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Effects of eating habits and food components on working efficacy, and attraction level of tribal youths in traditional farming

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A multiform field study was performed over a period of four years from 2017-18 to 2020-21 to perceive the corporal working efficiency and attraction level in farming by the way of livelihood assessment of tribal youths. The manual working capacity of tribal youths is quite diminished owing to deviations in food components, residual deposits of harmful agrochemicals on food products, manipulated working atmosphere, and radical changes in the socio-economical condition of the tribals. The maximum tribal youths are physically weakened, have an impaired immune system, are severely malnourished along with multiple nutrient deficiency disorders due to ignorance of their traditional diets. It has been observed that there is on an average 46.07% decrease in own working efficiency with a 40% aberration in attraction level from farming activities over the last sixty years from 1960-61 to 2020-21. In the existing stipulation, only 14% of tribal youths are extremely attracted, and 19% are fairly involved, however, 27% of tribal youths take up farming as a subsidiary occupation, and 40% of youths are away from parental farming for livelihood. The traditional food components of tribals were also replaced from nutrient-affluent small millets, and underutilized fruits and vegetables to energy-loaded less nutritious rice, wheat, and potatoes. The traditional wisdom for uses of these historic food components is also decreased considerably concerning spending time. It is an imperative need on behalf of the tribal youth healthiness to have an adequate nutritional daily diet which will deliver a healthy life to recover their physical working capacity.

Keywords: Millets, Modern foods, Nutritional security, Traditional foods, Traditional wisdom, Tribal youths

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Historically, the tribal communities of Rajasthan habitually experienced adverse natural situations and had identical fitness to perform outstandingly in dangerous ecological conditions for an extensive period without power-driven support. They could also walk for miles in a day on stony and undulated areas with supplementary weight. The tribals gain essential energy and nourishment from day-to-day consumption of traditional food components to maintain their physical and mental health and raise work performance. Subsequently, earlier small millets and underutilized organically grown fruits and vegetables have been extensively consumed by tribals as staple foods. Gradually, the area coverage under these nutrient-rich crops reduced steadily over past eighty years and especially after the Green Revolution period due to their lesser monetary competitiveness with key food crops such as potatoes, wheat, paddy and hybrid maize. Both the historical records of tribal dietary traditions and the evidence of cropping patterns indicate that millets and nutrient-rich traditional food crops such as beans, and barley had a distinctive position in the daily diet and played a significant role in the nutritional security of tribal communities. In the past sixty years, significant changes were reported in lifestyle, dietary habits, mechanization in agriculture, and residual effects of agrochemicals, which have negative impacts on the working capacity of tribal farmers. There has also been an increase in wine consumption and non-communicable diseases like diabetes, cardiovascular troubles, chronic respiratory problems, and poor mental health. Initiatives of various socio-economic improvements, as well as described adverse effects of climate alteration, have resulted in shifting food habits and dietary components of tribal[1]. The daily diet based on nutrient affluent small millets, underutilized fruits and vegetables provides

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restorative nutrition, which helps in maintaining better health by providing vital minerals, micronutrients, fibre, protein, carbohydrates, vitamins, starch, and also has a good profile of phenolic acid, flavonoids and amino acids along with lower glycemic index[2]. Small millets are relatively more nutritious than rice and wheat in terms of dietary fibre, proteins, minerals (iron, phosphorus, potassium, calcium, magnesium, manganese, copper, zinc, and boron), vitamin B (niacin, pyridoxine and folic acid), and health-encouraging phytochemicals (carotenoids, polyphenols, isoprenoids, phytosterols, saponins, polysaccharides, lignans, phytoestrogens, phycocyanins)[2]. Accordingly, millet can be helpful in to fight against malnutrition, reducing blood cholesterol, and sugar levels, and it also contains lecithin which strengthens the nervous system[1]. Traditional Indian meals, such as jaggery rich in iron (4.6 mg 100 g^{-1}), roasted chickpea seeds abundant in protein (20.5 g 100 g^{-1}), and sesame seeds good in potassium (468 mg 100 g^{-1}), were commonly consumed by tribal people, which were highly useful for healthiness[2]. However, at present a lot of coloured candies, potato chips, fat-containing bakery items of cake, noodles, and pups are prepared by using baking powder, preservatives, oil and artificial colours. All these products are popular snacks among tribal youths which are less nutritious and more deleterious to health. Similarly, maximum tribal youths have shifted from low-caloric, fibrous nutrient-rich traditional diets to energy-rich food products such as saturated fats, sugar, oils, meats, lower category processed foods, and greater consumption of soft drinks and wines[3]. Millets, fruits like date palm, custard apple, *jamun*, *karonda*, ber, *pilu*, mahuva, mulberry, *kainth*, *khirni*, tamarind, *bael*, aonla, and boiled vegetables such as cluster bean, *kachri*, *ker*, *khejri* pods, snap melon, spine gourd, were recognized as the major components of the traditional diet, which have excellent nutritive value, are now hardly eaten by the tribal youths[1,4]. The older tribal farm women had necessary erudition about value addition and food processing by drying, nutritive liquor making, fruit paste, mediational arak, and concentrate juice by the use of seasonal fruits and vegetables which were available sufficiently during a particular season. The hypothesis behind the research is to determine whether the switch from traditional, nutrient-rich meals to modern, less nutrient-dense foods from the past had a major negative impact on tribal people's ability to work physically and their interest in farming occupation.

