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CONSUMPTION OF CEREALS AND PULSES IN TRIBAL'S OF NORTH-WESTERN PART IN NASHIK DISTRICT, MAHARASHTRA (INDIA): STUDY WITH THE USE OF GIS

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Abstract

Nutrition depends on diet, which consists of various articles of food. Hence, balanced and nutritious food is the most important single factor in connection with attainment and maintenance of health [1]. An individual's health is largely determined by nutrition, and it is determined by diet, which consists of a variety of food items. A total of 115 villages were chosen, and 23 villages from the list of (ITDP) villages were randomly chosen in each tehsil (administrative unite in India). By using a probability proportional to the size of the various tribes, a total of 10 households from each chosen village were covered. For this reason, households in each village were divided into groups based on tribe and the necessary numbers of households (HH) from each tribe were included in the survey. The total amount of share in terms of weightage of assuming food item was calculated and using the allocated weightage. As a result, eating a well-balanced and healthy diet is the single most significant element in achieving and maintaining good health of an individual depends largely on nutrition. Tribal populations are malnourished and as a result of food deficiencies, they are at risk of developing dietary deficiency diseases.

Keywords: nutrition, GIS, cereals, pulses, food items and composite weightages, Arc GIS, ILWICH software

KONSUMPCJA ZBÓŻ I ROŚLIN STRĄCZKOWYCH U PLEMION PÓŁNOCNO-ZACHODNIEJ CZĘŚCI DYSTRYKTU NASHIK, MAHARASHTRA (INDIE): BADANIA Z WYKORZYSTANIEM GIS

Abstrakt

Zdrowie jednostki jest w dużej mierze zdeterminowane przez odżywianie i określone przez dietę, która składa się z różnych produktów spożywczych. Tak więc zbilansowana i bogata w składniki odżywcze żywność jest najważniejszym pojedynczym czynnikiem związanym z osiągnięciem i utrzymaniem dobrego stanu zdrowia [1]. W sumie wybrano 115 wiosek, a 23 z tej listy (ITDP) losowo wybrano w każdym tehsilu (jednostka administracyjna w Indiach). Stosując prawdopodobieństwo proporcjonalne do wielkości różnych plemion, zbadano łącznie 10 gospodarstw domowych (HH) z każdej wybranej wioski. Z tego powodu gospodarstwa domowe w każdej wiosce podzielono na grupy w oparciu o plemię, a niezbędną liczbę gospodarstw domowych z każdego plemienia uwzględniono w ankiecie. Łączna wielkość udziału w wadze danego produktu spożywczego w posiłku

została obliczona przy użyciu przydzielonej wagi. Populacje plemienne są niedożywione, a w wyniku niedoborów żywności narażone na rozwój chorób związanych z niedoborem pokarmowym.

Słowa kluczowe: żywność, odżywianie, GIS, zboża, rośliny strączkowe, artykuły spożywcze i złożone wagi, Arc GIS, oprogramowanie ILWICH

1. INTRODUCTION

Tribal communities are economically and socially disadvantaged and secluded from the general population. They often stand out from other demographic groupings due to their environment and eating habits. Their eating habits are governed by the whims of nature and range from severe food shortages during the lean season to substantial intakes of a variety of meals during the post-harvest period. There are many factors that contribute to the development of different morbidities and under nutrition, including geographic isolation, primitive agricultural practises, socio-cultural taboos, a lack of formal education, inadequate infrastructure facilities, improper health seeking behaviour, poverty, etc [2]. The Indian government has been implementing a number of programmes under the Tribal Sub-Plan (TSP) approach for the uplift of the tribal inhabitants in order to minimise this. Areas covered by the ITDP have more than 50% of a tribal population, while areas with lower proportions are covered by the modified area development agency (MADA). The population's nutritional condition mostly depends on how much food is consumed in accordance to its demands, which is in turn impacted by food availability and purchasing power. Diverse tribes have different socioeconomic circumstances, such as different agricultural practises and occupational profiles, which are influenced by the ecosystems in which they dwell.

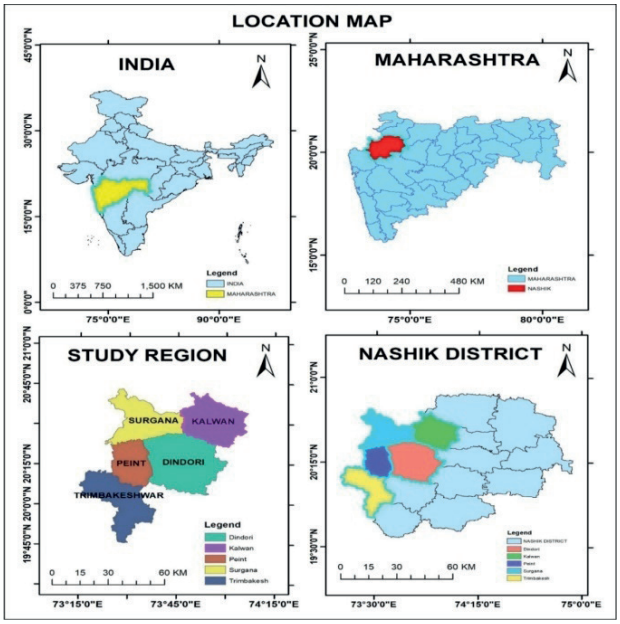

Fig. 1. The location map of the study area
Ryc. 1. Mapa ukazująca lokalizację obszaru badań

2. STUDY REGION

The study area is the north-western region of the Nashik District (Fig. 1). It extends from $19^0\ 44'\ 57''$ to $20^0 43'\ 55''$ north latitudes and $73^0\ 14'\ 05''$ to $73^0\ 06'\ 57''$ east longitudes. Study area covers an area of 4581.98 km^2, which is 29.40% of the geographical area of the district. It is surrounded by Deola and Chandwad tehsil in the east and the north-east, Gujrat state in the north, Palghar districts of Maharashtra State to the south-west, Igatpuri tehsil to the south. It consists of 5 tehsils, namely Peint, Dindori, Surgana, Kalwan and Trimabkeshwar. The population of the region is 976092. It includes 760 villages and 40 PHC [3].

