Nutritional Profiling of Selected Cereals, Legumes, Tubers, Fruits, and Vegetables for Food-based Intervention to Address Malnutrition in Nepal

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Introduction

The nutritional profiling of food holds significant importance, especially in the context of food plate design, dietary guideline development, and breeding purposes. The primary research objective is to create a comprehensive food composition database for seventy carefully selected foods, which include cereals, pulses, roots, tubers, fruits, and vegetables. It is worth noting that the nutritional content of food varies across different food composition databases published by various countries. This variability can be attributed to differences in genetics, sample type (whether raw, cooked, processed, or unprocessed), local climate, soil conditions, and other influencing factors. The core focus of this research is to provide comprehensive nutritional data, including micro-nutrients. This data will play a vital role in facilitating the development of dietary guidelines and will contribute to the efforts aimed at addressing the malnutrition issue in Nepal. The relation of food composition database is shown in **Figure 1 (**Source: U. Ruth Charrondiere, FAO).

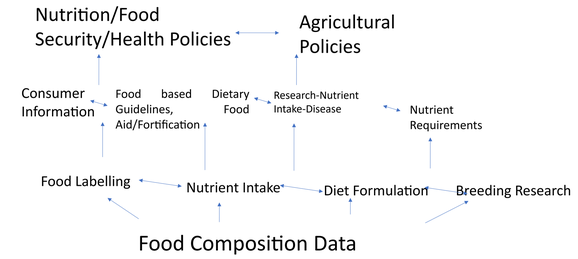

Figure 1: Implications of Food Composition Database

Materials and Methods

A total of 70 samples were gathered in Nepal from different locations, comprising 21 cereals, 6 legumes, 9 tubers and roots, 7 fruits, and 27 vegetables. The sampling method employed was purposive, with samples drawn from three distinct plots and subsequently combined to form composite samples. The analyses conducted included proximate analysis, assessment of mineral content (iron, calcium, phosphorous, zinc, sodium, and potassium), reducing sugar, determination of vitamin C levels, and measurement of total carotenoids as described by AOAC (2005). The sample collection area, number of food in individual food groups, and detailed list of sample is shown in Figure 2, Figure 3, and Table 1, respectively. The results are reported on a wet basis.

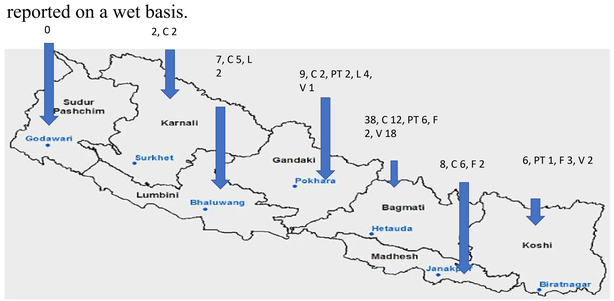

Figure 2: Sample Collection Province wise
Note: C=Cereals, L=Legumes, PT=Potato and Tubers, F=Fruits, V=Vegetables

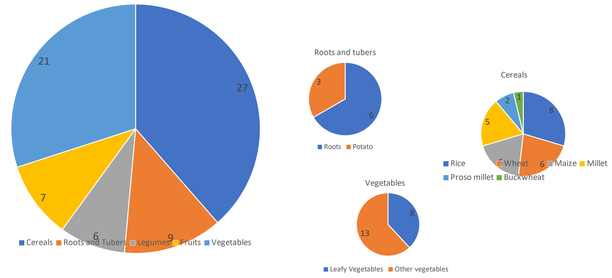

Figure 3: Sample category

Table 1: Sample list

Koshi	Madesh	Bagmati	Bagmati	Bagmati	Gandaki	Lumbini	Karnali
Chayote root local	Dasheheri	Mithe fapar 1	Marfa rayo	Deuti	Pokhreli basmati	Gautam	Dudhe chino
Chayote local	Seedless	MS-42-3	Sthaniya chamsur	Manakamana-3	Jetho budho	Bijaya	Hade chino
Chayote tender leaves	Swarna sab-1	Janakdev	Patane palungo	Rampur composite	Elephant yam	Mudule	
Washington novel	Samba mansuli sab-1	Khumal upahar	Khumal jyapu	Arun 2	Taro	Zinc wheat 1	
Khoku 1	Bahuguni 1	Suntale 1	Kathmandu local	Mankamana	String beans/Pinto beans	Zinc Wheat 2	
95 OKEJU	Chaite 5	Bensishar white	Pyuthane red raddish	Dalle kodo 1	Horse gram	Borlog	
	Hardinath 3	Kimichaur seto	Nino aril	Sailung kodo 1	Horse gram	Puja	
	Hardinath 6	Black eye bean	Akbare	Okhle kodo 1		Pratikshya	
		Cucumber	Bottle gourd local	Kabre kodo 2		cow pea	
		Pumpkin (Madale)	Black mustard leaves	Kabre kodo 1		Fiddle head	
		Pumpkin (Janto)	Pumpkin tender leaves	Colocasia tender leaves			
		Sandy pear	Srijana	Green Cornet			
		Sthaniya junar					