Methodology

An intensive field study was executed throughout the four years (2017-18 to 2020-21) to investigate the transformation in food components and daily diets of the tribals and their outcomes on working capability and attraction level in farming activities for the livelihood in the tribal-dominated *Aravali* region of Rajasthan in districts Pali, Sirohi, and Udaipur. Altogether, 1500 tribal farmers were interrogated regularly during the experimentation on various aspects. Three major groups, *i.e*., 500 farmers and farm women from tribal-dominated areas of each district *i.e.* Sirohi, Pali and Udaipur. Based on age and gender each group of farmers again divided into five subgroups *i.e.,* sub-group i (Tribal farmer aged 20-40 years), sub-group ii (Tribal farmer aged 41-60 years), sub-group iii (Tribal farmer aged > 61 years), sub-group iv (Tribal farm women aged < 50 years) and sub-group v (Tribal farm women aged > 50 years) for accruing all required information for fulfilment of the research objectives. Further, the relevant information regarding modern agriculture, advanced technology, physical working capacity and interest in doing agricultural works was gathered from sub-group i (Tribal farmer aged 20-40 years), information regarding transactions from traditional to modern agricultural technology and field working capacity was collected from subgroup ii (Tribal farmer aged 41-60 years) and knowledge regarding traditional farming systems like millet crops, traditional fruits and vegetables and working capacity and dedication for agricultural work was inquired from sub-group iii (Tribal farmer aged > 61 years). Nutritional value, food preparation, food consumption capacity and feeding pattern, value addition, and product diversification possibility of the millets, traditional fruits and vegetables were acquired from both farm women groups *i.e.,* sub-group iv (Tribal farm women aged < 50 years) and sub-group v (Tribal farm women aged > 50 years).

A well-planned inquiry form was developed for impact assessment and preliminary exams with the support of insistently structured evaluating scales[5]. The investigation survey forms were considered to apprehend all aspects that would illustrate the working proficiency and attraction level of the tribal youths. The interviewees were interrogated at their

homes, fields, gram sabha meetings, during on-campus training at KVK, Sirohi; DEE, MPUAT Udaipur and ARSS, Sumerpur-Pali and off-campus training at different villages. These sites were designated for the suitability of respondents and to make a particular state of affairs, where reciprocal (investigator and respondents) communicated their assessments freely and familiarly with the assistance of resident workers. The secondary facts were gathered from available authentic sources to sustain the outcomes of primary data. After the assortment of information, a tally sheet was arranged which simplified the tabulating of responses to each enquiry. Through expressive statistics, the findings were analysed by calculating exclusively mean and percentages. The results were simply positioned in tables and figures for clarity.

Results and Discussion

Diminishing physical working efficiency of tribal youths

The information documented through the investigation showed that the corporal working capacity of the tribal youths was continuously decreased. The mean working efficiency of the tribal youths was reduced by 18.83% during 40 years from 1960 to 2000 and an additional 33.56% in the next 20 years from 2001 to 2020 and the collective diminution in working capacity during the last 60 years from 1960 to 2020 was 46.07%. The maximum (34.62%) reduction was observed in manual land preparation, followed (33.33%) by pulling water from wells, light work (34.62%), heavy work (35.71%) and walking (37.5%) during 1960 to 2000, although intense decline in pulling water from wells (72.73%), pulling water from wells by bullocks (50%), digging of pits (61.54%) and walking (60%) from 2001 to 2020 (Table 1). The possible reasons for the reduced physical working ability of tribal youths were the transformation in dietary patterns and food ingredients, lower consumption of nutrient-rich traditional fruits and vegetables, doing the least possible physical work, deviations from historical daily routines, lower dietary intakes, intensive mechanization in agriculture and residual effects on foods due to exhaustive use of

Table 1 — Effect on the physical working capacity of the tribal farmers (n=900)

Field/physical work (manually)	Per cent decrease in physical working capacity					Overall (1960-2020) decrease (%)
	Before 1960 (working hours)	From 1960 to 2000		From 2001 to 2020		
		Working hours	Per cent decrease	Working hours	Per cent decrease	
Manually land preparation	13.0	8.5	34.62	5.5	35.29	57.69
Picking of FYM	11.0	9.0	18.18	7.0	22.22	36.36
Spreading of FYM	13.0	11.0	15.38	7.5	31.82	42.31
Ploughing by bullock	9.0	7.5	16.67	5.5	26.67	38.89
Work with spade	13.0	9.5	26.92	6.5	31.58	50.00
Field levelling work	9.0	7.5	16.67	6.0	20.00	33.33
Seed sowing	11.0	8.5	22.73	6.5	23.53	40.91
Hammer work	9.5	8.5	10.53	5.5	35.29	42.11
Pruning of trees by axe	9.0	7.5	16.67	5.5	26.67	38.89
Weeding and Hoeing	11.0	9	18.18	4.5	50.00	59.09
Flood irrigation by basin	13.0	11	15.38	8.0	27.27	38.46
Basin preparation	9.0	8.5	5.56	6.5	23.53	27.78
Spray of insecticides	11.0	9	18.18	5.5	38.89	50.00
Crop cutting by sickle	9.0	7.5	16.67	5.5	26.67	38.89
Pickup basket (10-15 kg)	11.0	9.5	13.64	6.5	31.58	40.91
Pulling water from well	7.0	5.5	21.43	1.5	72.73	78.57
Collection of crops	13.0	11.5	11.54	8.5	26.09	34.62
Threshing work (manually)	11.0	10.5	4.55	7.5	28.57	31.82
Winnowing	9.0	8.5	5.56	6.0	29.41	33.33
Vegetable picking	8.5	6.5	23.53	4.5	30.77	47.06
Pulling water from the well by bullock	7.5	5.0	33.33	2.5	50.00	66.67
Animal grassing	11.0	9	18.18	6.5	27.78	40.91
Bird watching	11.0	10.5	4.55	6.5	38.10	40.91
Digging of pits	9.0	6.5	27.78	2.5	61.54	72.22
Well digging	5.0	3.5	30.00	2.0	42.86	60.00
Other light works	13.0	8.5	34.62	5.0	41.18	61.54
Other heavy works	7.0	4.5	35.71	2.5	44.44	64.29
Average working capacity	9.8	7.9	18.83	5.27	33.56	46.07
Sack picking (kg)	100.0	75.0	25.0	40.0	46.67	60.0
Walking (km/day)	40.0	25.0	37.5	10.0	60.0	75.0

