (PKR 700, US\$ 4.5).

Composition and price of different spice recipes

Garam Masala ingredient comparison between different markets of Bannu

The results showed different prices for Garam masala (Table 3), and every market had its own individual price calculated per kg. All the markets were then compared with the standard price. The standard price per kg Garam masala was 914 PKR and *Cuminum cyminum* and *Coriandrum sativum* were used in maximum amount ranging from 135 (108.00 PKR, 0.67 US\$) and 225 (58.50 PKR, 0.37 US\$) g/kg (mean) respectively. *Syzygium aromaticum* (110 g/kg), *Myristica fragrans* (110 g/kg) and *Cinnamomum verum* (100 g/kg) were used in a moderate amount in Garam masala with prices of (242.00 PKR, 1.54 US\$), (126.50 PKR, 0.80 US\$) and (69.00 PKR, 0.44 US\$) while *Myristica dactyloides* (15 g/kg) was used in a minimum amount at a price of (17.62 PKR, 0.11 US\$). The price of per kg Garam masala at Chuk market was 715 PKR. The price was low as compared to the standard, one reason of which was that in Chuk market 2 constituents (*Elettaria cardamomum* and *Cinnamomum verum*) out of 10 were not used for the preparation of Garam masala. *Coriandrum sativum* (275 g/kg), *Laurus nobilis* (175 g/kg) and *Cuminum cyminum* (135 g/kg) (Mean) were found in a maximum quantity at low prices (61.87 PKR, 0.39 US\$), (78.75 PKR, 0.50 US\$) and (97.87 PKR, 0.62 US\$) respectively. *Myristica fragrans* (130 g/kg), *Syzygium aromaticum* (130 g/kg) and *Piper nigrum* (90 g/kg) were used in a moderate amount (130.00 PKR, 0.82 US\$), (214.50 PKR, 1.37 US\$) and (87.75 PKR, 0.56 US\$) respectively, while *Myristica dactyloides* (15 g/kg) was used in a minimum amount at a price of (17.62 PKR, 0.11 US\$). The price of per kg Garam masala at Tanchi market was 819 PKR. Tanchi market had a high Market price as compared to the Chuk market but when we compare it with a standard then it was low. In Tanchi Bazar the three plants were used in a maximum concentration i.e. *Coriandrum sativum* (225 g/kg), *Cuminum cyminum* (135 g/kg) and *Laurus nobilis* (125 g/kg) at a price of (58.50 PKR, 0.37 US\$), (74.25 PKR, 0.47 US\$) and (59.37 PKR, 0.38 US\$) respectively. *Syzygium aromaticum* (110 g/kg), *Myristica fragrans* (110 g/kg) and *Cinnamomum verum* (100 g/kg) were used in moderate concentration at prices of (209.00 PKR, 1.33 US\$), (112.20 PKR, 0.71 US\$) and (63.50 PKR, 0.43 US\$) respectively while *Myristica dactyloides* (15 g/kg) was used in a minimum amount at a price of (16.12 PKR, 0.10 US\$). Masala Mandi bazar had a high market value as compared to Chuk market, while lower than Tanchi market, Laki gate market and standard. Here out of 10 spice plants only one plant was not used in preparation of Garam masala i.e., *Laurus nobilis*. In Masala Mandi market the two plants used in a maximum concentration were *Coriandrum sativum* (350 g/kg) and *Cuminum cyminum* (135 g/kg) at a price of (61.25 PKR, 0.39 US\$) and (95.85 PKR, 0.61 US\$) respectively. *Syzygium aromaticum* (110 g/kg), *Myristica fragrans* (110 g/kg) and *Cinnamomum verum* (100 g/kg) were found in a moderate amount at a price of (242.00 PKR, 1.54 US\$), (126.50 PKR, 0.81 US\$) and (67.50 PKR, 0.42 US\$) respectively. While *Myristica dactyloides* (15 g/kg) was found in minimum amount at a price of (16.50 PKR, 0.11 US\$) respectively. Laki Gate market had a high market value as compared to Chuk market, Tanchi and Masala Mandi market while lower than the standard price. Here out of 10 spice plants only one plant was not used in preparation of Garam masala i.e., *Myristica dactyloides*. In Laki Gate market the three plants were used in a maximum concentration i.e., here also the *Coriandrum sativum* (240 g/kg), *Cuminum cyminum* (135 g/kg) and *Laurus nobilis* (130 v) were found in a maximum quantity at a price of (57.60 PKR, 0.37 US\$), (108.00 PKR, 0.69 US\$) and (60.00 PKR, 0.38 US\$) respectively. *Syzygium aromaticum* (110 g/kg), *Myristica fragrans* (110 g/kg) and *Cinnamomum verum* (100 g/kg) were included in a moderate amount at a price of (231.00 PKR, 1.47 US\$), (121.00 PKR, 0.77 US\$) and (69.00 PKR, 0.44 US\$) respectively, While *Elettaria cardamomum* (40 g/kg) was found in minimum amount at a price of (68.00 PKR, 0.43 US\$).

Table 2. Prices comparison spice taxa amongst four markets of Bannu.

Plant Name	Markets of Bannu											
	Chuk Bazar			Tanchi Bazar			Masala mandi Bazar			Laki Gate Bazar		
	Prices range in PKR	Mean prices PKR	Mean prices in US\$	Prices range in PKR	Mean prices PKR	Mean prices in US\$	Prices range in PKR	Mean prices PKR	Mean prices in US\$	Prices range in PKR	Mean prices PKR	Mean prices in US\$
<i>Allium cepa</i> L. (Amaryllidaceae)	70-80	75	0.4	-	-	-	70-90	80	0.5	70-100	85	0.5
<i>Allium sativum</i> L. (Amaryllidaceae)	400-450	425	2.7	380-430	405	2.5	400-450	425	2.7	350-390	370	2.3
<i>Amomum subulatum</i> Roxb. (Zingiberaceae)	1500-1700	1600	10.2	1700-1900	1800	11.5	1500-2000	1750	11.2	-	-	-
<i>Brassica compestris</i> L. (Brassicaceae)	160-200	180	1.2	-	-	-	200-230	215	1.4	190-200	195	1.3
<i>Capsicum annum</i> L. (Solanaceae)	650-850	750	4.8	-	-	-	700-900	800	5.1	750-1000	875	5.6
<i>Capsicum frutescens</i> L. (Solanaceae)	500-600	550	3.5	800-1000	900	5.8	650-850	750	4.8	800-900	850	5.4
<i>Cinnamomum verum</i> J. Presl. (Zingiberaceae)	-	-	-	620-650	635	4.1	650-700	675	4.3	630-750	690	4.4
<i>Coriandrum sativum</i> L. (Apiaceae)	200-250	225	1.4	250-270	260	1.7	150-200	175	1.1	230-250	240	1.5
<i>Cuminum cyminum</i> L. (Amaryllidaceae)	600-850	725	4.6	500-600	550	3.5	650-770	710	4.6	780-820	800	5.1
<i>Curcuma longa</i> L. (Zingiberaceae)	200-250	225	1.4	220-250	235	1.5	150-200	175	1.1	250-300	275	1.8
<i>Elettaria cardamomum</i> (L.) Maton. (Zingiberaceae)	-	-	-	1900-2000	1950	12.5	2000-2200	2100	13.5	1600-1800	1700	10.9
<i>Foeniculum vulgare</i> Mill. (Apiaceae)	-	-	-	-	-	-	180-220	200	1.3	220-250	235	1.5
<i>Laurus nobilis</i> L. (Lauraceae)	400-500	450	2.9	450-500	475	3.0	-	-	-	470-490	480	3.1
<i>Mangifera indica</i> L. (Lamiaceae)	75-95	85	0.5	-	-	-	90-120	105	0.6	-	-	-
<i>Mentha piperita</i> L. (Lamiaceae)	170-200	185	1.2	200-250	225	1.4	230-260	245	1.6	200-220	210	1.3
<i>Murraya koenigii</i> (L.) Spreng (Rutaceae)	1500-2000	1750	11.2	1400-1600	1500	9.6	1300-1500	1400	9.0	-	-	-
<i>Myristica dactyloides</i> (Myristicaceae)	1100-1250	1175	7.5	1050-1100	1075	6.9	1000-1200	1100	7.1	-	-	-
<i>Myristica fragrans</i> Houtt. (Myristicaceae)	950-1050	1000	6.4	920-1120	1020	6.5	1100-1200	1150	7.4	1050-1150	1100	7.1
<i>Nigella sativa</i> L. (Ranunculaceae)	-	-	-	2000-2300	2150	13.8	1500-2000	1750	11.2	1900-2000	1950	12.5
<i>Piper nigrum</i> L. (Piperaceae)	900-1050	975	6.3	1100-1200	1150	7.4	800-1000	900	5.8	1200-1500	1350	8.7

<i>Prunus armeniaca</i> L. (Rosaceae)	350-400	375	2.4	-	-	-	-	-	-	400-420	410	2.6
<i>Prunus domestica</i> L. (Rosaceae)	-	-	-	420-450	435	2.8	450-500	475	3.0	-	-	-
<i>Syzygium aromaticum</i> (L.) Merr. and L.M. Perry (Myrtaceae)	1400-1900	1650	10.6	1800-2000	1900	12.2	2000-2400	2200	14.1	2000-2200	2100	13.5
<i>Trachyspermum ammi</i> (L.) Sprague (Apiaceae)	-	-	-	150-190	170	1.1	170-220	195	1.3	-	-	-
<i>Trigonella foenum-graecum</i> L. (Fabaceae)	200-220	210	1.3	180-200	190	1.2	150-160	155	1.0	220-250	235	1.5
<i>Zingiber officinale</i> Roscoe (Zingiberaceae)	700-1000	850	5.4	600-800	700	4.5	1000-1100	1050	6.7	1000-1500	1250	8.0

Table 3. Garam Masala ingredient comparison between different markets of Bannu.

Plant Name	Markets of Bannu																			
	Standard				Chuk Bazar				Tanchi Bazar				Masala mandi Bazar				Laki Gate Bazar			
	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$
<i>Capsicum frutescens</i>	40-60	50	31.2	0.20	40-60	50	27.5	0.17	40-60	50	45.0	0.28	40-60	50	37.5	0.24	40-60	50	42.5	0.27
<i>Cinnamomum verum</i>	90-110	100	69.0	0.44	-	-	-	-	90-110	100	63.5	0.40	90-110	100	67.5	0.42	90-110	100	69.0	0.44
<i>Coriandrum sativum</i>	200-250	225	58.5	0.37	250-300	275	61.8	0.39	200-250	225	58.5	0.37	300-400	350	61.2	0.39	220-260	240	57.6	0.37
<i>Cuminum cyminum</i>	120-150	135	108	0.67	120-150	135	97.8	0.62	120-150	135	74.2	0.47	120-150	135	95.8	0.61	120-150	135	108.	0.69
<i>Elettaria cardamomum</i>	30-50	40	84.0	0.53	-	-	-	-	30-50	40	78.0	0.50	30-50	40	84.0	0.54	30-50	40	68	0.43
<i>Laurus nobilis</i>	100-150	125	56.2	0.36	150-200	175	78.7	0.50	100-150	125	59.3	0.38	-	-	-	-	100-150	125	60.0	0.38
<i>Myristica dactyloides</i>	10-20	15	17.6	0.11	10-20	15	17.6	0.11	10-20	15	16.1	0.10	10-20	15	16.5	0.11	-	-	-	-
<i>Myristica fragrans</i>	100-120	110	126.5	0.80	100-160	130	130	0.82	100-120	110	112.2	0.71	100-120	110	126.5	0.81	100-120	110	121	0.77
<i>Piper nigrum</i>	80-100	90	121.5	0.77	80-100	90	87.7	0.56	80-100	90	103.5	0.66	80-100	90	81.0	0.52	80-100	90	121	0.77
<i>Syzygium aromaticum</i>	100-120	110	242	1.54	100-160	130	214.5	1.37	100-120	110	209.0	1.33	100-120	110	242.0	1.54	100-120	110	231	1.47
Total	1000 g	1 kg	914	5.79	1000 g	1 kg	715	4.54	1000 g	1 kg	819	5.20	1000 g	1 kg	812	5.18	1000 g	1 kg	878	5.59

Biryani Masala ingredient comparison between different markets of Bannu

The standard price of per kg Biryani masala (Table 4) was 1049 PKR where *Laurus nobilis* and *Coriandrum sativum* were used in maximum amount of 120 g/kg (57.60 PKR, 0.37 US\$) and 140 g/kg (36.40 PKR, 0.23 US\$) (mean) respectively. *Syzygium aromaticum* (90 g/kg), *Nigella sativa* (75 g/kg) and *Elettaria cardamomum* (55 g/kg) were used in a moderate amount whose price were (198.00 PKR, 1.26 US\$), (161.25 PKR, 1.03 US\$) and (115.50 PKR, 0.73 US\$) while *Myristica dactyloides* (40 g/kg) was used in a minimum amount at a price of (47.00 PKR, 0.30 US\$). The price of one kg biryani masala at Chuk market was 679 PKR. The price was low as compared to the price in other markets, especially because in Chuk market only 3 spice plants out of 14 were included in biryani masala. These three plants were *Nigella sativa*, *Foeniculum vulgare* and *Cinnamomum verum*. Here also *Coriandrum sativum* (225 g/kg), *Laurus nobilis* (120 g/kg) and *Capsicum frutescens* (100 g/kg) (Mean) were found in a maximum quantity at a price of (55.62 PKR, 0.35 US\$), (54.00 PKR, 0.34 US\$) and (55.00 PKR, 0.35 US\$) respectively. *Cuminum cyminum* (90 g/kg), *Syzygium-aromaticum* (90 g/kg) and *Piper nigrum* (80 g/kg) were used in a moderate amount at a price of (62.25 PKR, 0.40 US\$), (148.50 PKR, 0.95 US\$) and (78.00 PKR, 0.50 US\$) respectively. *Amomum subulatum* (60 g/kg) was used in a small amount at a price of (96.00 PKR, 0.61 US\$). The price of per kg biryani masala at Tanchi market was 971 PKR. Tanchi market have a high Market value as compared to the Chuk market but when we compare it with a standard then it was low. Here out of 14 spice plants only *Foeniculum vulgare* was not used in preparation of biryani masala. In Tanchi Bazar the three plants were used in a maximum concentration i.e. *Coriandrum sativum* (140 g/kg), *Laurus nobilis* (120 g/kg) and *Curcuma longa* (110 g/kg) at a price of (36.40 PKR, 0.23 US\$), (57.00 PKR, 0.36 US\$) and (25.85 PKR, 0.16 US\$) respectively, while *Syzygium-aromaticum* (90 g/kg), *Piper nigrum* (80 g/kg) and *Nigella sativa* (75 g/kg) were used in moderate concentration at a price of (171.00 PKR, 1.08 US\$), (92.00 PKR, 0.59 US\$) and (161.25 PKR, 1.02 US\$) respectively while *Myristica fragrans* was used in a minimum amount at a price of (25.50 PKR 0.16US\$). Masala Mandi bazar had a high market value as compared to Chuk market and Laki Gate market while lower than Tanchi market and standard. Here out of 14 spice plants only one plant was not used in preparation of biryani masala i.e., *Laurus nobilis*. In Masala Mandi market the three plants were used in a maximum concentration i.e., *Coriandrum sativum* (200 g/kg), *Cuminum cyminum* and *Syzygium aromaticum* (90 g/kg) at a price of (35.00 PKR, 0.32 US\$), (63.90 PKR, 0.41US\$) and (198.00 PKR, 1.26 US\$) respectively. *Piper nigrum* (80 g/kg), *Nigella sativa* (75 g/kg) and *Foeniculum vulgare* (65 g/kg) were found in a moderate amount at a price of (72.00 PKR 0.46US\$), (131.25 PKR 0.86US\$) and (13.00 PKR 0.08US\$) respectively, while the *Myristica fragrans* and *Curcuma longa* (45 g/kg) were found in minimum amount whose price were (51.75 PKR, 0.33 US\$) and (7.87 PKR, 0.05 US\$) respectively. Laki Gate market had a high market value as compared to Chuk market while lower than Tanchi, Masala Mandi market and standard. Here out of 14 spice plants only two plants were not used in preparation of biryani masala i.e., *Myristica dactyloides* and *Amomum subulatum*. In Laki Gate Bazar the three plants were used in a maximum concentration i.e. Here also the *Coriandrum sativum* (200 g/kg), *Laurus nobilis* (120 g/kg) and *Syzygium aromaticum* (130 g/kg) were found in a maximum quantity at a price of (48.00 PKR, 0.31 US\$), (57.60 PKR, 0.37 US\$) and (273.00 PKR, 1.74 US\$) respectively. *Piper nigrum* (80 g/kg), *Nigella sativa* (75 g/kg) and *Foeniculum vulgare* (65 g/kg) were found in a moderate amount at a price of (108.00 PKR, 0.67 US\$), (146.50 PKR, 0.93 US\$) and (15.27 PKR, 0.10 US\$) respectively, while the *Myristica fragrans* (25 g/kg) was found in minimum amount at a price of (27.50 PKR, 0.18 US\$).