3. OBJECTIVES

1. To investigate the consumption of cereals and pulses among the tribal people.
2. To study the composite nutritional value as per assuming weightages.
3. To examine the pattern of diet and nutrition and their availability and intake in study regions.

4. MATERIAL AND METHODS

In this segment, an effort is made to investigate the overall state of the diet eaten by families in the region's tribal areas. Families from different villages were surveyed for this purpose, using questionnaires that included details about the food eaten in the households [4]. Due to the lack of data and information on these factors at the tribal level could not be obtained directly from

secondary sources, necessitating a detailed fieldwork of PHC wise per head per day consumption has been calculated through the sample village survey-2021. A total of 115 villages, out of them 23 villages from the list of tribal villages and 1140 households were randomly chosen in each tehsil. By using a probability proportional to the size of the various tribes, minimum 10 households from each chosen village were covered. For this reason, households in each village were divided into groups based on tribe and the necessary number of households from each tribe are included in the survey. The poll was conducted over a 12-month period to capture seasonal change. Simple statical methods like percentage and ratio have been used for tables. The cartographic techniques i.e., Arc GIS and ILWICH software have been used for the research work to precise conclusions. Per head per day availability y of food stuffs like, cereals, pulses etc. have been found out and shown through PHC wise isopleths maps with use of Arc GIS software's.

5. RESULTS AND DISCUSSION

Food and diet are often used interchangeably, although this isn't always the case. Food is a composite mixture of different ingredients, the amount of which can range from a fraction of a gram to hundreds of grams in certain situations. Anything that can be used as food is how the word foodstuff is described. Nutrition, on the other hand, refers to a complex mechanism in which the food we eat is used to nourish our bodies. A healthy diet is one that includes all the vital nutrients that the body requires to adequately control all its functions. Since no single food item contains all these nutrients in the correct proportions, a varied diet is necessary [5]**.**

5.1. Cereals

Cereals make up the majority of people's normal diets. Carbohydrates are mostly obtained from them. In the tribal areas, rice, nagali, jawar, wheat, bajara, and other cereals are consumed. During the fieldwork, the heads of the household were asked about their cereal use. The proportions of cereal-consuming families are determined based on their responses, and the results are shown in Table 1.

In the north-western part of Nashik district, 86% of the total surveyed PHCs eat rice; it is available on all occasions. This indicates that rice is a staple food for these individuals. However, all the tehsils, such as Peint, Dindori, Surgana, Kalwan and Trembakeshwar have a high proportion of rice-eating households (more than 70%). More than 800 mm of rain falls in the selected part of the country. Rice is consumed by more than 70% of families in the same belt on a regular basis. Similarly, the tribal areas, which include Trembakeshwar and Surgana tehsils (100%), have a large proportion of rice-eating families (Table 1). This belt contains vast villages and agricultural area favourable for rice production. The citizens have enough money to buy rice.

In the mountainous study area, the proportion of families eating jawar, bajara, and wheat is lower; however, the proportion of families eating rice is higher (Fig. 3, 4, 6). Wheat is the second most common cereal consumed by tribal people. About 69.4% of the total

Table 1. Tehsil-wise proportion of families having consumption of cereals to total number of surveyed families, 2020–2021
Tabela 1. Proporcja rodzin konsumujących zboża w stosunku do całkowitej liczby badanych rodzin, 2020–2021

Tehsils (Blocks)	% of families consuming cereals					
	Rice	Wheat	Bajara	Nagali	Jowar	Nachani
Peint	90	80	12	35	15	18
Dindori	70	90	65	05	45	–
Surgana	100	85	30	28	25	38
Kalwan	70	80	58	15	35	12
Trimbak	100	12	18	48	05	28
Region	**86**	**69.4**	**36**	**26.2**	**25**	**19.2**

Reference: surveyed and computed by authors, 2020–2021

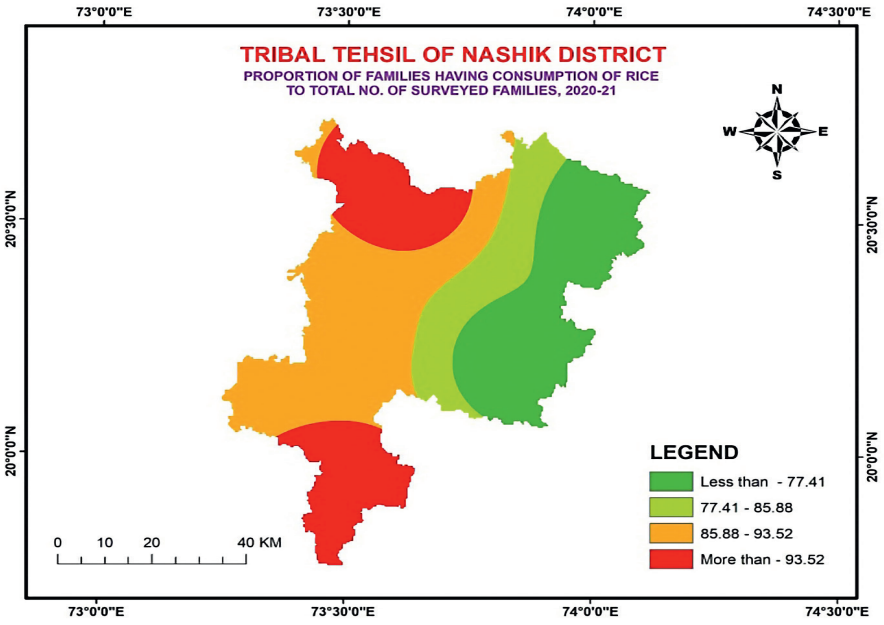

Fig. 2. Proportion of families having consumption of rice
Ryc. 2. Proporcja rodzin konsumujących ryż

number of surveyed PHCs said they consume wheat in their diet. Wheat-eating families are significantly more numerous in tribal tehsils such as Dindori, Peint, Surgana, Kalwan and some portion of Trimbakeshwar. In the study region, this is a major wheat-producing belt. These tehsils have stronger agricultural growth. The proportion of wheat-consuming families is slightly lower in the tribal regions [6].