agrochemicals. At present, tribal farmers are alive relatively more sophisticated daily lives in comparison to their previous challenging existence, which can have adverse strength implications and lessen physical effort efficiency[3]. Among, tribal youths who consume nutritious underutilized fruits and vegetables in their daily diet are healthier, nutritionally safe and have additional physical working efficiency than contemporary diet consumers[1]. The agro-industrial uprising in developing countries gradually the farmers are shift to cultivate and consume less nutritious refined food products[6]. The insignificant rising tendency was noted in the intake of animal sources based higher energy diets, and saturated fats with sugars whereas, a perceptive decline was noticed in intakes of complex carbohydrates, dietary fiber, underutilized fruits, vegetables and nutrient-affluent small millets[7,8]. These alterations reason of the inadequate supply of proteins, minerals (calcium, iron), and vitamins (carotenes, ascorbic acid, thiamine and riboflavin)[9], which cause nutrient deficiency disorders, enhance chronic diseases and decrease the working capacity of youths[10] and deteriorate labour productivity and also increase risks of occupational accidents[11]. Conventionally in Rajasthan, the tribals eat diverse diets containing naturally grown fruits, vegetables and other nutritious food products significantly decreased, which causes the occurrence of nutrition-related physiological disorders and chronic diseases such as diabetes, obesity, and cardiovascular problems and negatively affects physical health and working efficiency[4,12].

Diminishing attraction level in farming activities of tribal youths

The experimental survey results showed a constant decrease in the cultivation of traditional crops from 100% to 12.5%, cow rearing with farming from 36% to 15% and organic farming from 100% to 2% from 1960 to 2020. A sharp increase in buffalo rearing with farming (6% to 18%), goat rearing with farming (20% to 42%), poultry production (3% to 15%), advanced crop cultivation techniques (0% to 27%), partially mechanized farming (0% to 42%), agro-chemical based farming (0% to 98%), horticultural with crop cultivation (0% to 30%) from 1960 to 2020 (Table 2). It is also observed that before 1960 all tribals were occupied in agricultural activities as livelihood but at present a considerable population of tribal youths (40%) was forced to transfer from agriculture to non-agricultural work with less remuneration (Fig. 1). Possible causes behind shifting from agricultural to non-agricultural activities and diminishing interest from traditional agricultural activities was a significant decrease in physical working capacity of youths for doing energy consuming traditional agricultural works, less remuneration and drastic change in lifestyle of the tribal youths. Based on the survey results of this investigation, it was also observed that due to challenging and remote environment, deprived socio-economic situations,

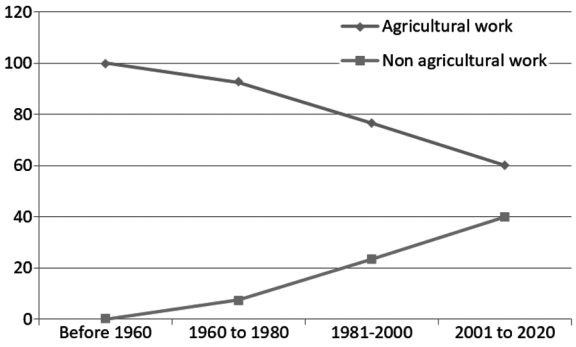

Fig. 1 — Shifting trend from agricultural to non agricultural activities of tribal farmers (n=900)

Table 2 — Diminishing interest in agricultural activities among tribal youths (n=900)