Karahi Masala ingredient comparison between different markets of Bannu

The standard price of per kg Karahi masala is 773 PKR (4.91 US\$) (Table 5), where *Coriandrum sativum* and *Cuminum cyminum* were used in maximum amount 390 g/kg (101.40 PKR, 0.65 US\$) and 150 g/kg (120.00 PKR, 0.76 US\$) (mean). *Capsicum frutescens* (75 g/kg), *Laurus nobilis* (70 g/kg) and *Piper nigrum* (70 g/kg) were used in a moderate amount whose price were (63.75 PKR, 0.41 US\$), (33.60 PKR, 0.21 US\$) and (94.50 PKR, 0.60 US\$) while *Elettaria cardamomum* (40 g/kg) was used in a minimum amount at a price of (84.00PKR, 0.53 US\$). The price of per kg Karahi masala at Chuk market was 540 (3.44 US\$). The price was low as compared to the standard by many reasons the one was that here in Chuk market the 2 constituents (spice plants) out of 9 were not used for the preparation of Karahi masala. These two plants were *Elettaria cardamomum* and *Cinnamomum verum*. Here also the *Coriandrum sativum* (390 g/kg), *Cuminum cyminum* (150 g/kg) (Mean) were found in a maximum quantity at a price of (87.75 PKR, 0.56 US\$) and (108.75 PKR, 0.69 US\$) respectively. *Capsicum frutescens* (100 g/kg), *Syzygium aromaticum* (95 g/kg) and *Laurus nobilis* (90 g/kg) were used in a moderate amount at a price of (55.00 PKR, 0.35 US\$), (156.75 PKR, 1.00 US\$) and (40.00 PKR, 0.26 US\$) respectively while *Piper nigrum* (70 g/kg) was used in a minimum amount at a price of (68.25 PKR, 0.43 US\$). The price of per kg Karahi masala at Tanchi market was 669 (4.27 US\$). Tanchi market had a high Market value as compared to the Chuk market but when we compare it with a standard then it was low. In Tanchi market the two plants were used in a maximum concentration i.e., *Coriandrum sativum* (390 g/kg) and *Cuminum cyminum* (150 g/kg) at a price of (101.40 PKR, 0.65 US\$) and (82.50 PKR, 0.53 US\$) respectively. *Capsicum frutescens* (75 g/kg), *Laurus nobilis* (70 g/kg) and *Piper nigrum* (70 g/kg) were used in moderate concentration at a

price of (67.50 PKR, 0.43 US\$), (33.25 PKR, 0.21 US\$) and (80.50 PKR, 0.51 US\$) respectively while *Elettaria cardamomum* (40 g/kg) was used in a minimum amount at a price of (78.00 PKR, 0.50 US\$). Masala Mandi market had a high market value as compared to Chuk market and Tanchi market while lower than Laki gate and standard. Here out of 9 spice plants only one plant was not used in preparation of Karahi masala i.e., *Laurus nobilis*. In Masala Mandi market the two plants were used in a maximum concentration i.e., *Coriandrum sativum* (390 g/kg) and *Cuminum cyminum* (150 g/kg) at a price of (68.25 PKR, 0.43 US\$) and (106.50 PKR, 0.68 US\$) respectively. *Capsicum frutescens* (75 g/kg) and *Piper nigrum* (70 g/kg) were found in a moderate amount at a price of (56.25 PKR, 0.36 US\$), (63.00 PKR, 0.40 US\$) respectively, while the *Elettaria cardamomum* (40 g/kg) was found in minimum amount at a price of (84.00 PKR, 0.54 US\$). Laki Gate market had a high market value as compared to Chuk market, Tanchi, Masala and Mandi market while lower than standard. In Laki Gate Bazar the two plants were used in a maximum concentration i.e. Here also the *Coriandrum sativum* (390 g/kg) and *Cuminum cyminum* (150 g/kg) were found in a maximum quantity at a price of (78.00 PKR, 0.50 US\$) and (120.00 PKR, 0.76 US\$) respectively. *Capsicum frutescens* (75 g/kg) *Laurus nobilis* (70 g/kg) and *Piper nigrum* (70 g/kg) were found in a moderate amount at a price of (63.75 PKR, 0.41 US\$), (33.60 PKR, 0.21 US\$) and (94.60 PKR, 0.60 US\$) respectively, while the *Elettaria cardamomum* (40 g/kg) was found in minimum amount at a price of (68.00 PKR, 0.43 US\$).

Salan Masala ingredient comparison between different markets of Bannu

The standard price of per kg Salan masala was (1152 PKR, 7.32 US\$) (Table 6). Where *Coriandrum sativum*, *Elettaria cardamomum* and *Capsicum frutescens* were used in maximum amount 275 g/kg (71.50 PKR, 0.45 US\$) 175 g/kg (376.50 PKR, 2.40 US\$) and (148.75 PKR, 0.94 US\$) each (mean) respectively. *Cuminum cyminum* (75 g/kg) and *Zingiber officinale* (70 g/kg) were used in a moderate amount whose price were (60.00 PKR, 0.38 US\$) and (87.50 PKR, 0.56 US\$) while *Cinnamomum verum* (65 g/kg) was used in a minimum amount at a price of (44.85 PKR, 0.28 US\$). The price of per kg Salan masala at Chuk market was 698. The price was low as compared to the standard by many reasons the one was that here in Chuk market the 2 constituents (spice plants) out of 7 were not used for the preparation of Salan masala. These two plants were *Elettaria cardamomum* and *Cinnamomum verum*. Here also *Coriandrum sativum* (325 g/kg) and *Cuminum cyminum* (225 g/kg) (Mean) were found in a maximum quantity at a price of (73.12 PKR, 0.47 US\$) and (163.12 PKR, 1.03 US\$) respectively. *Capsicum frutescens* (175 g/kg) was used in a moderate amount whose prices was (96.25 PKR, 0.61 US\$), while *Zingiber officinale* (110 g/kg) was used in a minimum amount at a price of (92.50 PKR, 0.60 US\$). Tanchi market had a high Market value as compared to the Chuk market but when we compare it with a standard then it was low. In Tanchi market the one plant was used in a maximum concentration i.e., *Coriandrum sativum* (275 g/kg) at a price of (71.50 PKR, 0.46 US\$), *Syzygium aromaticum* (165 g/kg) was used in moderate concentration whose prices was (313.50 PKR, 2.00 US\$), while *Cinnamomum verum* (65 g/kg) was used in a minimum amount at a price of (41.28 PKR, 0.26 US\$). Masala Mandi market had a high market value as compared to Chuk market, Tanchi and Laki Gate market while lower than standard. In Masala Mandi market the one plant was used in a maximum concentration i.e., *Coriandrum sativum* (275 g/kg), whose prices was (48.12 PKR, 0.31 US\$). *Syzygium aromaticum* (165 g/kg) was found in a moderate amount whose prices was (363.00 PKR, 2.31 US\$). While *Cinnamomum verum* (65 g/kg) was found in minimum amount at a price of (43.87 PKR, 0.28 US\$). Laki Gate market had a high market value as compared to Chuk market and Tanchi market while lower than Masala Mandi market and standard. In Laki Gate market the one plant was used in a maximum concentration i.e., here also *Coriandrum sativum* (275 g/kg), was found in a maximum quantity whose prices was (66.00 PKR, 0.42 US\$). *Syzygium aromaticum* (165 g/kg) was found in a moderate amount whose prices was (346.50 PKR, 2.20 US\$), while the *Cinnamomum verum* (65 g/kg) was found in minimum amount.

Rosh Masala ingredient comparison between different markets of Bannu

The standard price per kg Rosh masala was 423 PKR (2.70 US\$) where *Allium sativum* and *Allium cepa* were used in maximum amount 275 g/kg (116.88 PKR, 0.74 US\$) and 235 g/kg (19.98 PKR, 0.13 US\$) (mean) respectively (Table 7). *Curcuma longa* (175 g/kg) was used in a moderate amount at a price of (48.12 PKR, 0.31 US\$), while *Capsicum frutescens* (105 g/kg) was used in a minimum amount at a price of (89.25 PKR, 0.57 US\$). The price of per kg Rosh masala at Chuk market was 383 (2.07 US\$). It had low value as compared to all other markets. These two plants were *Allium sativum* and *Allium cepa* are used in maximum amount 275 g/kg (116.87 PKR, 0.74 US\$) and 235 g/kg (17.62 PKR, 0.11 US\$) (mean) respectively. *Curcuma longa* (175 g/kg) was used in a moderate amount at a price of (39.37 PKR, 0.25 US\$), while *Capsicum frutescens* (105 g/kg) was used in a minimum amount at a price of (57.75 PKR, 0.37 US\$). The price of per kg Rosh masala at Tanchi market was 407 (2.60 US\$). It had low value as compared to Laki gate bazar and standard. Out of 5 plants only one plant was absent in preparation. *Curcuma longa* and *Allium sativum* were used in maximum amount 360 g/kg (84.60 PKR, 0.54 US\$) and 325 g/kg (131.62 PKR, 0.88 US\$) (mean) respectively. *Cuminum cyminum* (210 g/kg) was used in a moderate amount at a price of (115.50 PKR, 0.74 US\$), while *Capsicum frutescens* (105 g/kg) was used in a minimum amount at a price of (76.12 PKR, 0.48 US\$). The

price of per kg Rosh masala at Masala mandi market was 393 (2.50 US\$). It has high value as compared to Chuk market while lower than Tanchi and Laki gate market. *Allium sativum* and *Allium cepa* were used in maximum amount 275 g/kg (116.87 PKR, 0.74 US\$) and 235 g/kg (18.80 PKR, 0.12 US\$) (mean) respectively. *Curcuma longa* (175 g/kg) was used in a moderate amount at a price of (29.75 PKR, 0.19 US\$), while *Capsicum frutescens* (105 g/kg) was used in a minimum amount at a price of (78.75 PKR, 0.50 US\$). The price of per kg Rosh masala at Laki gate market was 416 (2.64 US\$). It had high value as compared to Chuk market, Tanchi bazar and Laki gate market, while lower than standard. *Allium sativum* and *Allium cepa* were used in maximum amount 275 g/kg (101.75 PKR, 0.65 US\$) and 235 g/kg (19.97 PKR, 0.13 US\$) (mean) respectively. *Curcuma longa* (175 g/kg) was used in a moderate amount at a price of (53.62 PKR, 0.34 US\$) while *Capsicum frutescens* (105 g/kg) was used in a minimum amount at a price of (89.25 PKR, 0.57 US\$) (Table 7).

Qeema Masala ingredient comparison between different markets of Bannu

The standard price per kg Qeema masala was 651 PKR (4.14 US\$) where *Coriandrum sativum* and *Mentha piperita* were used in maximum amount 225 g/kg (58.50 PKR, 0.37 US\$) and 190 g/kg (47.28 PKR, 0.30 US\$) (mean) respectively (Table 8). *Allium sativum* (70 g/kg), *Zingiber officinale* and *Syzygium aromaticum* (65 g/kg) were used in a moderate amount whose price were (29.75 PKR, 0.19 US\$), (81.25 PKR, 0.52 US\$) and (143.00 PKR, 0.91 US\$) respectively while *Laurus nobilis* (45 g/kg) was used in a minimum amount at a price of (21.60 PKR, 0.14 US\$). The price of per kg Qeema masala at Chuk market was 480 (3.05 US\$). The price was low as compared to the standard by many reasons the one is that here in Chuk market the 1 constituent (spice plant) out of 11 was not used for the preparation of Qeema masala. That one plant was *Cinnamomum verum*. *Coriandrum sativum* (275 g/kg) and *Mentha piperita* (190 g/kg) (Mean) were found in a maximum quantity at a price of (61.88 PKR, 0.39 US\$) and (35.15 PKR, 0.22 US\$) respectively. *Allium sativum* (70 g/kg), *Zingiber officinale* and *Syzygium aromaticum* (65 g/kg) were used in a moderate amount whose price were (29.75 PKR, 0.19 US\$), (55.25 PKR, 0.35 US\$) and (107.25 PKR, 0.68 US\$) respectively while *Laurus nobilis* (45 g/kg) was used in a minimum amount at a price of (20.25 PKR, 0.13 US\$). The price of per kg Qeema masala at Tanchi market was 493 (3.14 US\$). The price was low as compared to the standard by many reasons the one was that here in Tanchi market the 1 constituent (spice plant) out of 11 was not used for the preparation of Qeema masala. That one plant was *Capsicum annum*. *Coriandrum sativum* (260 g/kg) and *Mentha piperita* (190 g/kg) (Mean) were found in a maximum quantity at a price of (67.60 PKR, 0.43 US\$) and (42.75 PKR, 0.27 US\$) respectively. *Allium sativum* (95 g/kg), *Capsicum frutescens* and *Cinnamomum verum* (75 g/kg) each were used in a moderate amount whose price were (38.48 PKR, 0.25 US\$), (67.50 PKR, 0.43 US\$) and (47.63 PKR, 0.30 US\$) respectively while *Syzygium aromaticum* (40 g/kg) was used in a minimum amount at a price of (76.00 PKR, 0.48 US\$). The price of per kg Qeema masala mandi market was 552 (3.52 US\$). The price is low as compared to the standard by many reasons the one is that here in Masala mandi market the 1 constituent (spice plant) out of 11 was not used for the preparation of Qeema masala. That one plant was *Laurus nobilis*. *Coriandrum sativum* (270 g/kg) and *Mentha piperita* (190 g/kg) (Mean) were found in a maximum quantity at a price of (45.50 PKR, 0.29 US\$) and (46.55 PKR, 0.30 US\$) respectively. *Allium sativum* (70 g/kg), *Zingiber officinale* and *Syzygium aromaticum* (65 g/kg) were used in a moderate amount whose price were (29.75 PKR, 0.19 US\$), (68.25 PKR, 0.43 US\$) and (143.00 PKR, 0.91 US\$) respectively while *Cinnamomum verum* (50 g/kg) was used in a minimum amount at a price of (33.75 PKR, 0.21 US\$). The price of per kg Qeema masala Laki gate market was 626 (3.97 US\$). Here also the *Coriandrum sativum* (225 g/kg) and *Mentha piperita* (190 g/kg) (Mean) were found in a maximum quantity at a price of (54.00 PKR, 0.34 US\$) and (39.90 PKR, 0.25 US\$) respectively. *Allium sativum* (70 g/kg), *Zingiber officinale* and *Syzygium aromaticum* (65 g/kg) were used in a moderate amount whose price were (25.90 PKR, 0.16 US\$), (81.25 PKR, 0.52 US\$) and (136.50 PKR, 0.87 US\$) respectively while *Laurus nobilis* (45 g/kg) was used in a minimum amount at a price of (21.60 PKR, 0.14 US\$).