In the study region, this is a minor nagali-producing belt. These tehsils have stronger agricultural growth.

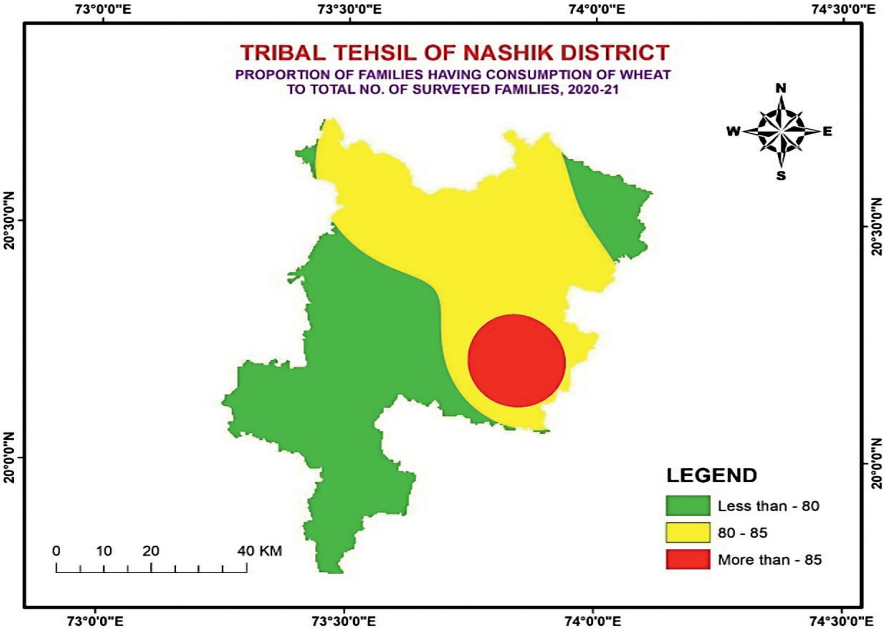

Fig. 3. Proportion of families having consumption of wheat
Ryc. 3. Proporcja rodzin konsumujących pszenicę

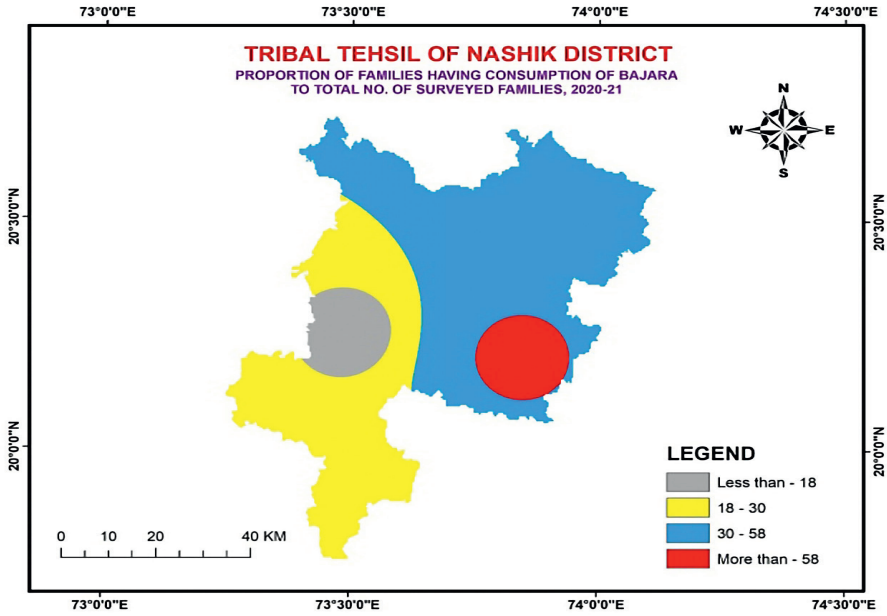

Fig. 4. Proportion of families having consumption of bajara (*Pennisetum glaucum*)
Ryc. 4. Proporcja rodzin konsumujących rozplenicę perłową (*Pennisetum glaucum*)

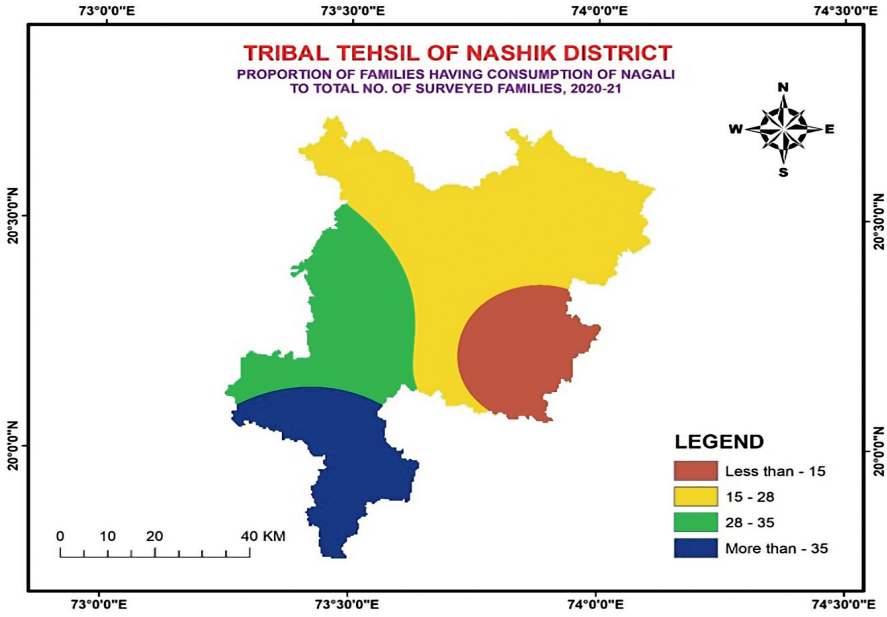

Fig. 5. Proportion of families having consumption of nagali
Ryc. 5. Proporcja rodzin konsumujących nagali