Results and Discussion

The energy content (Kcal/100 g of edible portion) provided by different food groups exhibited varying levels, with cereals being the highest at 312.8 Kcal/100 g, followed closely by legumes at 308.6 Kcal/100 g. In contrast, potatoes and tubers contributed the least energy, with only 89.4 Kcal/100 g, while fruits provided 50.5 Kcal/100 g, and vegetables contained 28.14 Kcal/100 g. Examining the carbohydrate content (g/100 g of edible portion) among the food groups, a similar pattern emerged. Cereals possessed the highest carbohydrate content, with 71.7 g/100 g, whereas vegetables had the lowest at 5.9 g/100 g. When considering the protein, fat, and ash content (g/100 g of edible portion), legumes exhibited the highest values, with 25.8 g, 3.4 g, and 3.2 g, respectively. In contrast, fruits contained the least protein (0.7 g), fat (0.1 g), and ash (0.4 g) among the food groups. The crude fiber content (g/100 g) of legumes was the highest at 3.82, followed by cereals at 2.52, and vegetables at 1.2. Fruits and legumes both exhibited crude fiber contents of less than 1 g/100 g. The reducing sugar content (g/100 g) was notably highest in fruits, measuring 5.04 g, while vegetables contained the least, with only 0.31 g. Regarding vitamin C content (mg/100 g), fruits had the highest concentration at 52.2 mg/100 g, followed by vegetables at 37.6 mg/100 g, and potatoes and tubers at 18 mg/100 g. Notably, cereals and legumes contained no detectable levels of vitamin C. The calcium, iron, phosphorus, potassium, and zinc content (mg/100 g) reached their highest levels in legumes at 203.4, 5.46, 309.6, 1225.7, and 2.8, respectively. In contrast, sodium content (mg/100 g) peaked in vegetables at 14.5, followed closely by potatoes and tubers at 14.3, and legumes at 8.4. Cereals stand out as a reliable source of calcium (89.1), iron (3.24), and zinc (2.14), while potatoes and tubers excel in potassium content at 413.8.

The lower mineral values in potatoes, tubers, fruits, and vegetables can be attributed to the expression of results on a wet basis. Furthermore, it's important to note that specific foods within these categories may exhibit variations in nutrient content, so the average nutrient values for food groups may not comprehensively represent all items within those groups. Nevertheless, the average nutrient profiles for food groups do provide valuable insights into nutrient distribution among these categories. The nutrient profile of food groups are represented in **Figure 4 and Figure 5**.

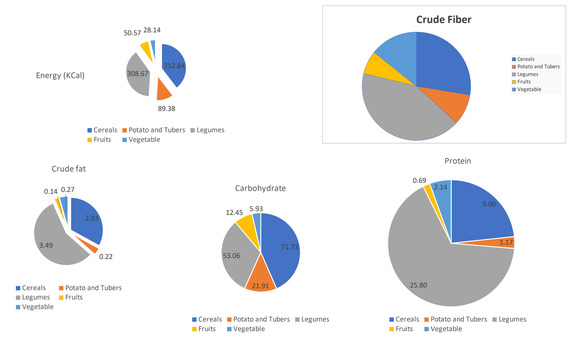

Figure 4: Energy value and proximate composition of food

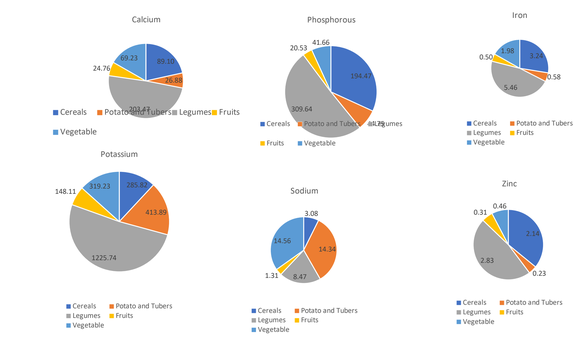

Figure 5: Mineral Content of Food

Conclusions

The overall results indicate that legumes serve as a valuable source of essential minerals, whereas fruits and vegetables are notably abundant in vitamins. This underscores the imperative to augment the incorporation of legumes, fruits, and vegetables in our daily dietary intake, thereby addressing the issue of hidden hunger and ensuring optimal nutritional security. However, it is essential to formulate a well-balanced diet tailored to the specific region, considering variables such as food availability, nutritional quality indices (pertaining to malnutrition status), and various socio-economic factors.

Acknowledgements

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AOAC (2005). Official Methods of Analysis of AOAC International. Ed. Horwithz, W. and Latimer, G.W., 18th Edn.