Kabuli Pulao Masala ingredient comparison between different markets of Bannu

The standard price per kg Kabuli Pulao masala was 1380 PKR (8.78 US\$) where *Cuminum cyminum* and *Elettaria cardamomum* were used in maximum amount 325 g/kg (260.00 PKR, 1.66 US\$) and 175 g/kg (367.50 PKR, 02.34 US\$) (mean) respectively (Table 9). *Syzygium aromaticum* (130 g/kg) and *Cinnamomum verum* (125 g/kg) were used in a moderate amount at a price of (286.00 PKR, 1.82 US\$) and (86.25 PKR, 0.55 US\$) respectively while *Amomum subulatum* (110 g/kg) was used in a minimum amount at a price of (198.00 PKR, 1.26 US\$). The price of per kg Kabuli Pulao masala at Chuk market was 1192 (7.59 US\$). The price was low as compared to the standard by many reasons the one was that here in Chuk market the 2 constituents (spice plants) out of 6 were not used for the preparation of Kabuli Pulao masala. These two plants were *Elettaria cardamomum* and *Cinnamomum verum*. *Cuminum cyminum* (400 g/kg) (Mean) was found in a maximum quantity whose prices was (290.00 PKR, 1.85 US\$). *Piper nigrum* and *Amomum subulatum* (235 g/kg) were used in a moderate amount at a price of (229.12 PKR, 1.46 US\$) and (376.00 PKR, 2.39 US\$) respectively, while *Syzygium aromaticum* (180 g/kg) was used in a minimum

amount at a price of (297.00 PKR, 1.89 US\$). The price of per kg Kabuli Pulao masala at Tanchi market was 1199 (7.64 US\$). The price was low as compared to the standard by many reasons. Here also the *Cuminum cyminum* and *Elettaria cardamomum* were used in maximum amount 325 g/kg (178.75 PKR, 1.14 US\$) and 175 g/kg (341.25 PKR, 2.17 US\$) (mean) respectively. *Syzygium aromaticum* (130 g/kg) and *Cinnamomum verum* (125 g/kg) were used in a moderate amount whose price were (247.00 PKR, 1.57 US\$) and (79.38 PKR, 0.51 US\$) respectively, while *Amomum subulatum* (110 g/kg) was used in a minimum amount at a price of (198.00 PKR, 1.26 US\$). The price of per kg Kabuli Pulao masala at Masala mandi market was 1231 (7.85 US\$). The price was low as compared to the standard and Laki gate market while higher than Tanchi and Chuk market. Here also the *Cuminum cyminum* and *Elettaria cardamomum* were used in maximum amount 325 g/kg (230.75 PKR, 1.47 US\$) and 175 g/kg (367.50 PKR, 2.34 US\$) (mean) respectively. *Syzygium aromaticum* (130 g/kg) and *Cinnamomum verum* (125 g/kg) were used in a moderate amount whose price were (286.00 PKR, 1.82 US\$) and (34.38 PKR, 0.22 US\$) respectively, while *Amomum subulatum* (110 g/kg) was used in a minimum amount at a price of (192.50 PKR, 1.23 US\$). The price of per kg Kabuli Pulao masala at Laki gate market was 1276 (8.15 US\$). The price was low as compared to the standard while higher than Masala mandi, Tanchi and Chuk market. Here in Laki gate market the 1 constituent (spice plant) out of 6 was not used for the preparation of Kabuli Pulao masala, i.e., *Amomum subulatum*. Here also the *Cuminum cyminum* and *Elettaria cardamomum* were used in maximum amount 325 g/kg (260.00 PKR, 1.66 US\$) and 200 g/kg (340.00 PKR, 2.17 US\$) (mean) respectively. *Cinnamomum verum* (150 g/kg) was used in a moderate amount at a price of (103.50 PKR 0.66US\$), while *Piper nigrum* (145 g/kg) was used in a minimum amount at a price of (195.75 PKR, 1.25 US\$).

Machli Masala ingredient comparison between different markets of Bannu

The standard price per kg Machli masala was 674 PKR (4.26 US\$), where *Coriandrum sativum* and *Cuminum cyminum* were used in maximum amount 225 g/kg (58.50 PKR, 0.37 US\$) and 175 g/kg (140.00 PKR, 0.89 US\$) (mean) respectively (Table 10). *Syzygium aromaticum* (70 g/kg), *Curcuma longa* and *Trigonella foenum-graecum* (65 g/kg) each were used in a moderate amount whose price were (154.00 PKR, 0.98 US\$), (17.87 PKR, 0.11 US\$) and (15.27 PKR, 0.09 US\$) while *Capsicum annum* (45 g/kg) was used in a minimum amount at a price of (38.25 PKR, 0.24 US\$). The price of per kg Machli masala at Chuk market was 540 (3.45 US\$). The price was low as compared to the standard by many reasons the one was that here in Chuk market only one constituent (spice plant) out of 11 was not used for the preparation of Machli masala. That one plants was *Cinnamomum verum*. Here also the *Coriandrum sativum* and *Cuminum cyminum* were used in maximum amount 225 g/kg (50.63 PKR, 0.32 US\$) and 175 g/kg (126.88 PKR, 0.81 US\$) (mean) respectively. *Syzygium aromaticum* (70 g/kg), *Curcuma longa* and *Trigonella foenum-graecum* (65 g/kg) were used in a moderate amount whose price were (115.50 PKR, 0.74 US\$), (14.63 PKR, 0.09 US\$) and (13.65 PKR, 0.09 US\$) respectively, while *Allium cepa* (55 g/kg) was used in a minimum amount at a price of (4.13 PKR, 0.03 US\$). The price of per kg Machli masala at Tanchi market was 583 (3.71 US\$). The price was low as compared to the standard, Masala mandi and Laki gate markets by many reasons the one is that here in Chuk market only two constituents (spice plants) out of 11 was not used for the preparation of Machli masala. These two plants were *Allium cepa* and *Capsicum annum*. Here also the *Coriandrum sativum* and *Cuminum cyminum* were used in maximum amount 225 g/kg (58.50 PKR, 0.37 US\$) and 175 g/kg (96.25 PKR, 0.61 US\$) (mean) respectively. *Cinnamomum verum* (85 g/kg) and *Zingiber officinale* (75 g/kg) were used in a moderate amount whose price were (53.98 PKR, 0.34 US\$) and (52.50 PKR, 0.33 US\$), respectively while *Curcuma longa* and *Trigonella foenum-graecum* (65 g/kg) were used in a minimum amount whose price were (15.28 PKR, 0.10 US\$) and (12.35 PKR, 0.08 US\$). The price of per kg Machli masala at Masala mandi market was 601 (3.82 US\$). The price was low as compared to the standard and Laki gate markets by many reasons. Here also the *Coriandrum sativum* and *Cuminum cyminum* were used in maximum amount 225 g/kg (39.38 PKR, 0.25 US\$) and 175 g/kg (124.25 PKR, 0.79 US\$) (mean) respectively. *Syzygium aromaticum* (70 g/kg), *Curcuma longa* and *Trigonella foenum-graecum* (65 g/kg) each were used in a moderate amount whose price were (154.00 PKR, 0.98 US\$), (11.38 PKR, 0.07 US\$) and (10.08 PKR, 0.06 US\$) respectively, while *Capsicum annum* (45 g/kg) was used in a minimum amount at a price of (36.00 PKR, 0.23 US\$). The price of per kg Machli masala at Laki gate market was 660 (4.20 US\$). The price was low as compared to the standard while higher than Chuk, Tanchi and Masala mandi markets. Here also the *Coriandrum sativum* and *Cuminum cyminum* were used in maximum amount 225 g/kg (54.00 PKR, 0.34 US\$) and 175 g/kg (140.00 PKR 0.89 US\$) (mean) respectively. *Syzygium aromaticum* (70 g/kg), *Curcuma longa* and *Trigonella foenum-graecum* (65 g/kg) each were used in a moderate amount whose price were (147.00 PKR, 0.94 US\$), (17.88 PKR, 0.11 US\$) and (15.28 PKR, 0.10 US\$) respectively, while *Allium cepa* (55 g/kg) was used in a minimum amount at a price of (4.68 PKR, 0.03 US\$) (Table 10).

Table 4. Biryani Masala ingredient comparison between different markets of Bannu.

Plant Name	Markets of Bannu																			
	Standard				Chuk Bazar				Tanchi Bazar				Masala mandi Bazar				Laki Gate Bazar			
	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$
<i>Amomum subulatum</i>	50-70	60	108.	0.69	50-70	60	96.0	0.61	50-70	60	108.0	0.69	50-70	60	105.0	0.67	-	-	-	-
<i>Capsicum frutescens</i>	50-100	75	63.7	0.41	80-120	100	55.0	0.35	50-100	75	67.5	0.43	50-100	75	56.2	0.36	50-100	75	63.7	0.41
<i>Cinnamomum verum</i>	60-80	60	41.4	0.26	-	-	-	-	60-80	60	38.1	0.24	60-80	60	40.5	0.26	60-80	60	36.0	0.23
<i>Coriandrum sativum</i>	130-150	140	36.4	0.23	200-250	225	55.6	0.35	130-150	140	36.4	0.23	180-220	200	35.0	0.22	180-220	200	48.0	0.31
<i>Cuminum cyminum</i>	60-80	70	56.0	0.36	80-100	90	62.2	0.40	60-80	70	38.5	0.25	80-100	90	63.9	0.41	60-80	70	56.0	0.36
<i>Curcuma longa</i>	30-60	45	12.3	0.08	60-100	80	18.0	0.11	100-120	110	25.8	0.16	30-60	45	7.87	0.05	30-60	45	12.3	0.08
<i>Elettaria cardamomum</i>	40-700	55	115.	0.73	-	-	-	-	40-700	55	107.2	0.68	40-700	55	115.0	0.73	40-700	55	93.5	0.60
<i>Foeniculum vulgare</i>	50-80	65	15.2	0.10	-	-	-	-	-	-	-	-	50-80	65	13.0	0.08	50-80	65	15.2	0.10
<i>Laurus nobilis</i>	110-130	120	57.6	0.37	110-130	120	54.0	0.34	110-130	120	57.0	0.36	-	-	-	-	110-130	120	57.6	0.37
<i>Myristica dactyloides</i>	30-50	40	47.0	0.30	50-100	75	88.1	0.56	30-50	40	43.0	0.27	40-80	60	66.0	0.42	-	-	-	-
<i>Myristica fragrans</i>	20-30	25	28.7	0.18	60-100	80	80.0	0.51	20-30	25	25.5	0.16	40-50	45	51.7	0.33	20-30	25	27.5	0.18
<i>Nigella sativa</i>	50-100	75	161.	1.03	-	-	-	-	50-100	75	161.2	1.02	50-100	75	131.2	0.84	50-100	75	146.5	0.93
<i>Piper nigrum</i>	70-90	80	108.	0.69	70-90	80	78.0	0.50	70-90	80	92.0	0.59	70-90	80	72.0	0.46	70-90	80	108.0	0.67
<i>Syzygium aromaticum</i>	80-100	90	198.	1.26	80-100	90	148	0.95	80-100	90	171.0	1.08	80-100	90	198.0	1.26	120-140	130	273.0	1.74
Total	1000 g	1 kg	1049	6.70	1000 g	1 kg	679	4.68	1000 g	1 kg	971	6.16	1000 g	1 kg	947	6.09	1000 g	1 kg	922	5.98

Table 5. Karahi Masala ingredient comparison between different markets of Bannu.

Plant Name	Markets of Bannu																			
	Standard				Chuk Bazar				Tanchi Bazar				Masala mandi Bazar				Laki Gate Bazar			
	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$
<i>Capsicum frutescens</i>	70-80	75	63.75	0.41	80-120	100	55.00	0.35	70-80	75	67.50	0.43	70-80	75	56.25	0.36	70-80	75	63.75	0.41
<i>Cinnamomum verum</i>	50-60	55	37.95	0.24	-	-	-	-	50-60	55	34.92	0.22	50-60	55	37.12	0.24	50-60	55	37.95	0.24
<i>Coriandrum sativum</i>	380-400	390	101.4	0.65	380-400	390	87.75	0.56	380-400	390	101.4	0.65	380-400	390	68.25	0.43	380-400	390	78.00	0.50
<i>Cuminum cyminum</i>	140-160	150	120	0.76	140-160	150	108.7	0.69	140-160	150	82.50	0.53	140-160	150	106.5	0.68	140-160	150	120	0.76
<i>Elettaria cardamomum</i>	30-50	40	84.00	0.53	-	-	-	-	30-50	40	78.00	0.50	30-50	40	84.00	0.54	30-50	40	68.00	0.43
<i>Laurus nobilis</i>	30-50	70	33.60	0.21	80-100	90	40.50	0.26	30-50	70	33.25	0.21	-	-	-	-	30-50	70	33.60	0.21
<i>Piper nigrum</i>	60-80	70	94.50	0.60	60-80	70	68.25	0.43	60-80	70	80.50	0.51	60-80	70	63.00	0.40	60-80	70	94.50	0.60
<i>Syzygium aromaticum</i>	90-100	95	209	1.33	90-100	95	156.7	1.00	90-100	95	180.5	1.15	100-130	115	253	1.61	90-100	95	199.5	1.27
<i>Trigonella foenum-graecum</i>	50-60	55	28.88	0.18	100-110	105	23.62	0.15	50-60	55	10.45	0.07	100-110	105	16.27	0.10	50-60	55	12.93	0.08
Total	1000 g	1 kg	773	4.91	1000 g	1 kg	540.6	3.44	1000 g	1 kg	669	4.27	1000 g	1 kg	684	4.36	1000 g	1 kg	708	4.50

Table 6. Salan Masala ingredient comparison between different markets of Bannu.