Agricultural activities	The interest level of tribal farmers in agricultural activities (out of 100)				S.Em±
	Before 1960	1960 to 1980	1981-2000	2001 to 2020	
Grow traditional crops /varieties	100.0	98.0	82.0	12.5	1.694
Cow raring + Farming	36.0	43.0	27.0	15.0	0.898
Buffalo raring + Farming	6.0	9.0	13.0	18.0	0.480
Goat raring + Farming	20.0	27.0	36.0	42.0	0.662
Poultry farming + Farming	3.0	7.0	13.0	15.0	0.447
Advanced crop cultivation technologies	0.0	0.0	3.0	27.0	0.196
Partially mechanized farming	0.0	0.0	13.0	42.0	0.240
Agro-chemical farming	0.0	0.0	5.0	98.0	0.466
Organic farming	100.0	100.0	95.0	2.0	1.567
Semi-protected cultivation	0.0	0.0	0.0	0.5	-
Horticulture + Crop production	0.0	0.0	5.0	32.0	0.194
Sedimentary work + Farming	0.0	0.0	3.0	27.0	0.195
Other business work	0.0	0.0	10.0	40.0	0.195

lower risk-taking capacity, higher illiteracy rate, insufficient communication system and deprived extension reach, lesser use of modern technologies in the tribal area of district Sirohi, Pali and Udaipur. Therefore, agriculture was declining towards low-return occupation leading to accelerating migration of tribal youths to neighbouring urban areas of Gujarat for exploration of suitable jobs. More than 18% of tribal farm women of district Sirohi adopted vegetable cultivation with retail marketing to get more remuneration with less physical workload than traditional crop cultivation[13]. The outcomes of the experimental survey presented in (Fig. 2) that the interest level of tribal youths in crop production was reduced significantly. Presently, only 14% of the youths are extremely involved, and 19% are moderately interested in agricultural work with all modern facilities for assisting. However, 27% of tribal youths adopt farming as a secondary occupation with other light work close to cities and 40% of youths leave traditional farming for lower remuneration in nearby towns. Analogous outcomes were also observed by Bhardwaj & Nandal[13] in the tribal-dominated area of southwestern Rajasthan. Because of insufficient nourishment, the immunity to disease or infection of the tribal youths was weakened and the incidence of becoming ill increased, which caused a significant decline in work efficiency. Conversely, loss of attentiveness due to hypoglycemia in undernourished youths also causes upsurges in work accidents. These circumstances enhance the poor-quality work pool, reduce work productivity, augment labour costs, and subsequently decrease the daily wages of workers and massive dissimilarities in income distribution[14].

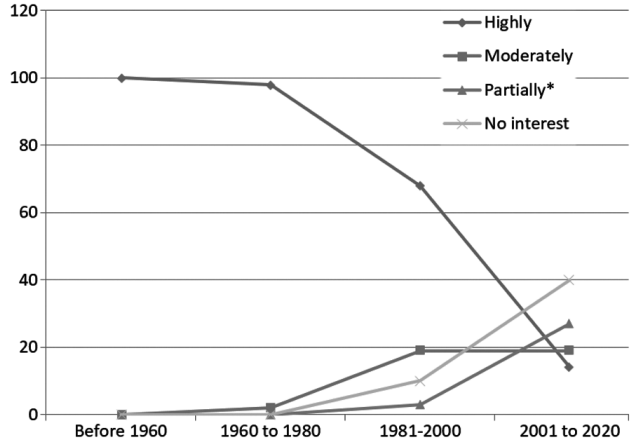

Fig. 2 — Interest levels of tribal farmers in farming activities (crop production)
*Adopt agriculture as a secondary business

Traditional foods and their changing pattern among tribals

Traditional foods originated from resident plants and animals through seasonal harvesting, and these food products also bear social connotation[15]. Before the initiation of the green revolution impacts and socio-economic transformations in tribal areas, traditional foods consisted mainly of wild-grown and cultivated millets, fruits and vegetables, beans, barley, and fresh milk of goats and cows. Gradually, some of the foods become well-liked and others are disliked concerning the organoleptic quality, texture and appearance of products and there has been a transfer in the direction of eating energy-rich, less nutritious refined food products. Augmented utilization of unhealthy processed foods coincides with neglecting the healthy traditional diets and inadequate time for meal preparation[16]. The information recorded during the experimental survey showed a significant decrease in small millets, sorghum, pearl millet, maize, barley, pulses and traditional fruits and vegetables consumption, whereas radical rise in rice, wheat, and potatoes consumption and insignificant addition in utilization of meat, sugar, dairy product, refined oil and modern fruits in daily diet. In 1960 the regular diet of tribals was comprised of small millets (13%), sorghum (13.2%), pearl millet (19.3%), maize (36.5%), barley (4.5%), wheat (1%), pulses (5.5%), meat (3%), dairy product (1.5%), sugar/gur/refined oil (0.5%), traditional fruits and vegetables (5.5%), and there was never utilization of rice and modern fruits, whereas, rarely prepare wheat *chapati* on festivals or in presence of specific guests (Table 3). At the time of the survey (2016 to 2020) the tribals daily diet consisted of 0.2% minor millets, 1.0% sorghum, 5.3% pearl millet, 10.2% hybrid maize, 4.0% barley, 56% wheat, 7.5% rice, 2.0% pulses, 4.8% meat, 3.0% dairy products, 2.0% sugar and oil, 3.0% traditional fruits and vegetables and 3.5% modern fruits and vegetables (Table 3). The most undesirable feature of this nutritional transition was the substitution of millets with socially more prestigious and refined grains. The cause of the transition in food habits of tribals was the transformation in the agricultural production system, the well-known public distribution system of food products and the improved socio-economic condition of the tribal farmers. Gradually, rises in rice consumption have coincided with declines in the eating of flatbread (*roti*) which is commonly prepared by mixing home-grown grains, including millet, wheat, barley, maize, and buckwheat, in addition to