The proportion of nagali-consuming families is slightly lower in the tribal regions (Fig. 5). The residents of the tribal region eat jawar as their main dish. Around 25% of the PHCs questioned eat jawar as part of their daily diet. Figure 6 shows that in all health facilities, the proportion of tribal families who consume jawar is less than 5%. In some parts of the research area, particularly in places with primary health facilities such as kulwandi and jogmodi, the proportion of families who consume jawar ranges from 15 to 25%. Similarly, in kalwan PHC, the percentage of families who consume Jawar ranges from 25 to 35. 25 percent of Jawar-consuming families

live in the area ranging from Peint to Trimbakeshwar. Furthermore, indigenous people in all the tehsils studied consume less jawar. Ragi, scientifically known as *Eleusine coracana*, is a nutrient-dense cereal crop. Ragi has a variety of nutritional benefits for your body. Ragi intake has many health benefits, including lowering the risk of heart disease, improving digestion, and managing diabetes. One of the most nutrient-dense cereals is finger millet (*Eleusine coracana*) [7].

In the tribal tehsil of Nashik district, bajara becomes a food source for 36% of the total number of surveyed PHCs. This is the only tehsil where almost all of the

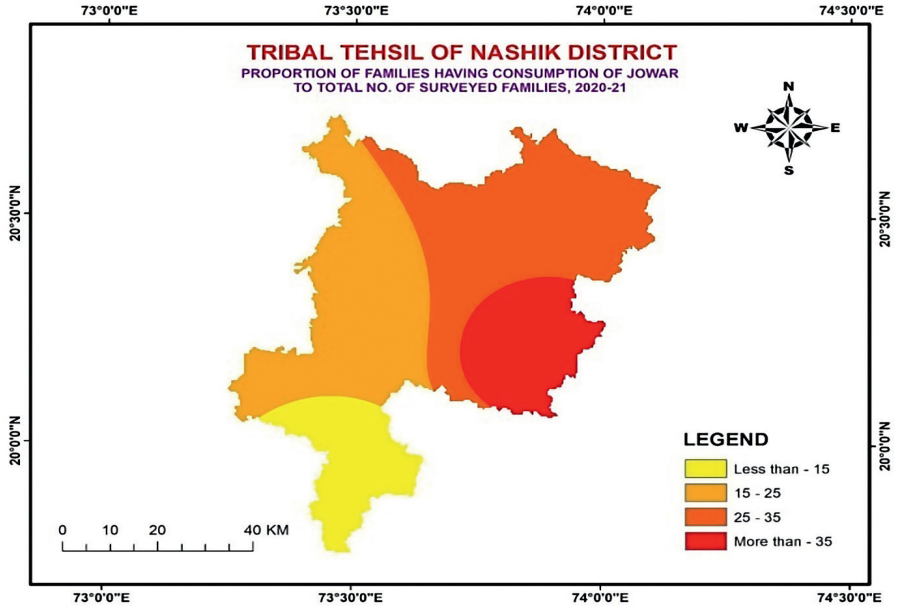

Fig. 6. Proportion of families having consumption of jowar (*Sorgum* sp.)
Ryc. 6. Proporcja rodzin konsumujących sorgo (*Sorgum* sp.)

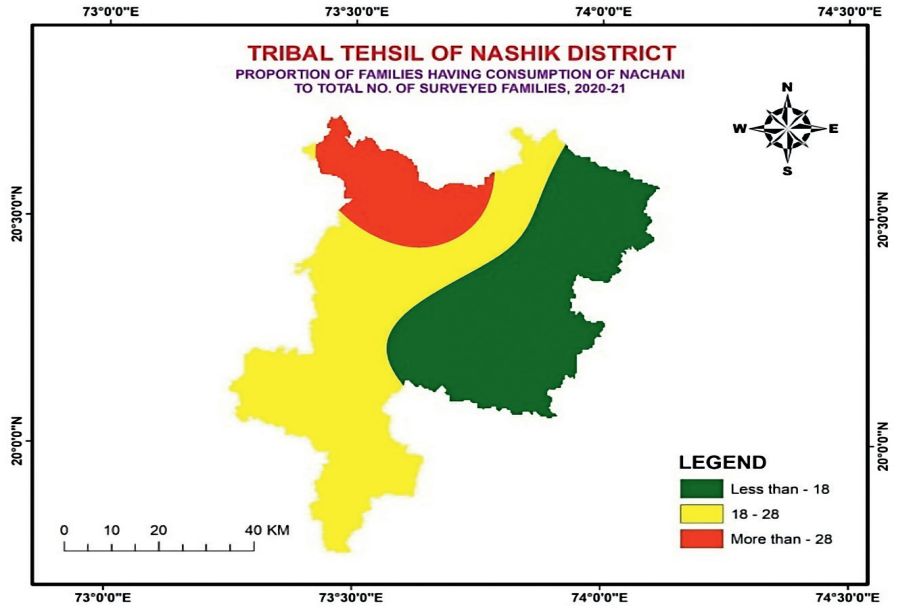

Fig. 7. Proportion of families having consumption of nachani (*Eleusine coracana*)
Ryc. 7. Proporcja rodzin konsumujących manneczkę łękowatą (*Eleusine coracana*)

surveyed families use bajara as a staple meal. With the exception of this tehsil, people in the rest of the research area consume relatively little bajara (Fig. 4). Nagali is the fourth most common cereal consumed by tribal people. About 26.2% of the total number of surveyed PHCs said they consume nagali in their diet. Nagali-eating families are significantly more numerous in tribal tehsils such as Trimabkeshwar, Peint, Surgana, Kalwan and some portion of Dindori.