Plant Name	Markets of Bannu																			
	Standard				Chuk Bazar				Tanchi Bazar				Masala mandi Bazar				Laki Gate Bazar			
	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$
<i>Capsicum frutescens</i>	150-200	175	148.7	0.94	150-200	175	96.25	0.61	150-200	175	157.5	1.00	150-200	175	131.2	0.84	150-200	175	148.7	0.95
<i>Cinnamomum verum</i>	50-80	65	44.85	0.28	-	-	-	-	50-80	65	41.28	0.26	50-80	65	43.87	0.28	50-80	65	44.85	0.29
<i>Coriandrum sativum</i>	250-300	275	71.50	0.45	300-350	325	73.12	0.47	250-300	275	71.50	0.46	250-300	275	48.12	0.31	250-300	275	66.00	0.42
<i>Cuminum cyminum</i>	50-100	75	60.00	0.38	200-250	225	163.1	1.03	50-100	75	41.25	0.26	50-100	75	53.25	0.34	50-100	75	60.00	0.42
<i>Elettaria cardamomum</i>	150-200	175	376.5	2.40	-	-	-	-	150-200	175	341.2	2.17	150-200	175	367.5	2.34	150-200	175	297.5	1.89
<i>Syzygium aromaticum</i>	150-180	165	363.0	2.31	150-180	165	272.2	1.73	150-180	165	313.5	2.00	150-180	165	363.0	2.31	150-180	165	346.5	2.20
<i>Zingiber officinale</i>	60-80	70	87.50	0.56	100-120	110	93.50	0.60	60-80	70	49.00	0.31	60-80	70	73.50	0.47	60-80	70	87.50	0.56
Total	1000 g	1 kg	1152	7.32	1000 g	1 kg	698.2	4.44	1000 g	1 kg	1015	6.46	1000 g	1 kg	1080	6.89	1000 g	1 kg	1050	6.73

Table 7. Rosh Masala ingredient comparison between different markets of Bannu.

Plant Name	Markets of Bannu																			
	Standard				Chuk Bazar				Tanchi Bazar				Masala mandi Bazar				Laki Gate Bazar			
	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$
<i>Allium cepa</i>	220-250	235	19.9	0.13	220-250	235	17.6	0.11	-	-	-	-	220-250	235	18.8	0.12	220-250	235	19.9	0.13
<i>Allium sativum</i>	250-300	275	116.8	0.74	250-300	275	116.8	0.74	300-350	325	131.6	0.88	250-300	275	116.8	0.74	250-300	275	101.7	0.65
<i>Capsicum frutescens</i>	90-120	105	89.2	0.57	90-120	105	57.7	0.37	90-120	105	76.1	0.48	90-120	105	78.7	0.50	90-120	105	89.2	0.57
<i>Cuminum cyminum</i>	200-220	210	149.1	0.95	200-220	210	152.2	0.97	200-220	210	115.5	0.74	200-220	210	149.1	0.95	180-200	190	152.0	0.97
<i>Curcuma longa</i>	150-200	175	48.1	0.31	150-200	175	39.3	0.25	340-380	360	84.6	0.54	150-200	175	29.7	0.19	185-205	195	53.6	0.34
Total	1000 g	1 kg	423	2.70	1000 g	1 kg	383	2.07	1000 g	1 kg	407	2.60	1000 g	1 kg	393	2.50	1000 g	1 kg	416	2.64

Table 8. Qeema Masala ingredient comparison between different markets of Bannu.

Plant Name	Markets of Bannu																			
	Standard				Chuk Bazar				Tanchi Bazar				Masala mandi Bazar				Laki Gate Bazar			
	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$
<i>Allium sativum</i>	60-80	70	29.7	0.19	60-80	70	29.7	0.19	90-100	95	38.4	0.25	60-80	70	29.7	0.19	60-80	70	25.9	0.16
<i>Capsicum annum</i>	50-70	60	55.5	0.35	50-70	60	45.0	0.29	-	-	-	-	50-70	60	48.0	0.31	50-70	60	52.5	0.33
<i>Capsicum frutescens</i>	80-120	100	85.0	0.54	80-120	100	55.0	0.35	50-100	75	67.5	0.43	80-120	100	75.0	0.48	80-120	100	85.0	0.54
<i>Cinnamomum verum</i>	40-60	50	34.5	0.22	-	-	-	-	50-100	75	47.6	0.30	40-60	50	33.7	0.21	40-60	50	34.5	0.22
<i>Coriandrum sativum</i>	200-250	225	58.5	0.37	250-300	275	61.8	0.39	240-280	260	67.6	0.43	260-280	270	45.5	0.29	200-250	225	54.0	0.34
<i>Curcuma longa</i>	50-100	75	20.6	0.13	50-100	75	16.8	0.11	80-120	100	23.5	0.15	50-100	75	13.1	0.08	50-100	75	20.6	0.13
<i>Laurus nobilis</i>	30-60	45	21.6	0.14	30-60	45	20.2	0.13	30-60	45	21.3	0.14	-	-	-	-	30-60	45	21.6	0.14
<i>Mentha piperita</i>	180-200	190	47.2	0.30	180-200	190	35.1	0.22	180-200	190	42.7	0.27	180-200	190	46.5	0.30	180-200	190	39.9	0.25
<i>Piper nigrum</i>	50-60	55	74.2	0.47	50-60	55	53.6	0.34	50-60	55	63.2	0.40	50-60	55	49.5	0.32	50-60	55	74.2	0.47
<i>Syzygium aromaticum</i>	50-80	65	143	0.91	50-80	65	107.2	0.68	30-50	40	76.0	0.48	50-80	65	143	0.91	50-80	65	136	0.87
<i>Zingiber officinale</i>	45-85	65	81.2	0.52	45-85	65	55.2	0.35	45-85	65	45.0	0.29	45-85	65	68.2	0.43	45-85	65	81.2	0.52
Total	1000 g	1 kg	651	4.14	1000 g	1 kg	480	3.05	1000 g	1 kg	493	3.14	1000 g	1 kg	552	3.52	1000 g	1 kg	626	3.97

Table 9. Kabuli Pulao masala ingredient comparison between different markets of Bannu.

Plant Name	Markets of Bannu																			
	Standard				Chuk Bazar				Tanchi Bazar				Masala mandi Bazar				Laki Gate Bazar			
	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$
<i>Amomum subulatum</i>	110-120	110	198	1.26	270-300	235	376	2.39	110-120	110	198	1.26	110-120	110	192.5	1.23	-	-	-	-
<i>Cinnamomum verum</i>	100-150	125	86.25	0.55	-	-	-	-	100-150	125	79.3	0.51	100-150	125	34.38	0.22	140-160	150	103.5	0.66
<i>Cuminum cyminum</i>	300-350	325	260	1.66	350-450	400	290	1.85	300-350	325	178.7	1.14	300-350	325	230.7	1.47	300-350	325	260.0	1.66
<i>Elettaria cardamomum</i>	150-200	175	367.5	2.34	-	-	-	-	150-200	175	341.2	2.17	150-200	175	367.5	2.34	180-220	200	340.0	2.17
<i>Piper nigrum</i>	120-150	135	182.2	1.15	270-300	235	229.1	1.46	120-150	135	155.2	0.99	120-150	135	121.5	0.77	130-160	145	195.7	1.25
<i>Syzygium aromaticum</i>	110-150	130	286	1.82	160-200	180	297	1.89	110-150	130	247	1.57	110-150	130	286	1.82	160-200	180	378.0	2.41
Total	1000 g	1 kg	1380	8.78	1000 g	1 kg	1192	7.59	1000 g	1 kg	1199	7.64	1000 g	1 kg	1231	7.85	1000 g	1 kg	1276	8.15

Table 10. Machli Masala comparison between different markets of Bannu.

Plant Name	Markets of Bannu																			
	Standard				Chuk Bazar				Tanchi Bazar				Masala mandi Bazar				Laki Gate Bazar			
	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$
<i>Allium cepa</i>	50-60	55	4.67	0.02	50-60	55	4.13	0.03	-	-	-	-	50-60	55	4.40	0.03	50-60	55	4.68	0.03
<i>Allium sativum</i>	50-70	60	25.50	0.16	100-120	110	46.75	0.30	100-120	110	44.55	0.28	50-70	60	25.50	0.16	50-70	60	22.20	0.14
<i>Capsicum annuum</i>	30-60	45	38.25	0.24	60-100	80	60.00	0.38	-	-	-	-	30-60	45	36.00	0.23	30-60	45	39.38	0.25
<i>Capsicum frutescens</i>	60-100	80	68.00	0.43	60-100	80	44.00	0.28	120-140	130	117.00	0.75	60-100	80	60.00	0.38	60-100	80	68.00	0.43
<i>Cinnamomum verum</i>	70-100	85	58.65	0.37	-	-	-	-	70-100	85	53.98	0.34	70-100	85	57.38	0.37	70-100	85	58.65	0.37
<i>Coriandrum sativum</i>	200-250	225	58.50	0.37	200-250	225	50.63	0.32	200-250	225	58.50	0.37	200-250	225	39.38	0.25	200-250	225	54.00	0.34
<i>Cuminum cyminum</i>	150-200	175	140.00	0.89	150-200	175	126.88	0.81	150-200	175	96.25	0.61	150-200	175	124.25	0.79	150-200	175	140.00	0.89
<i>Curcuma longa</i>	60-70	65	17.87	0.11	60-70	65	14.63	0.09	60-70	65	15.28	0.10	60-70	65	11.38	0.07	60-70	65	17.88	0.11
<i>Syzygium aromaticum</i>	60-80	70	154.00	0.98	60-80	70	115.50	0.74	60-80	70	133.00	0.85	60-80	70	154.00	0.98	60-80	70	147.00	0.94
<i>Trigonella foenum-graecum</i>	50-80	65	15.27	0.09	50-80	65	13.65	0.09	50-80	65	12.35	0.08	50-80	65	10.08	0.06	50-80	65	15.28	0.10
<i>Zingiber officinale</i>	50-80	75	93.75	0.60	50-80	75	63.75	0.41	50-80	75	52.50	0.33	50-80	75	78.75	0.50	50-80	75	93.75	0.60
Total	1000 g	1 kg	674.46	4.26	1000 g	1 kg	540.00	3.45	1000 g	1 kg	583.41	3.71	1000 g	1 kg	601.12	3.82	1000 g	1 kg	660.82	4.20

Kabab Masala ingredient comparison between different markets of Bannu

The standard price of per kg Kabab masala was 578 (3.67 US\$) (Table 11). *Cuminum cyminum* and *Coriandrum sativum* were used in maximum amount 225 g/kg (180.00 PKR 1.14US\$) and 225 g/kg (58.50 PKR 0.37US\$) (mean) respectively. *Curcuma longa* (75 g/kg), *Capsicum annum* (70 g/kg) and *Allium cepa* (65 g/kg) were used in a moderate amount whose price were (20.62 PKR, 0.13 US\$), (61.60 PKR, 0.39 US\$) and (5.20 PKR, 0.03 US\$) respectively while *Mentha piperita* (55 g/kg) was used in a minimum amount at a price of (13.47 PKR, 0.08 US\$). The price of per kg Kabab masala at Chuk market was 475 (3.03 US\$), the price was low as compared to the standard. Here also the *Cuminum cyminum* and *Coriandrum sativum* were used in maximum amount 225 g/kg (163.13 PKR 1.04US\$) and 225 g/kg (50.63 PKR 0.32US\$) (mean) respectively. *Curcuma longa* (75 g/kg), *Capsicum annum* (70 g/kg) and *Allium cepa* (65 g/kg) were used in a moderate amount whose price were (16.88 PKR, 0.11 US\$), (38.50 PKR, 0.25 US\$) and (4.85 PKR, 0.03 US\$) respectively while *Mentha piperita* (55 g/kg) was used in a minimum amount at a price of (10.18 PKR, 0.06 US\$). The price of per kg Kabab masala at Tanchi market was 412 (2.63 US\$), the price was low as compared to the standard and all the other three markets, by many reasons the one was that here in Tanchi market the 2 constituents (spice plant) out of 9 were not used for the preparation of Kabab masala. These two plants were *Allium cepa* and *Capsicum annum*. Here also the *Cuminum cyminum* and *Coriandrum sativum* were used in maximum amount 225 g/kg (123.75 PKR, 0.79 US\$) and 300 g/kg (78.00 PKR, 0.50 US\$) (mean) respectively. *Curcuma longa* (125 g/kg), *Mentha piperita* (105 g/kg) and *Allium sativum* (95 g/kg) were used in a moderate amount whose price were (29.38 PKR, 0.19 US\$), (23.63 PKR, 0.15 US\$) and (38.48 PKR, 0.25 US\$) respectively while *Capsicum frutescens* (70 g/kg) was used in a minimum amount at a price of (63.00 PKR, 0.40 US\$). The price of per kg Kabab masala at Masala mandi market was 510 (3.25 US\$), the price was low as compared to the standard and Laki gate market. Here also the *Cuminum cyminum* and *Coriandrum sativum* were used in maximum amount 225 g/kg (159.50 PKR, 1.02 US\$) and 225 g/kg (54.00 PKR, 0.34 US\$) (mean) respectively. *Curcuma longa* (75 g/kg), *Capsicum frutescens* (70 g/kg) and *Allium cepa* (65 g/kg) were used in a moderate amount whose price were (13.13 PKR, 0.08 US\$), (52.50 PKR, 0.33 US\$) and (5.20 PKR, 0.03 US\$) respectively, while *Mentha piperita* (55 g/kg) was used in a minimum amount at a price of (13.48 PKR, 0.09 US\$). The price of per kg Kabab masala at Laki gate market was 562 (3.58 US\$), the price was low as compared to the standard, Chuk, Tanchi and Masala mandi market. *Cuminum cyminum* and *Coriandrum sativum* were used in maximum amount 225 g/kg (180.00 PKR, 1.15 US\$) and 225 g/kg (54.00 PKR, 0.34 US\$) (mean) respectively. *Curcuma longa* (75 g/kg), *Capsicum frutescens* (70 g/kg) and *Allium cepa* (65 g/kg) were used in a moderate amount whose price were (20.63 PKR, 0.13 US\$), (59.50 PKR, 0.38 US\$) and (5.53 PKR, 0.04 US\$) respectively, while *Mentha piperita* (55 g/kg) was used in a minimum amount at a price of (11.55 PKR, 0.07 US\$).