Table 3 — Shifting trend in food habits of tribal farmers (n=900)

Food groups/foods	Per cent share of different food produce in the daily diet of tribal farmers				S.Em±
	Before 1960	1960 to 1980	1981-2000	2001 to 2020	
Minor millets*	13.0	6.0	2.5	0.2	0.267
Sorghum	13.2	9.5	5.8	1.0	0.266
Pearl millet	19.3	15.0	10.0	5.3	0.190
Maize	36.5	38.0	20.3	10.2	0.528
Barley	4.5	6.7	7.2	4.0	0.152
Wheat	1.0	4.5	30.0	56.0	0.367
Rice	0.0	1.0	1.8	7.5	0.150
Pulses	5.5	4.5	3.0	2.0	0.785
Meats	3.0	3.5	4.0	4.8	0.266
Dairy products	1.5	2.5	3.3	3.0	0.181
Sugar/gur & oils	0.5	1.0	1.3	2.0	0.040
Traditional fruits & vegetables	5.5	7.5	6.5	3.0	0.228
Modern fruits & vegetables	0.0	0.3	2.0	3.5	0.036
Traditional wine/wine and *desi daru* consumption trend					
Traditional wine	100.0	99.5	70.5	34.2	2.839
Modern wine	0.0	0.5	29.5	65.8	0.144
Traditional drink/arks/Nutri-drink and soft drink consumption trend					
Traditional drinks	100.0	100.0	77.3	26.7	1.694
Modern drinks	0.0	0.0	22.7	73.5	0.480

*Finger millet (Ragi), foxtail millet (Kangni), kodo millet (kodo), proso millet (Cheena), barnyard millet (Sawan) and little millet (Kutki).

reducing in various other recipes which also prepared by local crops[16]. Many of these long-established food crops were believed to significantly contribute to the food security of tribals by decreasing dependency on one or two food crops such as wheat and rice, providing food quality and maintaining dietary diversity[17]. Furthermore, the government supply under the public distribution system of food was also distributed wheat and rice in tribal areas so people consumed more than millets[1]. Several explanations were given for this drastic decline in historical nutritious food components, containing a preference for the taste of wheat, rice and potatoes over home-grown grains and reduced drudgery in preparing and cooking rice and potatoes as compared to roti of small millets and pearl millets. Contributors deliberated about the more desirable taste, nutritional significance, and organoleptic quality of traditional foods over contemporary foods, but it was observed that these food products were often unobtainable or costly, which was said to be the only cause of people consuming modern foods. Many participants stated that they do not believe in modern foods because of the detrimental agrochemicals residual loads used on them and consider that they are adulterated. Fewest tribal respondents considered that presently persons have short life expectancies, are not as powerful and healthy, and are frequently getting sick, due to eating modern foods primely, including wheat, rice and potatoes. Although there is no evidence to authenticate this, the nutritional quality of conventionally grown foods, traditional crops and cereals was well documented[18] as the gradual declines in the nutritional potential of rice and wheat with the great extent of polishing it receives[19]. When inquired if the routes of deviation in food habit were favourable or undesirable, the majority of respondents answered that food availability has increased significantly and people can now get sufficient food whereas earlier there were severe food shortages, however, they were also well-known about that nutrition has considerably reduced because they were eating home-grown traditional foods.

Traditional wisdom for uses of millet, fruits and vegetables

The elder women (>50 years of age) had excellent traditional wisdom for uses of millets in daily diet as grain flour roti, stiff porridge, thin porridge, *rabodi*, *daliya*, green leaf mix vegetable, cracked seed, sweet *churma*, cooked grains, sprouts, water-soaked seed, *jhajheria*, *sabji*, *ghatte*, *pania, papdi, chhawadi*, malt-weaning food, laddu, *shakkarpara, khurmi, murku, sev*, *barfi, halwa, gulse*, sweet and savoury products (Table 4). They also use traditional fruits and vegetables for preparing *chuhara*, fruit powder, nutritive paste, fruit *pak,* dried fruits, nutritive drugs, mixed desi-wine, roasted fruits, *panchcutta,* dried pods, fried pods, mixed *dhokli*, *chutney*, and pickle in

daily diet. The older age (>50 years age) women had good traditional wisdom for diversified preparation by uses of millets, traditional fruits and vegetables in daily diet such as pearl millet (80%), maize (87%), sorghum (82%), finger millet (70%), proso millet (26%), foxteail millet (68%), kodo millet (56%), little

Table 4 — Frequency of awareness about traditional uses of millets, traditional fruits and vegetables in different age groups of tribal farm women (n=600)