About 19.2% of the total number of surveyed PHCs said they consume ragi (nachani) in their diet. Ragi-eating families are significantly more in tribal tehsils such as Surgana, Trimbakeshwar, Peint and some portion of Kalwan (Fig. 6).

5.2. PULSES

For the bulk of the tribal population, pulses are an essential source of protein. They are made up of different types of grains (Dals), peas, and beans. Pulses have a protein content ranging from 13% to 25%. In particular, pulses are more effective in helping people overcome protein deficiency. Pulses are a staple of the tribal diet. Pulses are high in iron and contain many vitamins such as riboflavin and thiamine [8].

This table clearly shows that pulses such as math, chawali, gram, moog, udid, toor are commonly consumed in their daily diet. Toor is one of the key ingredients in the everyday diet of more than 91.6% of the

Table 2. Tehsil-wise proportion of families paving consumption of pulses to total No. of surveyed families, 2020–2021
Tabela 2. Proporcja rodzin konsumujących rośliny strączkowe w stosunku do ogólnej liczby badanych rodzin, wg jednostek administracyjnych tehsil, 2020–2021

Tehsils(Blocks)	% of Families Consuming Pulses						
	Toor	Moog	Math	Udid	Chawali	Gram	Other
Peint	70	75	87	95	78	15	28
Dindori	98	92	65	88	95	38	43
Surgana	90	89	100	75	68	42	53
Kalwan	100	92	87	62	62	52	35
Trembak	100	100	89	75	70	62	45
Region	**91.6**	**89.61**	**85.6**	**78.4**	**74.6**	**41.8**	**40.8**

Reference: surveyed and computed by authors, 2020–2021

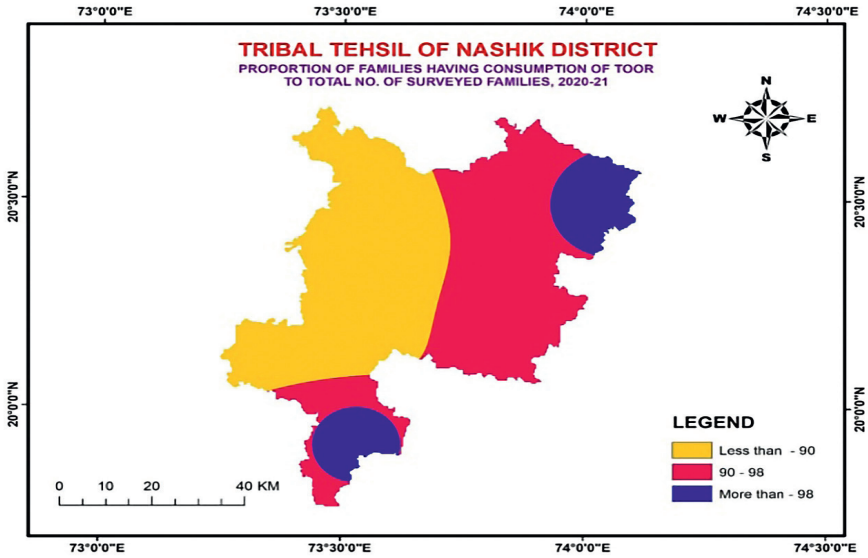

Fig. 8. Proportion of families having consumption of Toor (*Cajanus cajan*)
Ryc. 8. Proporcja rodzin konsumujących niklę indyjską (*Cajanus cajan*)

families polled. Moog is consumed by about 89.6% of the overall studied households (Table 2). However, in economically established tehsils such as Peint the proportion of families who consume moog is lower. Math and udid are also in higher demand among tribals. The math market belt stretches from Peint to Trimbakeshwar Tehsil, as seen in the table. Udid use by surveyed families is higher in the Peint and Dindori tehsils, where it accounts for more than 85% of families [9].

The research regions of Dindori and Peint tehsils have the highest concentration of Chawali-consuming families. Gram is consumed by about 41.8% of the

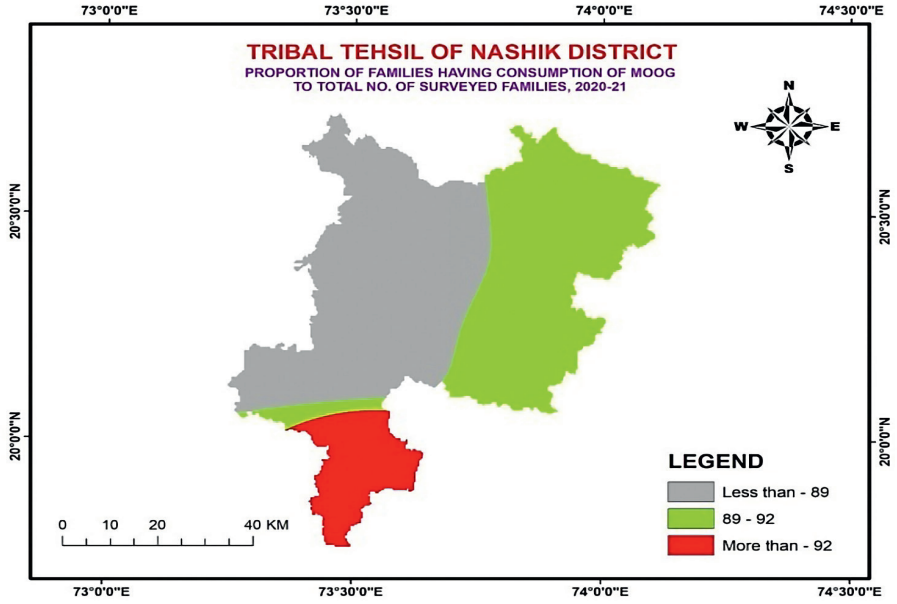

Fig. 9. Proportion of families having consumption of Moog
Ryc. 9. Proporcja rodzin konsumujących moog