Haleem Masala ingredient comparison between different markets of Bannu

The standard price per kg Haleem masala was 865 (5.52 US\$), where *Cuminum cyminum* and *Coriandrum sativum* were used in maximum amount 235 g/kg (188.00 PKR, 1.20 US\$) and 225 g/kg (58.50 PKR, 0.37 US\$) (mean) respectively (Table 12). *Capsicum annum* and *Capsicum frutescens* (90 g/kg) were used in a moderate amount whose price were (81.00 PKR, 0.52 US\$) and (79.20 PKR, 0.50 US\$) while *Cinnamomum verum* (45 g/kg) was used in a minimum amount at a price of (31.05 PKR, 0.20 US\$). The price of per kg Haleem masala at Chuk market was 606 (3.87 US\$). The price was low as compared to the standard, Tanchi, Masala mandi and Laki gate markets by many reasons the one is that here in Chuk market the 2 constituents (spice plants) out of 9 were not used for the preparation of Haleem masala. These two plants were *Nigella sativa* and *Cinnamomum verum*. Here also the *Coriandrum sativum* (275 g/kg) and *Cuminum cyminum* (250 g/kg) (Mean) were found in a maximum quantity at a price of (61.88 PKR, 0.39 US\$) and (181.25 PKR, 1.15 US\$) respectively. *Syzygium aromaticum* (90 g/kg) and *Capsicum frutescens* (90 g/kg) were used in a moderate amount at a price of (148.50 PKR, 0.95 US\$) and (49.50 PKR, 0.32 US\$) respectively while *Myristica fragrans* (50 g/kg) was used in a minimum amount at a price of (50.00 PKR, 0.32 US\$). The price of per kg Haleem masala at Tanchi market was 725 (4.61 US\$). The price was low as compared to the standard, Masala mandi and Laki gate markets by many reasons the one was that here in Tanchi market the 1 constituent (spice plant) out of 9 was not used for the preparation of Haleem masala. That one plant was *Capsicum annum*. Here also the *Coriandrum sativum* (270 g/kg) and *Cuminum cyminum* (235 g/kg) (Mean) were found in a maximum quantity at a price of (70.20 PKR, 0.45 US\$) and (125.25 PKR, 0.82 US\$) respectively. *Nigella sativa* (105 g/kg) and *Capsicum frutescens* (90 g/kg) were used in a moderate amount at a price of (225.75 PKR, 1.43 US\$) and (81.00 PKR, 0.52 US\$) respectively while *Cinnamomum verum* (45 g/kg) was used in a minimum amount at a price of (28.75 PKR, 0.18 US\$). The price of per kg Haleem masala at Masala mandi market was 756 (4.83 US\$). The price was low as compared to the standard and Laki gate markets. Here also the *Coriandrum sativum* (225 g/kg) and *Cuminum cyminum* (235 g/kg) (Mean) were found in a maximum quantity at a price of (39.37 PKR, 0.25 US\$) and (166.85 PKR, 1.07 US\$) respectively. *Nigella sativa* (105 g/kg), *Capsicum annum* and *Capsicum frutescens* (90 g/kg) were used in a moderate amount at a price of (183.75 PKR, 1.17 US\$), (67.50 PKR, 0.43 US\$) and (72.00 PKR, 0.46

US\$) respectively while *Cinnamomum verum* (45 g/kg) was used in a minimum amount at a price of (30.38 PKR, 0.19 US\$). The price of per kg Haleem masala at Laki gate market was 832 (5.30 US\$). The price was low as compared to the standard. Here also the *Coriandrum sativum* (225 g/kg) and *Cuminum cyminum* (235 g/kg) (Mean) were found in a maximum quantity at a price of (54.00 PKR, 0.34 US\$) and (188.00 PKR, 1.20 US\$) respectively. *Nigella sativa* (105 g/kg), *Capsicum annuum* and *Capsicum frutescens* (90 g/kg) were used in a moderate amount at a price of (204.75 PKR, 1.30 US\$), (78.75 PKR, 0.50 US\$) and (76.50 PKR, 0.49 US\$) respectively while *Cinnamomum verum* (45 g/kg) was used in a minimum amount at a price of (31.50 PKR, 0.20 US\$).

Achar gosht Masala ingredient comparison between different markets of Bannu

The standard price per kg Achar gosht masala was 474 PKR (3.02 US\$), where *Foeniculum vulgare* and *Coriandrum sativum* were used in maximum amount both 175 g/kg (41.12 PKR, 0.26 US\$) and (45.50 PKR, 0.29 US\$) (mean) respectively (Table 13). *Curcuma longa* (95 g/kg) and *Nigella sativa* (90 g/kg) were used in a moderate amount whose price were (26.12 PKR, 0.17 US\$) and (193.50 PKR, 1.23 US\$) while *Trigonella foenum-graecum* (50 g/kg) was used in a minimum amount at a price of (11.75 PKR, 0.07 US\$). The price of per kg Achar gosht masala at Chuk market was 335 (2.14 US\$). The price was low as compared to the standard by many reasons the one was that here in Chuk market the 2 constituents (spice plants) out of 8 were not used for the preparation of Achar gosht masala. These two plants were *Nigella sativa* and *Foeniculum vulgare*. Here also the *Coriandrum sativum* (250 g/kg) and *Brassica compestris* (210 g/kg) (Mean) were found in a maximum quantity at a price of (56.25 PKR, 0.36 US\$) and (26.10 PKR, 0.17 US\$) respectively. *Cuminum cyminum* (160 g/kg) and *Curcuma longa* (150 g/kg) were used in a moderate amount at a price of (116.00 PKR, 0.74 US\$) and (33.75 PKR, 0.21 US\$) respectively while *Trigonella foenum-graecum* (50 g/kg) was used in a minimum amount at a price of (37.80 PKR, 0.24 US\$). The price of per kg Achar gosht masala at Tanchi market was 454 (2.89 US\$). The price was low as compared to the standard by many reasons the one was that here in Tanchi market the 2 constituents (spice plants) out of 8 were not used for the preparation of Achar gosht masala. These two plants were *Foeniculum vulgare* and *Brassica compestris*. Here also the *Coriandrum sativum* (350 g/kg) and *Curcuma longa* (170 g/kg) (Mean) were found in a maximum quantity at a price of (91.00 PKR, 0.58 US\$) and (39.95 PKR, 0.25 US\$) respectively. *Capsicum frutescens* (150 g/kg) and *Trigonella foenum-graecum* (150 g/kg) were used in a moderate amount at a price of (135.00 PKR, 0.86 US\$) and (9.50 PKR, 0.06 US\$) respectively while *Nigella sativa* (50 g/kg) was used in a minimum amount at a price of (107.50 PKR, 0.68 US\$). The price of per kg Achar gosht masala at Masala mandi market was 474 (3.02 US\$). Here also the *Coriandrum sativum* (175 g/kg) and *Foeniculum vulgare* (175 g/kg) (Mean) were found in a maximum quantity at a price of (30.63 PKR, 0.20 US\$) and (35.00 PKR, 0.22 US\$) respectively. *Curcuma longa* (95 g/kg) and *Nigella sativa* (90 g/kg) were used in a moderate amount at a price of (6.63 PKR, 0.10 US\$) and (157.50 PKR, 1.00 US\$) respectively while *Trigonella foenum-graecum* (50 g/kg) was used in a minimum amount at a price of (7.75 PKR, 0.05 US\$). The price of per kg Achar gosht masala at Laki gate market was 444 (2.83 US\$). Here also the *Coriandrum sativum* (235 g/kg) and *Foeniculum vulgare* (175 g/kg) (Mean) were found in a maximum quantity at a price of (56.40 PKR 0.36 US\$) and (41.13 PKR 0.26 US\$) respectively. *Curcuma longa* (95 g/kg) and *Trigonella foenum-graecum* (90 g/kg) were used in a moderate amount at a price of (26.13 PKR, 0.17 US\$) and (21.15 PKR, 0.13 US\$) respectively while *Nigella sativa* (50 g/kg) was used in a minimum amount at a price of (97.50 PKR, 0.62 US\$).

Chat Masala ingredient comparison between different markets of Bannu

The standard price per kg Chat masala was 609 PKR (3.86 US\$), where *Cuminum cyminum* and *Coriandrum sativum* were used in maximum amount 325 g/kg (260.00 PKR, 1.65 US\$) and 125 g/kg (32.50 PKR, 0.21 US\$) (mean) respectively (Table 14). *Piper nigrum* (90 g/kg), *Foeniculum vulgare* (90 g/kg) and *Zingiber officinale* (90 g/kg) were used in a moderate amount whose price were (121.50 PKR, 0.77 US\$), (21.15 PKR, 0.13 US\$) and (121.50 PKR, 0.77 US\$) while *Trachyspermum ammi* (75 g/kg) was used in a minimum amount at a price of (14.62 PKR, 0.09 US\$). The price of per kg Chat masala at Chuk market was 545 (3.46 US\$). The price was low as compared to the standard by many reasons the one was that here in Chuk market the 2 constituents (spice plants) out of 8 were not used for the preparation of Chat masala. These two plants were *Foeniculum vulgare* and *Trachyspermum ammi*. Here also the *Cuminum cyminum* (340 g/kg) and *Coriandrum sativum* (155 g/kg) (Mean) were found in a maximum quantity at a price of (246.50 PKR, 1.57 US\$) and (34.87 PKR, 0.22 US\$) respectively. *Mangifera indica* (130 g/kg) and *Mentha piperita* (120 g/kg) were used in a moderate amount at a price of (11.05 PKR, 0.07 US\$) and (22.20 PKR, 0.14 US\$) respectively, while *Piper nigrum* (115 g/kg) was used in a minimum amount at a price of (112.12 PKR, 0.71 US\$). The price of per kg Chat masala at Tanchi market was 488 (3.11 US\$). The price was low as compared to the standard by many reasons the one was that here in Chuk market the 2 constituents (spice plants) out of 8 were not used for the preparation of Chat masala. These two plants were *Foeniculum vulgare* and *Mangifera indica*. Here also the *Cuminum cyminum* (340 g/kg) and *Coriandrum sativum* (155 g/kg) were found in a maximum quantity at a price of (187.00 PKR, 1.19 US\$) and (40.30 PKR, 0.26 US\$) respectively. *Zingiber officinale* (130 g/kg) and *Trachyspermum*

ammi (125 g/kg) were used in a moderate amount at a price of (91.00 PKR, 0.58 US\$) and (21.25 PKR, 0.14 US\$) respectively, while *Piper nigrum* (100 g/kg) was used in a minimum amount at a price of (115.00 PKR, 0.73 US\$). The price of per kg Chat masala at Masala mandi market was 499 (3.17 US\$). Here also the *Cuminum cyminum* (325 g/kg) and *Coriandrum sativum* (125 g/kg) (Mean) were found in a maximum quantity at a price of (230.75 PKR, 1.47 US\$) and (21.87 PKR, 0.41 US\$) respectively. *Piper nigrum* (90 g/kg), *Foeniculum vulgare* (90 g/kg) and *Zingiber officinale* (90 g/kg) were used in a moderate amount whose price were (81.00 PKR, 0.51 US\$), (18.00 PKR, 0.11 US\$) and (94.50 PKR, 0.60 US\$) respectively, while *Trachyspermum ammi* (75 g/kg) was used in a minimum amount at a price of (14.60 PKR, 0.10 US\$). The price of per kg Chat masala at Laki gate market was 570 (3.63 US\$). The price was low as compared to the standard by many reasons the one was that here in Laki gate market the 2 constituents (spice plants) out of 8 were not used for the preparation of Chat masala. These two plants were *Mangifera indica* and *Trachyspermum ammi*. Here also the *Cuminum cyminum* (325 g/kg) were found in a maximum quantity at a price of (260.00 PKR, 1.66 US\$). The *Coriandrum sativum* (125 g/kg) and *Mentha piperita* (120 g/kg) were used in a moderate amount at a price of (30.00 PKR, 0.20 US\$) and (25.20 PKR, 0.16 US\$) respectively, while *Piper nigrum* (90 g/kg), *Foeniculum vulgare* (90 g/kg) and *Zingiber officinale* (90 g/kg) were used in a minimum amount whose price were (121.50 PKR, 0.77 US\$), (21.15 PKR, 0.13 US\$) and (112.50 PKR, 0.71 US\$) respectively.

Nihari Masala ingredient comparison between different markets of Bannu

The standard price per kg Nihari masala was 656 PKR (4.18 US\$), where *Capsicum frutescense* and *Foeniculum vulgare* were used in maximum amount 190 g/kg (161.50 PKR, 1.03 US\$) and 190 g/kg (44.65 PKR, 0.28 US\$) (mean) respectively (Table 15). *Curcuma longa* (100 g/kg) and *Amomum subulatum* (70 g/kg) were used in a moderate amount at a price of (27.50 PKR, 0.17 US\$) and (126.00 PKR, 0.80 US\$) while *Myristica fragrans* (45 g/kg) was used in a minimum amount at a price of (51.75 PKR, 0.33 US\$). The price of per kg Nihari masala at Chuk market was 654 (4.15 US\$). The price was low as compared to the standard by many reasons the one was that here in Chuk market the 1 constituent (spice plant) out of 8 was not used for the preparation of Nihari masala. That one plant was *Foeniculum vulgare*. Here also the *Capsicum frutescense* (240 g/kg) and *Coriandrum sativum* (220 g/kg) (Mean) were found in a maximum quantity at a price of (132.00 PKR, 0.84 US\$) and (49.50 PKR, 0.32 US\$) respectively. *Curcuma longa* (110 g/kg) and *Amomum subulatum* (100 g/kg) were used in a moderate amount whose price were (24.75 PKR, 0.15 US\$) and (160.00 PKR, 1.01 US\$) respectively, while *Myristica fragrans* (65 g/kg) was used in a minimum amount at a price of (65.00 PKR, 0.41 US\$). The price of per kg Nihari masala at Tanchi market was 645 (4.11 US\$). The price was low as compared to the standard by many reasons the one was that here in Chuk market the 1 constituent (spice plant) out of 8 was not used for the preparation of Nihari masala. That one plant was *Foeniculum vulgare*. Here also the *Capsicum frutescense* (210 g/kg) and *Coriandrum sativum* (215 g/kg) (Mean) were found in a maximum quantity at a price of (189.00 PKR, 1.20 US\$) and (55.90 PKR, 0.36 US\$) respectively. *Curcuma longa* (200 g/kg) and *Cuminum cyminum* (185 g/kg) were used in a moderate amount at a price of (47.00 PKR, 0.30 US\$) and (101.75 PKR, 0.65 US\$) respectively, while *Myristica fragrans* (50 g/kg) was used in a minimum amount at a price of (51.00 PKR, 0.32 US\$). The price of per kg Nihari masala at Masala mandi market was 583 (3.70 US\$). Here also the *Capsicum frutescense* and *Foeniculum vulgare* were used in maximum amount 190 g/kg (142.50 PKR, 0.90 US\$) and 190 g/kg (38.00 PKR, 0.24 US\$) (mean) respectively. *Curcuma longa* (100 g/kg) and *Amomum subulatum* (70 g/kg) were used in a moderate amount at a price of (17.50 PKR, 0.11 US\$) and (122.50 PKR, 0.78 US\$) while *Myristica fragrans* (45 g/kg) was used in a minimum amount at a price of (51.75 PKR, 0.33 US\$). The price of per kg Nihari masala at Laki gate market was 497 (3.15 US\$). The price was low as compared to the standard by many reasons the one was that here in Laki gate market the 2 constituents (spice plants) out of 8 were not used for the preparation of Nihari masala. These two plants were *Amomum subulatum* and *Myristica dactyloides*. Here also the *Coriandrum sativum* (240 g/kg) (Mean) were found in a maximum quantity at a price of (57.60 PKR, 0.36 US\$) respectively. *Cuminum cyminum* (175 g/kg) and *Curcuma longa* (160 g/kg) were used in a moderate amount at a price of (140.00 PKR, 0.90 US\$) and (44.00 PKR, 0.28 US\$) respectively, while *Myristica fragrans* (45 g/kg) was used in a minimum amount at a price of (49.50 PKR, 0.31 US\$).