Common Name and Botanical Name	Traditional wisdom for different uses	Frequency of awareness (%)	
		<50 years	> 50 years
Pearl millet *Pennisetum glaucum*	Grain flour roti, popped seed, stiff porridge, thin porridge, rabodi, daliya, green leaf mix vegetable, cracked seed, sweet churma, cooked grains, sprouts	30	80
Maize (Makka) *Zea mays* L	Cracked seed, water-soaked seed, sprouts, popped seed, stiff porridge, thin porridge, jhajheria, sabji, flour roti, ghatte, charma, pania, papdi, chhawadi, rabodi	25	87
Sorghum (Jawar) *Sorghum bicolor*	Grain flour roti, popped seed, stiff porridge, thin porridge, cracked seed, sweet churma, sweet and savoury products	17	82
Finger millet (Ragi) *Eleusine coracana*	Flour roti, malt–weaning food, laddoo, porridge, shakkarpara, papri, khurmi, murku, sev, barfi, halwa, gulse, sweet and savoury products	13	70
Proso millet (Cheena) *Panicum miliaceum*	Laddoo, porridge, shakkarpara, papri, khurmi, murku, sev, barfi, halwa, gulse, sweet and savoury products,	3	26
Foxtail millet (Kangni) *Setaria italica*	Flour roti, malt–weaning food, laddoo, porridge, shakkarpara, papri, khurmi, murku, sev, barfi, halwa, gulse, sweet and savoury products	18	68
Kodo millet (kodo) *Paspalum scrobiculatum*	Mix flour roti, malt–weaning food, laddoo, porridge, shakkarpara, papri, khurmi, murku, sev, barfi, halwa, gulse, sweet and savoury products	8	56
Little millet (Kutki) *Panicum sumatrense*	Mix flour roti, laddoo, porridge, shakkarpara, papri, khurmi, murku, sev, barfi, halwa, gulse, sweet and savoury products	27	82
Bamyard millet (Sawan) *Echinochloa crusgalli*	Flour roti, malt – weaning food, laddoo, porridge, shakkarpara, papri, khurmi, murku, sev, barfi, halwa, gulse, sweet and savoury products, puri, sharbat, soaked seed,	4	46
Wild date palm (Khajoor) *Phoenix sylvestris*	Dry fruits, *chuhara*, fruit powder, nutritive paste (date *pak*)	12.0	68.0
Annona (*Custard apple*) *Annona reticulata*	Fresh fruits, fruit powder, fruit *pak,* fruit paste	18.0	80.0
Ber (*Bor*) *Ziziphus nummularia*	*Chuhara*, dry and fresh fruits, fruit drugs	35.0	85.0
Khirani (*Rayan*) *Mimusops hexandra*	Dry and fresh fruits, nutritive drugs	8.0	86.0
Jamun *Syzygium cumini*	Fermented drugs, fruit juice, fresh fruits,	40.0	60.0
Pilu (*Timru*) *Salvadora oleoides*	Nutritive drugs, fresh fruits, fruit juice, mixed wine, juice blend	5.0	90.0
Ker *Capparis deciduas*	Dry and fresh fruits, roasted fruits, powder, *panchcutta*	23.0	80.0
Kachri *Cucumis callosus*	Dry and fresh fruits, *panchcutta*, fruit powder	25.0	97.0
Khejri pods *Prosopis cineraria Druee*	Dry and fresh pods, pod powder, pod *pak*, pod paste, *panchcutta*	10.0	90.00
Bael *Aegle marmalos*	Fruit powder, pulp, fruit pak, paste, drugs, *Bilb giri churna*, *Bilwadi churna*	20.0	70.0
Tamarind *Tamarindus indica*	Nutritive wine, pulp, *chutney,* paste, ark, local drink, sarbat	40.0	60.0
Cluster-bean (Guwar) *Cyamopsis tetragonoloba*	Fresh vegetables, dry pods, fried pods, powder, mixed dhokli, chutney	78	90
Spine gourd (Kinkoda) *Momordica dioica*	Fresh vegetables, dry slices, fried slices, powder, chutney, pickle	12	92
Snapmelon (Phoot) *Cucumis melo momordica* (Roxb.)	Fresh vegetables, dry slices, fried slices, powder, chutney, pickle, pulp	33	98
Traditional green leafy vegetables (Bhatuwa, ameranthas, methi, palar)	Fresh vegetable, dry leaves, leaves powder, chutney, mixed soup	13	78

millet (82%), bamyard millet (46%), wild date-palm (68%), ber (85%), *khirani* (86%), custard apple (80%), *jamun* (60%), *pilu* (90%), *ker* (80%), *kachri* (97%), *khejri* pods (90%), *bael* (70%), tamarind (60%), cluster bean (90%), spine gourd (92%), snap-melon (98%) and traditional green leafy vegetables (78%), whereas the younger generation had fewer traditional knowledge for uses of these traditional crops (Table 4). Similarly, older tribal women had additional wisdom for the utilization of traditional fruits for nutritional security. Changes in dietary patterns may be the cause of the tribal people forgetting traditional wisdom for using millet and traditional fruits and vegetables in their daily diet. The wisdom for growing, harvesting, cooking, and processing traditional food products in tribal parts of Rajasthan was drastically lost within a very short period, between 2001 and 2020. The dietary pattern remained similar despite economic growth, probably due to concomitant population expansion, low income and inadequate food supply[20], but after the green revolution an extreme decrease in production and consumption of traditional foods due to increased production of wheat and rice in tribal areas[21]. Cereal-based and value-added food products were supplemented with millets and gained huge popularity due to nutritional business possibilities and economic advantages[22]. The millets are used for the preparation of varied processed food products such as bakery and puffed products, ready-to-eat snacks, quick-cooking cereals, kids supplementary foods, weaning foods and more significantly healthy foods by suitable milling and processing techniques[23]. However, the preparation of these products is time-consuming and arduous, with the outcome that modern foods based on historical processing have entered the markets with enormous success[24]. Though, small millets were not an imperative ingredient in the day-to-day diet of American and European individuals, however, now these countries have attention to recognize the importance of millets as a component of multigrain and gluten-free cereal food products. Millets are also the primary food of the people in millet-producing areas and are used for preparing several foods and beverages like *idli*, *dosa, papad, chakli*, porridges, bread, infant and snack foods in many African and Asian countries[25].