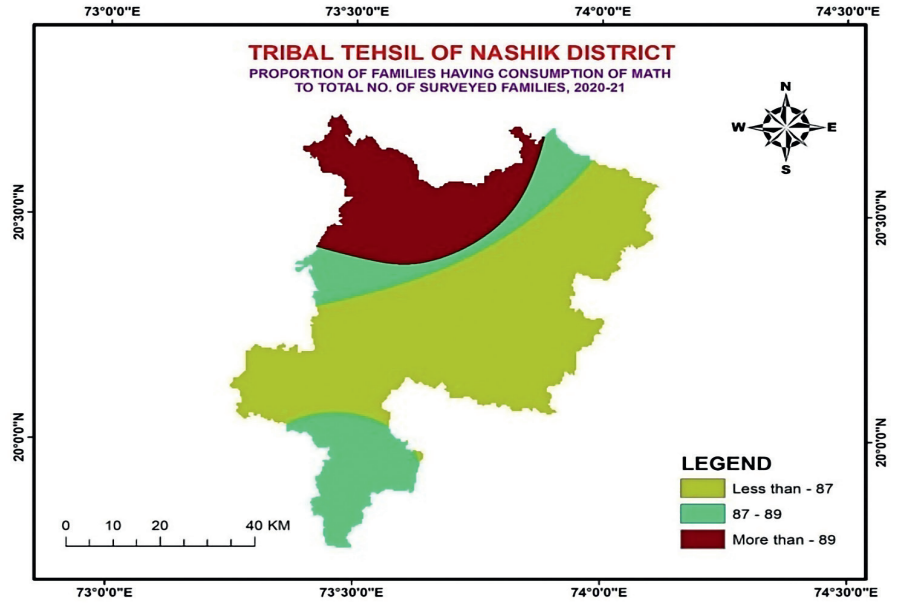

Fig. 10. Proportion of families having consumption of math
Ryc. 10. Proporcja rodzin konsumujących math

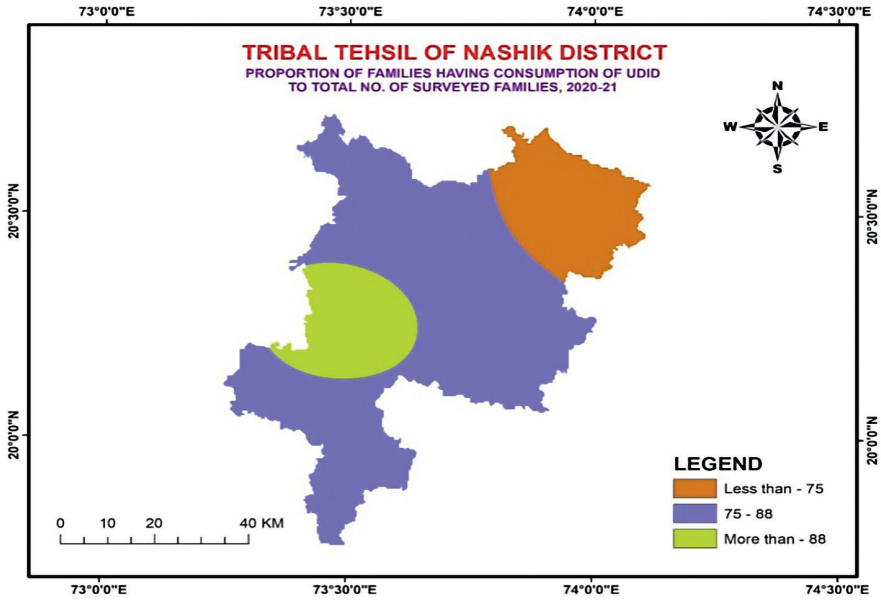

Fig. 11. Proportion of families having consumption of udid (*Vigna mungo*)
Ryc. 11. Proporcja rodzin konsumujących fasolę mungo (*Vigna mungo*)

overall studied households. Better soils are needed for the growth of Gram. The tehsils of Dindori, Surgana and Kalwan have a lot of these kinds of soils. Other areas of the soils are infertile, which may explain why a smaller proportion of families consume gram on a daily basis

5.3. COMPOSITE NUTRITIONAL VALUE

Weightages according to calories and percentage of families using different food products is allocated to calculate the tehsil-wise composite nutritional value. The weightages assigned to each object are listed in the table below.

During the fieldwork, data was gathered on how the families consumed different food products in their daily meals. The data was processed, and the percentages of families that consumed each food item were calculated. The total amount of share in terms of weightages of a given food item in the meal was calculated using the allocated weightages (Table 3). For example, in Surgana tehsil, 100 percent of total families surveyed eat Rice in

Table 3. Weightages given to various food items according to per 100% of families using them and calories they contain
Tabela 3. Wagi przydzielone do różnych artykułów spożywczych, wg procentu rodzin używających te artykuły and wartości kalorycznej

Sr. No.	Food Items (Cereals	Weightages	Sr. No.	Food Items (Pulses)	Weightages
1	Bajara	10	1	Gram	10
2	Jawar	08	2	Chawali	09
3	Wheat	06	3	Udid	09
4	Rice	06	4	Moog	08
5	Nagali	04	5	Math	08
6	Nachani	04	6	Toor	07
			7	Other	06