Chatni Masala ingredient comparison between different markets of Bannu

The standard price of per kg Chatni masala was 801 PKR (5.10 US\$) where *Prunus armeniaca* and *Cuminum cyminum* were used in maximum amount 225 g/kg (92.25 PKR, 0.59 US\$) and 190 g/kg (153.60 PKR 0.98 US\$) (mean) respectively (Table 16). *Prunus domestica* (165 g/kg) and *Capsicum frutescens* (145 g/kg) were used in a moderate amount at a price of (78.37 PKR, 0.50 US\$) and (123.25 PKR, 0.78 US\$) while *Allium sativum* (100 g/kg) were used in a minimum amount at a price of (47.50 PKR, 0.30 US\$). The price of per kg Chatni masala at Chuk market was 773 (4.93 US\$). The price was low as compared to the standard by many reasons the one was that here in Chuk market the 1 constituent (spice plants) out of 6 was not used for the preparation of Chatni masala. That one plant was *Prunus domestica*. Here also the *Prunus armeniaca* and *Cuminum cyminum* were used in maximum amount

225 g/kg (84.38 PKR, 0.54 US\$) and 220 g/kg (159.50 PKR, 1.02 US\$) (mean) respectively. *Capsicum frutescens* (190 g/kg) was used in a moderate amount at a price of (104.50 PKR, 0.67 US\$), while *Allium sativum* (160 g/kg) was used in a minimum amount at a price of (68.00 PKR, 0.43 US\$). The price of per Chatni masala at Tanchi market was 781 (4.99 US\$). The price was low as compared to the standard by many reasons the one was that here in Tanchi market the 1 constituent (spice plant) out of 6 was not used for the preparation of Chatni masala. That one plant was *Prunus armeniaca*. Here also the *Cuminum cyminum* and *Murraya koenigii* were used in maximum amount 230 g/kg (126.50 PKR, 0.81 US\$) and 220 g/kg (330 PKR, 2.10 US\$) (mean) respectively. *Capsicum frutescens* (195 g/kg) was used in a moderate amount at a price of (175.50 PKR, 1.12 US\$) while *Allium sativum* (150 g/kg) was used in a minimum amount whose price is (60.75 PKR, 0.39 US\$). The price of per kg Chatni masala at Masala mandi market was 778 (4.96 US\$). The price was low as compared to the standard by many reasons the one was that here in Masala mandi market the 1 constituent (spice plant) out of 6 was not used for the preparation of Chatni masala. That one plant was *Prunus armeniaca*. Here also the *Cuminum cyminum* and *Murraya koenigii* were used in maximum amount 230 g/kg (163.30 PKR, 1.04 US\$) and 220 g/kg (308.00 PKR, 1.96 US\$) (mean) respectively. *Capsicum frutescens* (195 g/kg) was used in a moderate amount at a price of (146.25 PKR 0.93US\$) while *Allium sativum* (150 g/kg) was used in a minimum amount at a price of (63.75 PKR, 0.41 US\$). The price of per kg Chatni masala at Laki gate market was 599 (3.81 US\$). The price was low as compared to the standard by many reasons the one was that here in Laki gate market the 2 constituents (spice plants) out of 6 were not used for the preparation of Chatni masala. These two plants were *Murraya koenigii* and *Prunus domestica*. Here also the *Prunus armeniaca* was used in maximum amount 285 g/kg (116.85 PKR, 0.74 US\$). *Cuminum cyminum* (250 g/kg) was used in a moderate amount at a price of (200.00 PKR, 1.27 US\$), while *Capsicum frutescens* (230 g/kg) was used in a minimum amount at a price of (195.50 PKR, 1.25 US\$).

Panda Masala ingredient comparison between different markets of Bannu

The standard price per kg Panda masala was 869 PKR (5.53 US\$), where *Coriandrum sativum* and *Piper nigrum* were used in maximum amount 170 g/kg (44.54 PKR, 0.28 US\$) and 140 g/kg (189.00 PKR, 1.20 US\$) (mean) respectively (Table 17). *Allium sativum* (120 g/kg), *Cuminum cyminum* (110 g/kg) and *Mentha piperita* (100 g/kg) were used in a moderate amount at a price of (57.00 PKR, 0.36 US\$), (88.000 PKR, 0.56 US\$) and (24.50 PKR, 0.16 US\$) while *Zingiber officinale* (70 g/kg) was used in a minimum amount at a price of (87.50 PKR 0.56 US\$). The price of per kg Panda masala at Chuk market is 661 (4.20 US\$). Here also the *Coriandrum sativum* and *Piper nigrum* were used in maximum amount 170 g/kg (38.25 PKR, 0.24 US\$) and 140 g/kg (136.50 PKR, 0.87 US\$) respectively. *Allium sativum* (120 g/kg), *Cuminum cyminum* (110 g/kg) and *Mentha Piperita* (100 g/kg) were used in a moderate amount at a price of (51.00 PKR, 0.32 US\$), (79.75 PKR, 0.51 US\$) and (18.50 PKR, 0.12 US\$), while *Zingiber officinale* (70 g/kg) was used in a minimum amount at a price of (59.50 PKR, 0.37 US\$). The price of per kg Panda masala at Tanchi market was 726 (4.61 US\$). Here also the *Coriandrum sativum* and *Piper nigrum* were used in maximum amount 170 g/kg (44.20 PKR, 0.28 US\$) and 140 g/kg (161.00 PKR, 1.02 US\$) respectively. *Allium sativum* (120 g/kg), *Cuminum cyminum* (110 g/kg) and *Mentha piperita* (100 g/kg) were used in a moderate amount at a price of (48.60 PKR, 0.31 US\$), (60.50 PKR, 0.38 US\$) and (22.50 PKR, 0.14 US\$) while *Zingiber officinale* (70 g/kg) was used in a minimum amount at a price of (49.00 PKR, 0.31 US\$). The price of per kg Panda masala at Masala mandi market was 745 (4.75 US\$). Here also the *Coriandrum sativum* and *Piper nigrum* were used in maximum amount 170 g/kg (29.75 PKR, 0.19 US\$) and 140 g/kg (126.00 PKR, 0.80 US\$) respectively. *Allium sativum* (120 g/kg), *Cuminum cyminum* (110 g/kg) and *Mentha piperita* (100 g/kg) were used in a moderate amount at a price of (51.00 PKR, 0.32 US\$), (78.10 PKR, 0.50 US\$) and (24.50 PKR, 0.16 US\$), while *Zingiber officinale* (70 g/kg) was used in a minimum amount at a price of (73.50 PKR, 0.47 US\$). The price of per kg Panda masala at Laki gate market was 836 (5.32 US\$). Here also the *Coriandrum sativum* and *Piper nigrum* were used in maximum amount 170 g/kg (40.80 PKR, 0.26 US\$) and 140 g/kg (189.00 PKR, 1.20 US\$) respectively. *Allium sativum* (120 g/kg), *Cuminum cyminum* (110 g/kg) and *Mentha piperita* (100 g/kg) were used in a moderate amount whose price were (44.40 PKR, 0.28 US\$), (88.00 PKR, 0.56 US\$) and (21.00 PKR, 0.13 US\$) while *Zingiber officinale* (70 g/kg) was used in a minimum amount at a price of (87.50 PKR, 0.56 US\$).

Table 11. Kabab Masala ingredient comparison of different markets of Bannu.

Plant Name	Markets of Bannu																			
	Standard				Chuk Bazar				Tanchi Bazar				Masala mandi Bazar				Laki Gate Bazar			
	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$
<i>Allium cepa</i>	60-70	65	5.20	0.03	60-70	65	4.85	0.03	-	-	-	-	60-70	65	5.20	0.03	60-70	65	5.53	0.04
<i>Allium sativum</i>	90-100	95	42.75	0.27	90-100	95	40.38	0.26	90-100	95	38.48	0.25	90-100	95	40.38	0.26	90-100	95	35.15	0.22
<i>Capsicum annuum</i>	100-120	110	96.80	0.62	100-120	110	82.50	0.53	-	-	-	-	100-120	110	88.00	0.56	100-120	110	96.25	0.61
<i>Capsicum frutescens</i>	60-80	70	61.60	0.39	60-80	70	38.50	0.25	60-80	70	63.00	0.40	60-80	70	52.50	0.33	60-80	70	59.50	0.38
<i>Coriandrum sativum</i>	200-250	225	58.50	0.37	200-250	225	50.63	0.32	280-320	300	78.00	0.50	200-250	225	54.00	0.34	200-250	225	54.00	0.34
<i>Cuminum cyminum</i>	200-250	225	180.00	1.14	200-250	225	163.13	1.04	200-250	225	123.75	0.79	200-250	225	159.75	1.02	200-250	225	180.00	1.15
<i>Curcuma longa</i>	70-80	75	20.62	0.13	70-80	75	16.88	0.11	100-150	125	29.38	0.19	70-80	75	13.13	0.08	70-80	75	20.63	0.13
<i>Mentha piperita</i>	50-60	55	13.47	0.08	50-60	55	10.18	0.06	100-110	105	23.63	0.15	50-60	55	13.48	0.09	50-60	55	11.55	0.07
<i>Zingiber officinale</i>	60-100	80	100.00	0.64	60-100	80	68.00	0.43	60-100	80	56.00	0.36	60-100	80	84.00	0.54	60-100	80	100.0	6.67
Total	1000 g	1 kg	578.94	3.67	1000 g	1 kg	475.05	3.03	1000 g	1 kg	412.24	2.63	1000 g	1 kg	510.44	3.25	1000 g	1 kg	562.61	3.58

Table 12. Haleem Masala ingredient comparison of different markets of Bannu.

Plant Name	Markets of Bannu																			
	Standard				Chuk Bazar				Tanchi Bazar				Masala mandi Bazar				Laki Gate Bazar			
	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$
<i>Capsicum annuum</i>	80-100	90	81.00	0.52	100-120	115	86.25	0.55	-	-	-	-	80-100	90	72.00	0.46	80-100	90	78.75	0.50
<i>Capsicum frutescens</i>	80-100	90	79.20	0.50	80-100	90	49.50	0.32	80-100	90	81.00	0.52	80-100	90	67.50	0.43	80-100	90	76.50	0.49
<i>Cinnamomum verum</i>	40-50	45	31.05	0.20	-	-	-	-	40-50	45	28.75	0.18	40-50	45	30.38	0.19	40-50	45	31.05	0.20
<i>Coriandrum sativum</i>	200-250	225	58.50	0.37	250-300	275	61.88	0.39	260-280	270	70.20	0.45	200-250	225	39.37	0.25	200-250	225	54.00	0.34
<i>Cuminum cyminum</i>	210-260	235	188.00	1.20	240-260	250	181.25	1.15	210-260	235	129.25	0.82	210-260	235	166.85	1.07	210-260	235	188.00	1.20
<i>Curcuma longa</i>	90-110	105	23.30	0.15	120-140	130	29.25	0.19	140-160	150	35.25	0.22	90-110	105	18.38	0.12	90-110	105	28.88	0.18
<i>Myristica fragrans</i>	40-60	50	57.50	0.37	40-60	50	50.00	0.32	40-60	50	51.00	0.32	40-60	50	57.50	0.37	40-60	50	55.00	0.35
<i>Nigella sativa</i>	90-120	105	225.75	1.44	-	-	-	-	90-120	105	225.75	1.43	90-120	105	183.75	1.17	90-120	105	204.75	1.30
<i>Syzygium aromaticum</i>	50-60	55	121.00	0.77	80-100	90	148.50	0.95	50-60	55	104.50	0.67	50-60	55	121.00	0.77	50-60	55	115.50	0.74
Total	1000 g	1 kg	865.31	5.52	1000 g	1 kg	606.63	3.87	1000 g	1 kg	725.70	4.61	1000 g	1 kg	756.82	4.83	1000 g	1 kg	832.43	5.30

Table 13. Achar gosht Masala ingredient comparison between different markets of Bannu.

Plant Name	Markets of Bannu																			
	Standard				Chuk Bazar				Tanchi Bazar				Masala mandi Bazar				Laki Gate Bazar			
	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$
<i>Brassica campestris</i>	130-160	145	31.17	0.20	190-230	210	26.10	0.17	-	-	-	-	130-160	145	31.18	0.20	130-160	145	28.28	0.18
<i>Capsicum frutescens</i>	100-120	110	93.50	0.60	110-130	120	66.00	0.42	140-160	150	135.00	0.86	100-120	110	82.54	0.53	100-120	110	93.50	0.60
<i>Coriandrum sativum</i>	150-200	175	45.50	0.29	240-260	250	56.25	0.36	340-360	350	91.00	0.58	150-200	175	30.63	0.20	230-240	235	56.40	0.36
<i>Cuminum cyminum</i>	150-170	160	32.00	0.20	150-170	160	116.00	0.74	120-140	130	71.50	0.46	150-170	160	113.6	0.72	80-120	100	80.00	0.51
<i>Curcuma longa</i>	90-100	95	26.12	0.17	140-160	150	33.75	0.21	160-180	170	39.95	0.25	90-100	95	16.63	0.10	90-100	95	26.13	0.17
<i>Foeniculum vulgare</i>	150-200	175	41.12	0.26	-	-	-	-	-	-	-	-	150-200	175	35.00	0.22	150-200	175	41.13	0.26
<i>Nigella sativa</i>	80-100	90	193.50	1.23	-	-	-	-	40-60	50	107.50	0.68	80-100	90	157.50	1.00	40-60	50	97.50	0.62
<i>Trigonella foenum-graecum</i>	40-60	50	11.75	0.07	90-130	110	37.80	0.24	140-160	150	9.50	0.06	40-60	50	7.75	0.05	80-100	90	21.15	0.13
Total	1k g	1 Kg	474.66	3.02	1k g	1 Kg	335.90	2.14	1k g	1 Kg	454.45	2.89	1k g	1 Kg	474.66	3.02	1k g	1 Kg	444.09	2.83

Table 14. Chat Masala ingredient comparison between different markets of Bannu.

Plant Name	Markets of Bannu																			
	Standard				Chuk Bazar				Tanchi Bazar				Masala mandi Bazar				Laki Gate Bazar			
	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$
<i>Coriandrum sativum</i>	100-150	125	32.50	0.21	145-165	155	34.87	0.22	145-165	155	40.30	0.26	100-150	125	21.87	0.14	100-150	125	30.00	0.20
<i>Cuminum cyminum</i>	300-350	325	260.00	1.65	330-350	340	246.50	1.57	330-350	340	187.00	1.19	300-350	325	230.75	1.47	300-350	325	260.00	1.66
<i>Foeniculum vulgare</i>	80-100	90	21.15	0.13	-	-	-	-	-	-	-	-	80-100	90	18.00	0.11	80-100	90	21.15	0.13
<i>Mangifera indica</i>	50-120	85	8.92	0.05	120-140	130	11.05	0.07	-	-	-	-	50-120	85	8.92	0.05	-	-	-	-
<i>Mentha piperita</i>	100-140	120	29.40	0.19	100-140	120	22.20	0.14	130-170	150	33.75	0.21	100-140	120	29.52	0.19	100-140	120	25.20	0.16
<i>Piper nigrum</i>	80-100	90	121.50	0.77	100-130	115	112.12	0.71	80-120	100	115.00	0.73	80-100	90	81.00	0.51	80-100	90	121.50	0.77
<i>Trachyspermum ammi</i>	70-80	75	14.62	0.09	-	-	-	-	115-135	125	21.25	0.14	70-80	75	14.62	0.10	-	-	-	-
<i>Zingiber officinale</i>	80-100	90	121.50	0.77	130-150	140	119.00	0.75	120-140	130	91.00	0.58	80-100	90	94.50	0.60	80-100	90	112.50	0.71
Total	1k g	1 Kg	609.60	3.86	1k g	1 Kg	545.74	3.46	1k g	1 Kg	488.30	3.11	1k g	1 Kg	499.18	3.17	1k g	1 Kg	570.35	3.63

Table 165 Nihari Masala ingredient comparison between different markets of Bannu.