Nutritional evolution of traditional and modern food produce

The traditional foods are more nutritious than the modern food. Millets are high in protein from 6.2 g in bamyard millet to 16.9 g in oat, fat from 1.3 g in ragi to 5.0 g in pearl millet, carbohydrates from 60.9 g in foxtail millet to 72.6 g in ragi, energy from 309 cal. in kodo millet to 397 cal. in bamyard millet, folic acid from 9 mg in proso millet to 56 mg in oat, thiamine from 0.21 mg in proso millet to 0.76 mg in oat, riboflavin from 0.01 mg in proso millet to 0.25 mg in pearl millet, zinc from 0.7 mg in kodo millet to 4.0 mg in oat, calcium from 10 mg in maize to 344 mg in ragi, iron from 0.5 mg in kodo millet to 9.30 mg in little millet and in proso millet, phosphorus from 110 mg in foxtail millet to 289 mg in pearl millet, fibre with soluble fibre content from 1.2 g in pearl millet to 11.6 g in oat per 100 g edible parts (Table 5). Anti-nutritional elements such as phytate and polyphenols have been sustained in small millets but they were predominantly restricted to the seed coat and the milled millets are mostly free from the anti-nutritional issues[26]. The bulkiness of the millet fibres and the sluggish digestion rate cause feel fuller on fewer calories and consequently may help to avoid excess calories eating[27,28]. Millets are rich sources of dietary fibre and offer a series of nutrients and phytochemicals including tocopherol, Mg and folate that improve health[29]. Finger millet is affluent in fat, carbohydrate, protein, energy 328 k Cal/100 g[30,31], iron, phosphorus, fibre, vitamins and an exceptional source of calcium (344 mg/100 g)[32], which is superior to all other cereals and also contain iodine which highest among all the food grains. It is also an excellent source of polyunsaturated fatty acid and has super-quality protein along with the existence of lysine, threonine, and valine amino acids[33], sulphur-containing amino acids[32,34], vitamin-A, Vitamin-B, antioxidants and phosphorus[35] with low fat and glycemic index[36]. Among the millets, pearl millet is the most important part of the traditional diets of tribals, which contains an adequate quantity of N, P, K, Zn, Mg, Fe, Ca, folic acid and riboflavin, whereas the second most important food millet is sorghum was also rich in phenolic compounds and antioxidants[37]. The steady reduction in the alimentary consumption of all food groups, particularly millet since 1975[38]. Many researchers also reported that minor millets are better than or at par with other cereals in containing minerals, proteins, vitamins, dietary fibre and energy[39]. Traditional fruits and vegetables are comparatively more nutritious than commercial fruits and contain a balanced quantity of ascorbic acid, carotenoids, thiamine, riboflavin, niacin, pyridoxine, folacin, minerals, fat, protein and dietary fibre, which

Table 5 — Nutrient content of traditional food (millets, fruits and vegetables) and modern foods (cereals, fruits and vegetables) per 100 g[2,4,7,41]

Nutrients	Traditional Food (Millets)*	Modern Foods (Cereals)**	% Change	Traditional Fruits#	Modern Fruits##	% Change	Traditional Vegetables@	Modern Vegetables@@	% Change
Protein (g)	10.31	10.02	-2.83	3.45	0.67	-96.55	4.83	1.29	-73.21
Fat (g)	3.39	1.11	-67.27	1.02	0.30	-98.99	1.11	0.29	-74.17
CHO (g)	65.87	71.48	+8.51	24.71	14.76	-75.29	8.05	6.53	-18.85
Energy (Cal.)	346.5	345.5	-0.30	131.9	64.43	+31.89	72.63	33.29	-54.17
Ascorbic acid (mg)	NA	NA	NA	37.06	46.65	-62.94	37.17	17.75	-52.24
Carotenes (µg)	NA	NA	NA	235.8	861.71	+ 135.81	3558.62	2078.67	-41.59
Folic acid (mg)	27.47	22.96	-16.41	NA	NA	NA	NA	NA	NA
Thiamin (mg)	0.40	0.27	-32.19	0.11	0.18	-99.90	0.07	0.05	-19.19
Riboflavin (mg)	0.12	0.11	-10.37	0.07	0.08	-99.94	0.19	0.05	-71.33
Niacin (mg)	NA	NA	NA	0.79	0.38	-99.21	0.47	0.87	+85.11
Minerals (g)	NA	NA	NA	1.37	0.51	-98.63	NA	NA	NA
Zinc (g)	2.45	1.70	-30.33	NA	NA	NA	NA	NA	NA
Calcium (mg)	55.73	29	-47.96	72.93	16.29	-27.07	133.58	13.20	-90.12
Iron (mg)	4.78	2.8	-41.43	3.16	0.56	-96.84	2.37	0.43	-82.01
Phosphorus (mg)	222.1	205.6	-7.46	45.0	22.43	-55.00	62.17	32.94	-47.01
Fiber (g)	6.05	1.01	-83.32	2.58	1.61	-97.42	4.71	0.51	-89.24
Total phenol	79.74	8.735	-89.05	NA	NA	NA	NA	NA	NA

*Average composition of traditional food: Pearl millet (*Pennisetum glaucum* L.), Sorghum (*Sorghum bicolor* L.), Ragi (*Eleusine coracana* L.), Foxtail millet (*Setaria italica* L.), Proso millet (*Panicum miliaceum* L.), Barnyard millet (*Echinochloa frumentacea* L.), Kodo millet (*Paspalum scrobiculatum* L.), Little millet (*Panicum sumatrense* L.), Maize (*Zea mays* L.), Barley (*Hordeum vulgare*), Oat (*Avena sativa*).
**Average composition of modern foods: Rice (*Oryza sativa*), Wheat (*Triticum aestivum*).