Reference: Computed by Researcher, 2020–2021

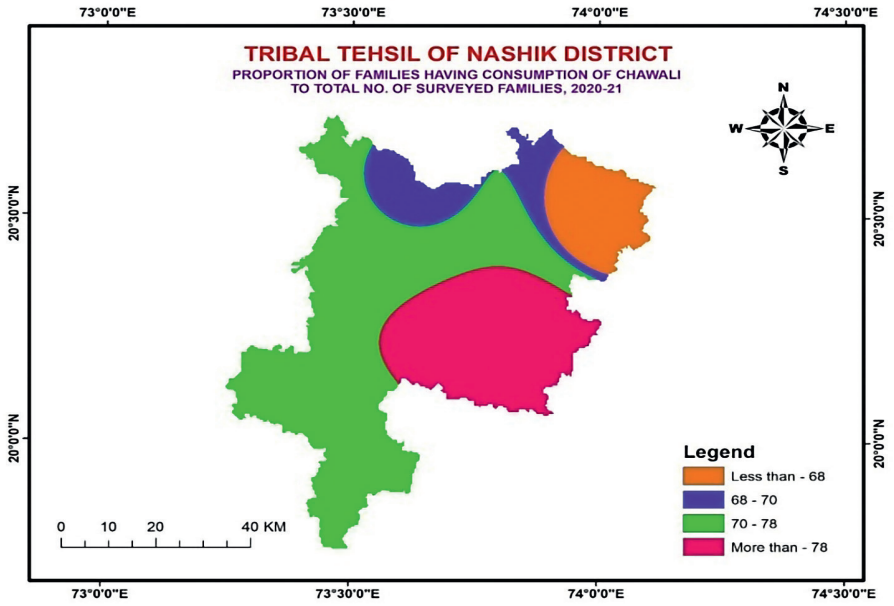

Fig. 12. Proportion of families having consumption of chavali (*Vigna unguiculata subsp. unguiculata*)
Ryc. 12. Proporcja rodzin konsumujących fasolę czarne oczko (*Vigna unguiculata subsp. unguiculata*)

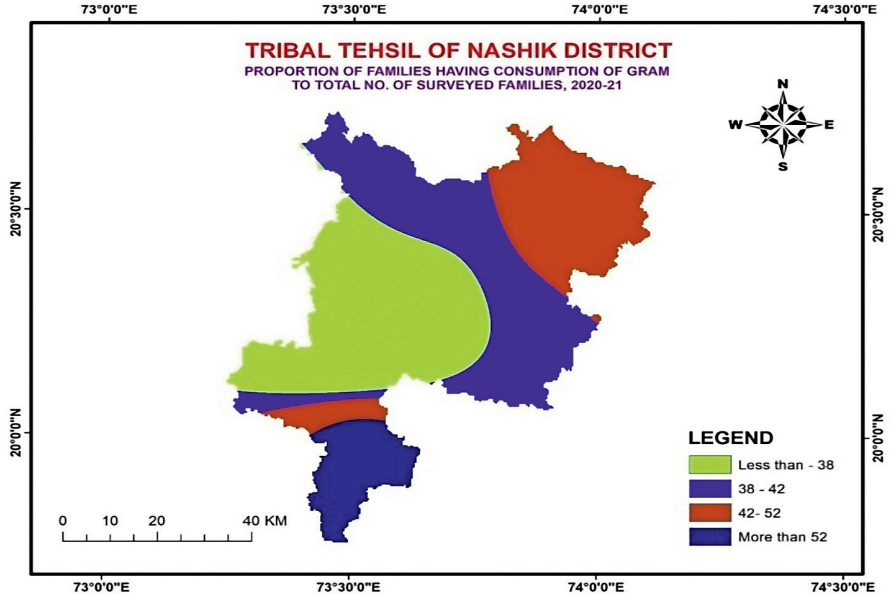

Fig. 13. Proportion of families having consumption of Gram (*Vigna radiata*)
Ryc. 13. Proporcja rodzin konsumujących fasolkę złotą (*Vigna radiata*)

their diet. Therefore, the corresponding weightages for this percentage of families would be 6. The cumulative nutritional values of cereals are derived from the total of all weight ages measured so far (Table 4). The composite nutrient values for cereals were 14.72 in Peint tehsil. This method was used to quantify the composite nutrient value for pulses, edible oil, milk, vegetables, and fruits. The cumulative composite value of Peint tehsil was 67.22 when the composite nutrition values were added together. The table shows the cumulative composite nutrition values measured on a tehsil-by-tehsil basis [10].

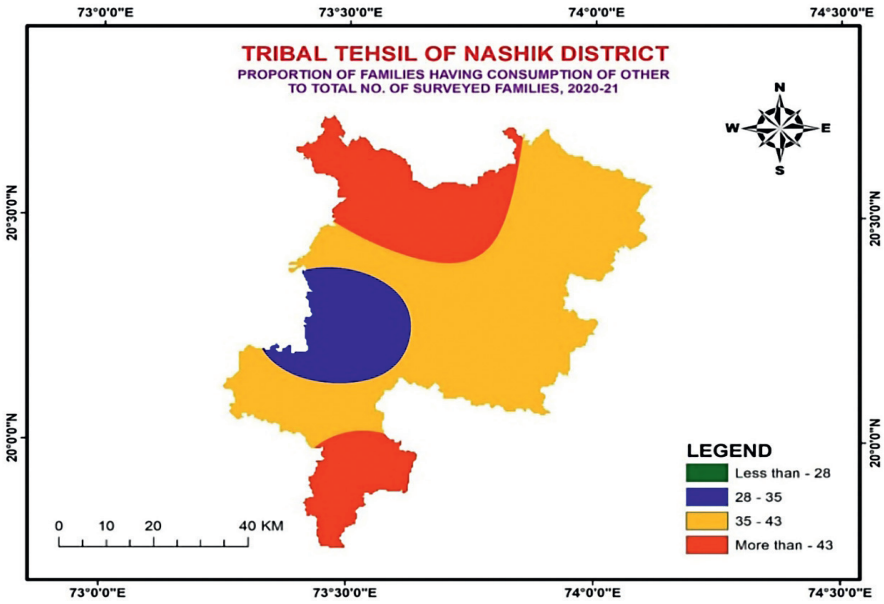

Fig. 14. Proportion of families having consumption of other pulses
Ryc. 14. Proporcja rodzin konsumujących inne rośliny strączkowe