Plant Name	Markets of Bannu																			
	Standard				Chuk Bazar				Tanchi Bazar				Masala mandi Bazar				Laki Gate Bazar			
	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$
<i>Capsicum frutescens</i>	180-200	190	161.50	1.03	230-250	240	132.00	0.84	190-220	210	189.00	1.20	180-200	190	142.50	0.90	180-200	190	161.50	1.02
<i>Coriandrum sativum</i>	160-200	180	46.80	0.30	200-240	220	49.50	0.32	205-225	215	55.90	0.36	160-200	180	31.50	0.20	220-260	240	57.60	0.36
<i>Cuminum cyminum</i>	150-200	175	140.00	0.90	185-205	195	141.37	0.90	180-190	185	101.75	0.65	150-200	175	124.25	0.79	150-200	175	140.00	0.90
<i>Myristica dactyloides</i>	40-60	50	58.75	0.37	60-80	70	82.25	0.52	50-90	70	75.25	0.48	40-60	50	55.00	0.35	-	-	-	-
<i>Myristica fragrans</i>	40-50	45	51.75	0.33	60-70	65	65.00	0.41	40-60	50	51.00	0.32	40-50	45	51.75	0.33	40-50	45	49.50	0.31
<i>Amomum subulatum</i>	60-80	70	126.00	0.80	90-110	100	160.00	1.01	60-80	70	126.00	0.80	60-80	70	122.50	0.78	-	-	-	-
<i>Foeniculum vulgare</i>	180-200	190	44.65	0.28	-	-	-	-	-	-	-	-	180-200	190	38.0	0.24	180-200	190	44.65	0.28
<i>Curcuma longa</i>	80-120	100	27.50	0.17	90-130	110	24.75	0.15	80-120	200	47.00	0.30	80-120	100	17.50	0.11	140-180	160	44.00	0.28
Total	1k g	1 Kg	656.95	4.18	1k g	1 Kg	654.87	4.15	1k g	1 Kg	645.90	4.11	1k g	1 Kg	583.00	3.70	1k g	1 Kg	497.25	3.15

Table 16. Chatni Masala ingredient comparison between different markets of Bannu.

Plant Name	Markets of Bannu																			
	Standard				Chuk Bazar				Tanchi Bazar				Masala mandi Bazar				Laki Gate Bazar			
	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$
<i>Allium sativum</i>	80-120	100	47.50	0.30	150-170	160	68.00	0.43	130-170	150	60.75	0.39	130-170	150	63.75	0.41	225-245	235	86.95	0.55
<i>Capsicum frutescens</i>	130-160	145	123.25	0.78	170-210	190	104.50	0.67	185-205	195	175.50	1.12	185-205	195	146.25	0.93	220-240	230	195.50	1.25
<i>Cuminum cyminum</i>	180-200	190	153.60	0.98	210-230	220	159.50	1.02	220-240	230	126.50	0.81	220-240	230	163.30	1.04	240-260	250	200.00	1.27
<i>Murraya koenigii</i>	150-200	175	306.25	1.95	200-210	205	356.75	2.27	210-230	220	330.00	2.10	210-230	220	308.00	1.96	-	-	-	-
<i>Prunus armeniaca</i>	200-250	225	92.25	0.59	200-250	225	84.38	0.54	-	-	-	-	-	-	-	-	275-295	285	116.85	0.74
<i>Prunus domestica</i>	150-180	165	78.37	0.50	-	-	-	-	200-210	205	89.17	0.57	200-210	205	97.38	0.62	-	-	-	-
Total	1k g	1 Kg	801.22	5.10	1k g	1 Kg	773.13	4.93	1k g	1 Kg	781.92	4.99	1k g	1 Kg	778.68	4.96	1k g	1 Kg	599.30	3.81

Table 187 Panda Masala ingredient comparison between different markets of Bannu.

Plant Name	Markets of Bannu																			
	Standard				Chuk Bazar				Tanchi Bazar				Masala mandi Bazar				Laki Gate Bazar			
	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$	Proportion of plant g/kg	Mean (g)	Price in PKR	Price in US\$
<i>Allium sativum</i>	100-140	120	57.00	0.36	100-140	120	51.00	0.32	100-140	120	48.60	0.31	100-140	120	51.00	0.32	100-140	120	44.40	0.28
<i>Capsicum frutescens</i>	70-100	85	72.25	0.46	70-100	85	46.75	0.30	70-100	85	76.50	0.49	70-100	85	63.75	0.41	70-100	85	72.25	0.46
<i>Coriandrum sativum</i>	160-180	170	44.54	0.28	160-180	170	38.25	0.24	160-180	170	44.20	0.28	160-180	170	29.75	0.19	160-180	170	40.80	0.26
<i>Cuminum cyminum</i>	100-120	110	88.00	0.56	100-120	110	79.75	0.51	100-120	110	60.50	0.38	100-120	110	78.10	0.50	100-120	110	88.00	0.56
<i>Curcuma longa</i>	50-100	75	20.62	0.13	50-100	75	16.87	0.11	50-100	75	17.62	0.11	50-100	75	13.12	0.08	50-100	75	20.62	0.13
<i>Mentha piperita</i>	80-120	100	24.50	0.16	80-120	100	18.50	0.12	80-120	100	22.50	0.14	80-120	100	24.50	0.16	80-120	100	21.00	0.13
<i>Piper nigrum</i>	130-150	140	189	1.20	130-150	140	136.50	0.87	130-150	140	161.00	1.02	130-150	140	126.00	0.80	130-150	140	189.00	1.20
<i>Syzygium aromaticum</i>	120-140	130	286	1.82	120-140	130	214.50	1.36	120-140	130	247.00	1.57	120-140	130	286.00	1.82	120-140	130	273.00	1.74
<i>Zingiber officinale</i>	60-80	70	87.50	0.56	60-80	70	59.50	0.37	60-80	70	49.00	0.31	60-80	70	73.50	0.47	60-80	70	87.50	0.56
Total	1k g	1 Kg	869.4	5.53	1k g	1 Kg	661.62	4.20	1k g	1 Kg	726.92	4.61	1k g	1 Kg	745.72	4.75	1k g	1 Kg	836.57	5.32

Quantitative analysis

Cross market assessments

To evaluate the similarity and differences amongst the four (4) selected markets of district Bannu, Jaccard Index (JI) technique were used. The maximum similarity was 66.66 between Tanchi and Laki Gate markets, followed by Tanchi and Chuk markets (62.50). The Laki Gate and Masala Mandi markets and Chuk and Masala Mandi markets shared the same results (44.44), while Masala Mandi and Tanchi Market demonstrate the least Jaccard Index (31.57) (Figure 5).

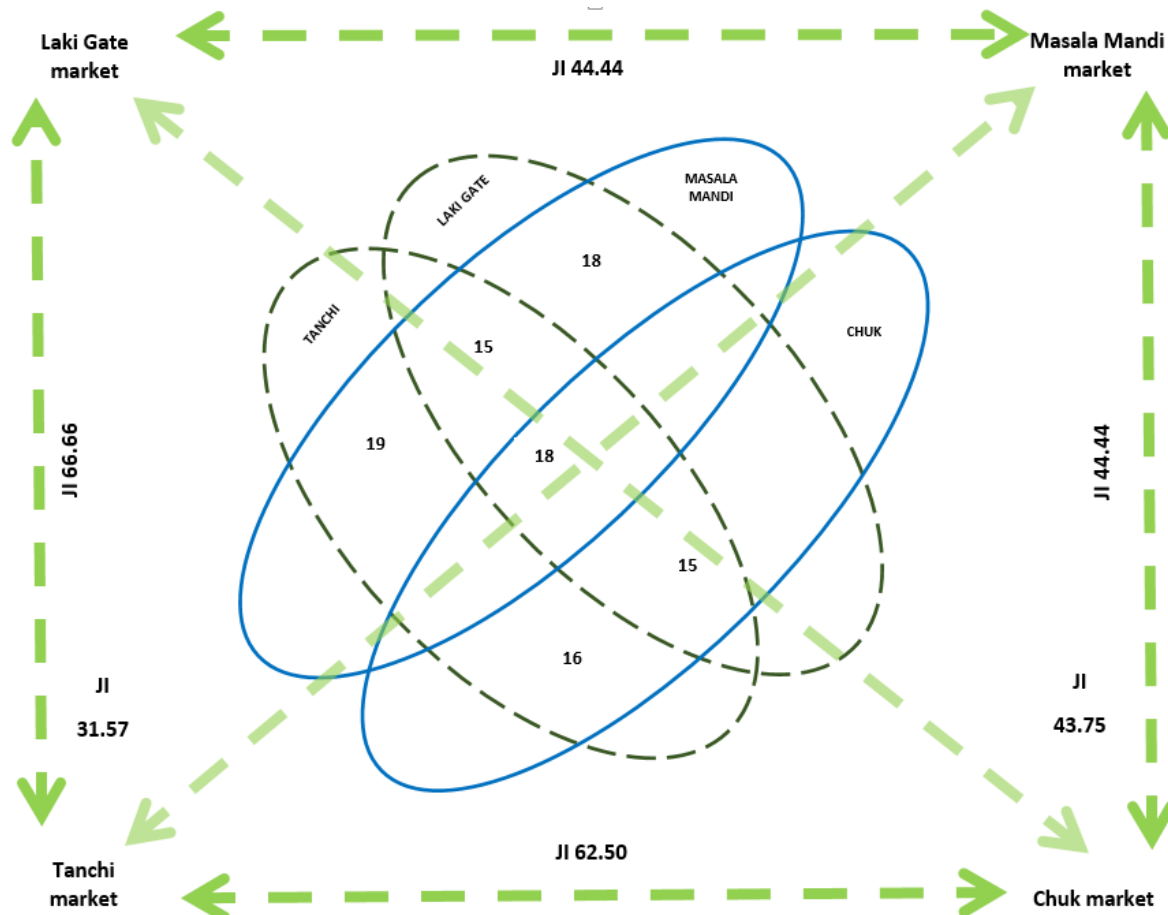


Figure 5. Venn diagram shows similarity amongst four selected markets of Bannu.

Correlation amongst different Markets

Correlation coefficient is used to measure the degree or proportion of a relationship existed amongst the two variables. In a current study the correlation analysis demonstrated that the highest positive correlation coefficient existed between Tanchi and Masala Mandi market ($r = 0.97$). The moderate positive correlation coefficient existed amongst Tanchi and Chuk market ($r = 0.89$), while the lowest positive correlation coefficient was recorded amongst Laki Gate and Chuk market ($r = 0.79$). There was no negative correlation existed amongst markets (Table 18).

Table 198 Correlation amongst four different markets of Bannu.

	<i>Chuk market</i>	<i>Tanchi market</i>	<i>Masala mandi market</i>	<i>Laki Gate market</i>
Chuk market	1			
Tanchi market	0.899977	1		
Masala mandi market	0.864406	0.97447	1	
Laki Gate market	0.799104	0.911568	0.957012	1

Correlation amongst different spice recipes.

There were 15 spice mixtures reported from 4 different markets of Bannu. Every market showed some unique composition and market price (Figure 6). The results showed pronounced degree of correlation (positive and negative) amongst the spice recipes. The highest positive correlation coefficient existed amongst Kabuli Pulao and Qeema masala recipes ($r = 0.99$), followed by Haleem and Garam masala recipes and Achar gosht and Haleem masala recipes ($r = 0.98$) each. The moderate positive correlation demonstrated by Haleem and Kabab masala recipes, Chat and Kabuli Pulao masala recipes and Chat and Qeema masala recipes ($r = 0.57$, $r = 0.55$ and $r = 0.52$) respectively. The smallest correlation coefficient reported amongst Kabab and Biryani masala recipes ($r = 0.05$), followed by Chat and Garam masala recipe ($r = 0.11$) and Kabab and Rosh masala recipe ($r = 0.17$). The highest negative correlation coefficient existed amongst Nihari and Qeema masala recipe ($r = -0.90$), followed by Chatni and Kabuli Pulao masala recipe ($r = -0.89$) and Chatni and Qeema masala recipe ($r = -0.87$). The moderate negative correlation coefficient existed amongst Nihari and Rosh masala recipe ($r = -0.54$) and Nihari and Biryani masala recipe ($r = -0.52$), while the lowest negative correlation coefficient were existed amongst Chat and Karahi masala recipe ($r = -0.13$) and Chat and Rosh masala recipe ($r = -0.17$) (Table 19).