#Average composition of traditional fruits: Karonda (*Carissa carandas*), Phalsa (*Grewia asiatica*), Bael (*Aegle marmelos*), Khirni (*Manilkara hexandra*), Timru (*Salvadora persica*), Custard apple (*Annona squamosa* L.), Ker (*Capparis decidua*), Tamarind (*Tamarindus indica* L.), Ber (*Ziziphus* sp.).
##Average composition of modern fruits: Apple (*Malus pumila*), Orange (*Citrus sinensis*), Guava (*Psidium guajava*), Mango (*Mangifera indica*), Banana (*Musa × paradisiacal*), Papaya (*Carica papaya*), Grape (*Vitis vinifera).*

@Average composition of traditional vegetables: Cluster bean (Cyamopsis tetragonoloba L.), Bathuwa leaf (*Chenopodium album*),Kinkoda *(Momordica dioica*), Kachri (Cucumis calosus), Khimp *(*Leptadaenia pyrotechnica), Khejri pod (*Prosopis cineraria*), Spinach (Spinacia oleracea), Snapmelon (Cucumis melo momordica), Ameranthes leaf (*Amaranthus cruentus*).
@@Average composition of Modern Vegetables: Tomato (*Solanum lycopersicum*), Potato (*Solanum tuberosum*), Brinjal (*Solanum melongena* L.). NA: Not available

were highly useful for maintaining good health, physical capacities and psychological well-being of tribals[1,40]. Some of the traditional fruits usually consumed by the tribals in their daily diet are excellent sources of protein such as *Limonia acidissima* (7.10 mg/100 g) and *Calligonum polygonoides* (6.05 mg/100 g); richest source of iron are *Tamarindus indica* (17.01 mg/100 g) and *Carissa carandas* (39.14 mg/100 g); an exceptional source of vitamin A are *Citrus japonica* (2575 IU), *Moringa oleifera* (190 IU); good source of vitamin C are *Phyllanthus emblica* (500-625 mg/100 g), *Ziziphus mauritiana* (85 mg/100 g), *Ziziphus jujuba* (188-544 mg/100 g); have a good amount of fat are *Calligonum polygonoides* (11.81-11.90 mg/100 g) and *Limonia acidissima* (3.70-3.75 mg/100 g); very good source of carbohydrate are *Aegle marmelos* (31.80 mg/100 g), *Tamarindus indica* (67.40 mg/100 g) and *Phoenix dactylifera* (70 mg/100 g); richest source of calcium *Leptadenia pyrotechnica* (156.30 mg/100 g) and *Calligonum polygonoides* (211.14 mg/100 g seed) are perform important role in nutritional security of south-western Rajasthan tribals. Similarly, some prominent underutilized fruits and vegetables also have a significant role in the nutritional security of tribals such as 100 g of ripened fresh fruit of *kachri* (*Cucumis callosus*) has 1.21 g fibre, 1.28 g fat, 43 Kcal energy and 29.81 mg vitamin C[4]. *Ker* (*Capparis decidua*) fruit also a historical fruit of Rajasthan is an excellent source of fat (2.0 g), protein (4.2 g), carbohydrate (18.2 g), dietary fibre (4.24 g), energy (107 Kcal) and vitamin C (50 mg) in 100g of fresh fruit[1]. The immature green pods of *khejri* (*Prosopis cineraria* Druee) usually recognized as *sangria* are an amazing source of digestive protein (5.1 g), dietary fiber (6.7 g), carbohydrate (14.15 g) and energy (82 Kcal) in 100 g of fresh pods.

Conclusion

It has been concluded that using of modern foods in the daily diet of tribal youths increased with progression, with a significant reduction in nutrient-rich traditional food consumption. Furthermore, it become visible that the corporal working efficiency and attraction level in farming activities have abruptly reduced and a considerable number of tribal youths are diverting to other non-agricultural occupations for livelihood. The traditional wisdom for food preparation from traditional crops is also significantly reduced. Based on the outcomes of this investigation, it is critical to appropriate nutrient management with nutritious traditional food constituents for recovering tribal youths well-being for future farming in tribal-dominated areas of Rajasthan and it is also compulsory to conserve all these traditional valuable food crops.

Conflict of Interest

The authors declare that there is no conflict of interest.

Author Contributions

R L B and L V conceptualised the research idea. R L B and A P collected and analysed the data, and drafted the paper. The paper was finalised by R L B, L V and A P.

Informed Consent

Informed consent was obtained from all respondents who voluntarily agreed to participate in the study.

Data Availability

All the collected data are presented in the article.

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