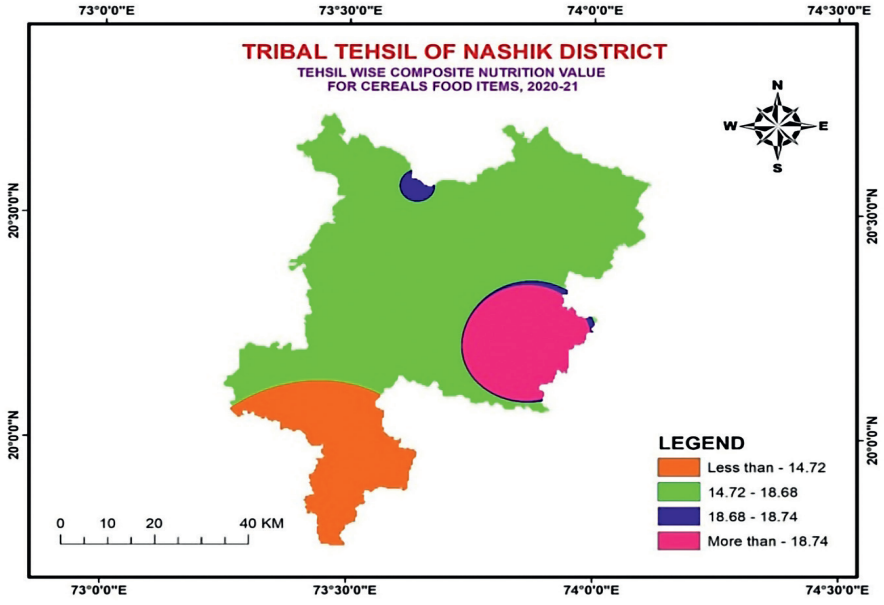

Fig. 15. Block wise composite nutrition values of cereal food items
Ryc. 15. Wartości odżywcze artykułów zbożowych wg bloków

The average composite nutrition values for the study area are 74.81 as seen in the table above. The Dindori tehsil of the region's aggregate values is higher than the normal. Since this area of the region is more under agriculture, people have a higher buying power and can afford to buy healthier foods, while the rest of the region's composite nutrition values are poor. Tribals live in this part of the area. They have a poor economic situation. Since tribal people are poor, they cannot afford to buy a variety of nutritious foods. Tribal populations are malnourished, and as a result of food deficiencies, they are at risk of developing dietary deficiency diseases [11].

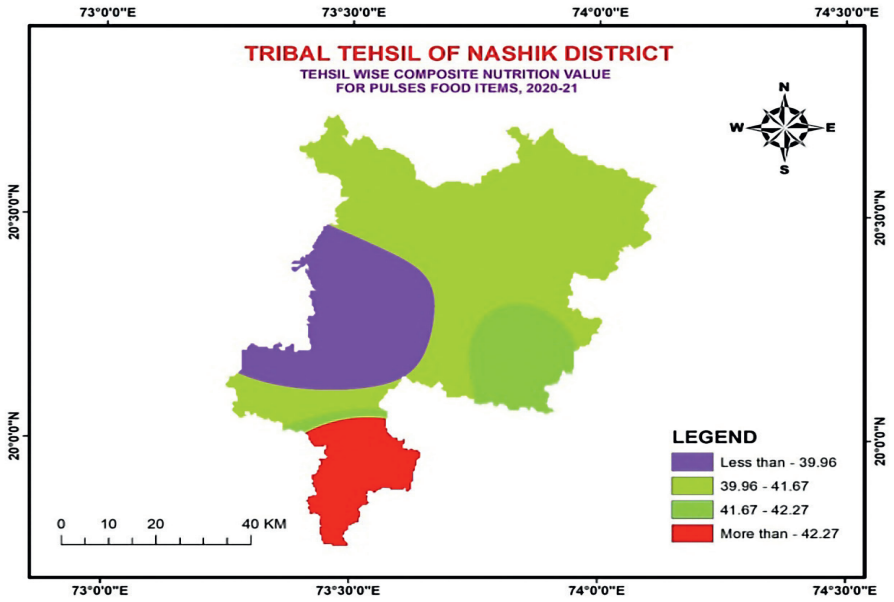

Fig. 16. Block wise composite nutrition values of pulse food items
Ryc. 16. Wartości odżywcze roślin strączkowych wg bloków

Table 4. Tehsil-wise composite nutrition values for various food items, 2020–2021
Tabela 4. Sumaryczne wartości odżywcze dla różnych rodzajów żywności wg rejonu administracyjnego, 2020–2021

Sr. No.	Tehsils	Cereals	Pulses
1	Peint	14.72	36.61
2	Dindori	19.9	42.27
3	Surgana	18.74	41.67
4	Kalwan	18.68	39.96
5	Trimbak	11.96	44.07
Region		**16.8**	**40.92**

Reference: Computed by Researcher, 2020–2021

6. CONCLUSIONS

The status is measured by computing composite nutrition values. For the entire region, the average composite nutrition value is 74.81. The proportion of wheat-consuming families is slightly lower in the tribal regions The indigenous inhabitants of the study region eat jowar, maize, wheat, and bajara as their major foods. Despite the fact that the terrain is conducive to rice farming, they still consume rice on occasion. indigenous people in all the tehsils studied consume less jawar. Ragi, scientifically known as *Eleusine coracana*, is a nutrient-dense cereal crop. Ragi has a variety of nutritional benefits for your body. Ragi intake has a number of health benefits, including lowering the risk of heart disease, improving digestion and managing diabetes. Pulses are a staple of indigenous people's diets, which they consume on a daily basis [12]. These people are unable to acquire such expensive items due to their poverty. They cannot afford to buy a variety of nutritious foods.

ABBREVIATION

ITDP – Integrated tribal development programme
HH – Households
PHC – Primary health centre
GIS – Geographical information system
MADA – Modified area development agency
TSP – Tribal sub plan

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