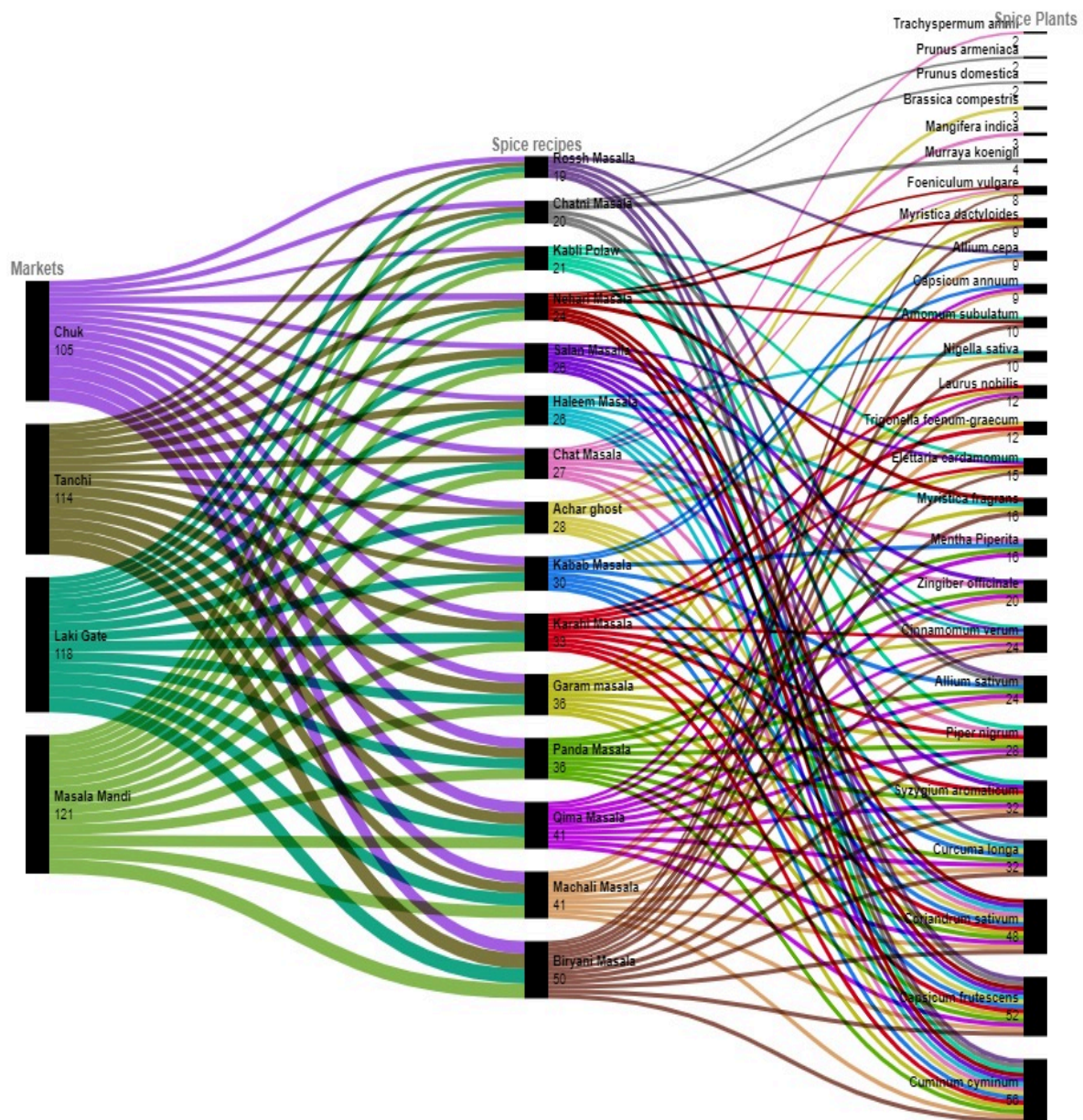


Figure 6. Alluvial diagram illustrating shows the presence of different spice mixtures and their composition in four selected markets of Bannu.

Table 19. Correlation amongst various spice recipes.

	<i>Garam Masala</i>	<i>Salan Masala</i>	<i>Biryani Masala</i>	<i>Karahi Masala</i>	<i>Rosh Masala</i>	<i>Qeema Masala</i>	<i>Kabli Pulao</i>	<i>Machli Masala</i>	<i>Kabab Masala</i>	<i>Haleem Masala</i>	<i>Achar ghost</i>	<i>Chat Masala</i>	<i>Nihari Masala</i>	<i>Chatni Masala</i>
Garam Masala	1													
Salan Masala	0.897	1.000												
Biryani Masala	0.854	0.974	1.000											
Karahi Masala	0.961	0.984	0.954	1.000										
Rosh Masala	0.951	0.942	0.959	0.973	1.000									
Qeema Masala	0.835	0.654	0.500	0.736	0.632	1.000								
Kabli Pulao	0.832	0.631	0.480	0.721	0.624	0.999	1.000							
Machli Masala	0.948	0.767	0.665	0.855	0.804	0.961	0.963	1.000						
Kabab Masala	0.456	0.268	0.054	0.339	0.174	0.870	0.869	0.704	1.000					
Haleem Masala	0.985	0.899	0.820	0.954	0.904	0.901	0.894	0.971	0.579	1.000				
Achar ghost	0.977	0.815	0.734	0.898	0.864	0.927	0.928	0.994	0.623	0.985	1.000			
Chat Masala	0.119	-0.279	-0.414	-0.134	-0.174	0.527	0.558	0.399	0.727	0.168	0.314	1.000		
Nihari Masala	-0.707	-0.708	-0.529	-0.717	-0.545	-0.903	-0.882	-0.814	-0.840	-0.819	-0.778	-0.265	1.000	
Chatni Masala	-0.682	-0.320	-0.203	-0.468	-0.442	-0.870	-0.893	-0.852	-0.782	-0.702	-0.809	-0.806	0.587	1.000

Novelty and recommendation

The knowledge of spices is an ancient knowledge passed from one generation to the other (Joseph and Voeks, 2021; Shariff *et al.*, 2021; Behera, 2021), but it is getting lost in the younger population. Spices have interesting medicinal properties. Hecke *et al.*, (2017) tested the antioxidant potential of some commonly found herbs and spices where strong correlation was existed amongst phenolic content and the extent of limited oxidation. Zhang *et al.*, (2019) reported 67 spices for antibacterial activity, also showed positive correlation amongst antibacterial effect and antioxidant and total phenolic content. Saxena *et al.*, (2009) showed a correlation amongst the antioxidant activity and phenolic content of some food plants (legumes, spices, oils, cereals, leafy vegetables, oil seeds, roots, tubers, and other vegetables). Pandey *et al.*, (2012) also showed positive correlation amongst antioxidant and total phenolic content of spices. Kim *et al.*, (2012) evaluated radical scavenging-linked antioxidant activities of spices and herbs. Also showed high correlation ($r=0.91$) between DPPH radical scavenging activity and total phenol content. The current study is the first-ever cross market assessment of spices recipe composition. The current study showed that there were large differences in the market value of supposedly standardized spice recipes. It is recommended that government takes notice about that issue so that the original spice mixtures could be available in markets.

Conclusions

Finally, we concluded that prices of each spice mixtures at each market different from each other and there was a clear-cut difference between the composition and prices. However, the most expensive market is the Laki gate market based on expensive spice mixtures as compared with other markets i.e., Chuk, Masala Mandi, and Tanchi markets. We found that the most diverse spice mixture was Biryani masala including fourteen spice taxa, while Rosh masala was the simplest spice mixture including five taxa out of twenty-six. More specifically, the most expensive spice recipe was-Kabli Polaw masala, meanwhile the cheapest spice mixture was Achar Ghost. Our study found strong correlation between Tanchi and Masala Mandi markets and Kabuli Pulao and Qeema masala recipes mixture.

Declarations

Ethics statement: Prior to the survey, we obtained oral informed consent from each participant.

Consent to publish: Any persons shown in images agreed to having their image published.

Funding: This research received no external funding.

Conflicts of Interest: The authors declare that they have no conflict of interest.

Author contributions: AAS designed the theoretical framework of the research, and, together with LB, planned the methodology and the field study. MM carried out the field study. FU, AB, and SK identified the spices taxa. AAS and LB analyzed the data, and drafted the first version of the manuscript, which was later commented on by and thoroughly revised and finalized by AAS and RWB. All authors have read and agreed to the published version of the manuscript.

Acknowledgments

Special thanks are due to all study participants of the different groups who generously shared their knowledge.

Literature cited

Aggarwal BB, Shishodia S. 2006. Molecular targets of dietary agents for prevention and therapy of cancer. *Biochemical Pharmacology* 71(10):1397-1421.

Ahmad S, Zafar M, Ahmad M, Ozdemir FA, Yaseen G, Sultana S, Kutlu MA. 2020. Palynological studies of winter weeds melliferous flora of district Bannu, Khyber Pakhtunkhwa, Pakistan. *Annali di Botanica* 10:77-86.

Anderson JA. 2009. China's Southwestern Silk Road in World History. *World History Connected* 6(1):1-7.

Arger A, Arger A. 2015. The Silk Road and its impact on globalization. *History* 105:16.

Balasubramanian S, Roselin P, Singh KK, Zachariah J, Saxena SN. 2016. Postharvest processing and benefits of black pepper, coriander, cinnamon, fenugreek, and turmeric spices. *Critical Reviews in Food Science and Nutrition* 56(10):1585-1607.

Behera HC. 2021. Traditional Agriculture, Culture and the Indigenous Knowledge (IK) among the Kondhs in Odisha, India of *Journal Human Ecology* 73:44-55.

Bouët A, Goundan A, Zaki C. 2020. Competitiveness of African countries in agrifood products. In: Bouët A, Odjo SP, Zaki C (eds.). *Africa Agriculture Trade Monitor* 77-117.

- Brown PM. 2009. Spices, Seasonings, and Flavors. In: Tarté R. (ed) *Ingredients in Meat Products*. (pp. 199-210). Springer, New York, NY.
- Butt MS, Pasha I, Sultan MT, Randhawa MA, Saeed F, Ahmed W. 2013. Black pepper and health claims: a comprehensive treatise. *Critical reviews in food science and nutrition* 53(9):875-886.
- Ceylan E, Fung DY. 2004. Antimicrobial activity of spices. *Journal of Rapid Methods and Automation in Microbiology* 12(1):1-55.
- Chi SP, Wu YC. 2014. Spices and seasonings. In: Toldrá F, Hui YH, Astiasarán I, Joseph G, Sebranek, Talon R. *Handbook of Fermented Meat and Poultry* (pp. 79-88). doi: 10.1002/9781118522653.ch10
- Chomchalow N. 2001. Spices production in Asia-An overview. *AU Journal of Technology* 5:2.
- Demam JM, Finley JW, Hurst WJ, Lee CY. 1999. *Principles of Food Chemistry* (Vol. 478, p. 446). Gaithersburg: Aspen Publishers.
- Embuscado ME. 2015. Spices and herbs: Natural sources of antioxidants—a mini review. *Journal of Functional Foods* 18:811-819.
- Gokoglu N. 2019. Novel natural food preservatives and applications in seafood preservation: A review. *Journal of the Science of Food and Agriculture* 99(5):2068-2077.
- Gupta M. 2010. Pharmacological properties and traditional therapeutic uses of important Indian spices: A review. *International Journal of Food Properties*, 13(5):1092-1116.
- Hanas OP. 1994. Seasoning ingredients. In: Underriner EW, Hume IR. (ed) *Handbook of Industrial Seasonings*. (pp. 20-42). Springer, Boston.
- Hecke VT, Ho PL, Goethals S, Smet DS. 2017. The potential of herbs and spices to reduce lipid oxidation during heating and gastrointestinal digestion of a beef product. *Food research international* 102:785-792.
- Hui YH. 2007. Food Manufacturing in the United States: Standard Industrial Classification. *Handbook of Food Products Manufacturing: Principles, Bakery, Beverages, Cereals, Cheese, Confectionary, Fats, Fruits, and Functional Foods* 1:85.
- Joseph E, Voeks R. 2021. Indian Diaspora Gastronomy: On the Changing Use of Herbs and Spices Among Southern California's Indian Immigrant Women. *Frontiers in Sustainable Food Systems* 5:83.
- Kaefer CM, Milner JA. 2008. The role of herbs and spices in cancer prevention. *The Journal of Nutritional Biochemistry* 19(6):347-361.
- Kamran S, Khan SM, Ahmad Z, Rahman AU, Iqbal M, Manan F, Ullah S. 2020. The role of graveyards in species conservation and beta diversity: a vegetation appraisal of sacred habitats from Bannu, Pakistan. *Journal of Forestry Research* 31(4):1147-1158.
- Kim IS, Yang M, Goo TH, Jo C, Ahn DU, Park JH, Lee OH, Kang SN, 2012. Radical scavenging-linked antioxidant activities of commonly used herbs and spices in Korea. *International journal of food sciences and nutrition* 63(5):603-609.
- Nadeem M, Riaz A. 2012. Cumin (*Cuminum cyminum*) as a potential source of antioxidants. *Pakistan Journal of Food Science* 22(2):101-107.
- Ndukwu MC, Simo-Tagne M, Bennamoun L. 2021. Solar drying research of medicinal and aromatic plants: An African experience with assessment of the economic and environmental impact. *African Journal of Science, Technology, Innovation and Development* 13(2):247-260.
- Padakatti T, Meti R. 2020. Indian spices: traditional and medicinal use. *International Journal of Home Science* 6(2):42-44.
- Pandey MM, Vijayakumar M, Rastogi S, Rawat AK. 2012. Phenolic content and antioxidant properties of selected Indian spices of Apiaceae. *Journal of herbs, spices and medicinal plants* 18(3):246-256.
- Peter KV, Babu KN. 2012. Introduction to herbs and spices: medicinal uses and sustainable production. In Peter KV (ed) *Handbook of herbs and spices second edition*, (pp. 1-16). Woodhead Publishing.
- Pukalchik M, Kydraliev K, Yakimenko O, Terekhova V. 2020. Effect of organic substances on wheat (*Triticum* spp.) productivity and soil enzyme functional stability under drought stress conditions. *Research on Crops* 21(2):210-214.
- Rathore MS, Shekhawat NS. 2008. Incredible spices of India: from traditions to cuisine. *American-Eurasian Journal of Botany* 1(3):85-89.
- Sachan AK, Kumar S, Kumari K, Singh D. 2018. Medicinal uses of spices used in our traditional culture: Worldwide. *Journal of Medicinal Plants Studies* 6(3):116-122.

- Sackewitz P. 1956. The Story of Spices von JW Parry, Chemical Publishing Co., New York. *Angewandte Chemie* 68(22):720-720.
- Saxena R, Venkaiah K, Anitha P, Venu L, Raghunath M. 2007. Antioxidant activity of commonly consumed plant foods of India: contribution of their phenolic content. *International Journal of Food Sciences and Nutrition* 58(4):250-260.
- Sehrawat R, Nema PK. 2018. Low-pressure superheated steam drying of onion slices: kinetics and quality comparison with vacuum and hot air drying in an advanced drying unit. *Journal of Food Science and Technology* 55(10):4311-4320.
- Sellami IH, Wannas WA, Bettaieb I, Berrima S, Chahed T, Marzouk B, Limam F. 2011. Qualitative and quantitative changes in the essential oil of *Laurus nobilis* L. leaves as affected by different drying methods. *Food Chemistry* 126(2):691-697.
- Shah AA, Rehman KU, Muhammad M, Khan N, Khan S, Shah MA, Khattak L. 2020. Eco-Floristic Study of Weed Flora of Garlic Crop in District Bannu, Khyber Pakhtunkhwa, Pakistan. *Elementary Education Online* 19(4):3212-3218.
- Shariff SM, Zahari MSM, Hanafiah MH, Ishak N. 2021. Traditional gastronomy knowledge transfers among Malay women: an exploratory study. *Journal of Foodservice Business Research* DOI: 10.1080/15378020.2021.1942748
- Shylaja MR, Peter KV. 2004. The functional role of herbal spices. *Handbook of herbs and spices* 2:11-21.
- Thomas L, Bhat AI, Cheriyan H, Babu KN. 2017. Value Chain Development and Technology Practices of Spices Crop in India (Cardamom, Ginger, Turmeric, Black pepper and Cinnamon). In Pandey PR, Pandey IR (eds.). *Challenges and Opportunities in Value Chain of Spices in South Asia*. SAARC Agriculture Centre.
- Walker T. 2008. Acquisition and Circulation of Medical Knowledge within the Early Modern Portuguese Colonial Empire. In Bleichmar D, Vos DP, Huffine K, Sheehan K. (Eds.), *Science in the Spanish and Portuguese Empires, 1500–1800* (pp. 247-270). Redwood City: Stanford University Press
- Zhang D, Gan RY, Farha AK, Kim G, Yang QQ, Shi XM, Shi CL, Luo QX, Xu XB, Li HB, Corke H. 2019. Discovery of antibacterial dietary spices that target antibiotic-resistant bacteria. *Microorganisms* 7(6):157.

