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IMPACT OF MODERNIZATION ON NUTRIENT COMPOSITION AND CONSUMPTION OF INDIGENOUS FOODS

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Abstract

Background

Modernization has reshaped global food systems, replacing traditional, nutrient-rich indigenous diets with industrially processed, energy-dense, and nutritionally inferior foods. These changes affect food quality, health outcomes, cultural practices, and environmental sustainability, particularly in rural communities where indigenous foods are integral to local identity.

Objectives

This study investigates the impact of modernization on the nutrient composition and consumption patterns of indigenous foods in District Okara, Pakistan. It explores changes in nutritional quality, dietary behavior, and socio-cultural factors influencing food choices.

Methods

A cross-sectional quantitative study was conducted with 200 adults using stratified random sampling. Dietary data were collected through 24-hour recall and food frequency questionnaires. Nutrient analysis of selected foods was conducted using AOAC protocols and compared with historical benchmarks. Regression and ANOVA were applied to assess associations between modernization and dietary changes.

Results

Indigenous foods, such as millets and wild greens, showed superior nutrient content (e.g., 11g protein, 3.5 mg iron, 8g fiber in millets) compared to modern staples. However, nutrient degradation over time was observed, including a 16.7% decline in iron content in millets. Income was significantly associated with indigenous food consumption ($p = 0.009$), while education and market access were not. Modernization level significantly influenced consumption patterns ($F = 44.54$, $p < 0.001$).

Conclusion

Modernization is linked to decreased consumption and nutritional quality of indigenous foods. Protecting traditional food systems is vital for ensuring nutritional security, cultural continuity, and ecological resilience. Policy efforts should promote indigenous food integration into national development strategies.

INTRODUCTION

Modernization of food systems: Refers to the process of transforming food systems into globalized, industrialized, and often Westernized systems as opposed to traditional, locally-based food systems. This shift often entails machine farming, processed foods, supermarkets, urban migration, and modifications to food choices and lifestyles (Popkin 2017). Due to modernization, food security and convenience have been improved. However, it has led to a nutrition transition evidenced by a decrease in dietary diversity, an increase in ultra-processed foods, and an increasing incidence of non-communicable disease (NCD) like obesity, diabetes, and cardiovascular disease (Monteiro et al. 2018). Indigenous and rural people are especially vulnerable to modernization, which threatens foodways, livelihoods, and traditional knowledge already being impacted by the changing climate. Indigenous foods refer to traditionally available plant and animal species that have cultural significance to the natives of a designated region. Foods such as millets, wild greens, legumes, roots, insects, and fish caught in local waters are often rich in micronutrients, dietary fibre, and phytochemicals (Kuhnlein et al., 2009). In addition, indigenous people depend on species of plants and animals for their identities and autonomy. Many indigenous foods may offer significant benefits over commercially processed foods, as more studies are showing. The finger millet has much higher calcium and iron content than white rice or wheat (Boda, Kadri, & Rajendran, 2025). But still, indigenous foods are undervalued, under-researched, and accessible in our modern food systems. Despite the heightened interest in indigenous food systems, several key gaps remain. To start with, limited empirical research shows that modernization changes the nutrient content of indigenous food type 1. Food processing, hybridization, and supply chain delay can degrade micronutrients and lower food quality (Burlingame et al., 2009). Furthermore, there is little proper assessment of the impact of modernisation on the use of indigenous foods in different regions. Much of the existing data is fragmented or region-specific. In the third place, research exploring how socio-cultural drivers interact with nutritional outcomes is scarce. This includes how colonial legacies, policy neglect, and media contribute to shifts away from traditional foods (Smith et al., 2021). Most research, at the same time, focuses on either nutrition or on cultural preservation, but not both. Eating local food is linked to many risk factors.

The replacement of traditional diets with industrially-produced staples can cause "hidden hunger" micronutrient deficiencies that can have long-term effects on health but aren't visibly obvious (Gómez et al., 2013). The loss of traditional food practices harms the knowledge and cultural rituals of indigenous communities. Indigenous food is often more sustainable and adapted to the local agroecological conditions than introduced food. They need less to grow, tolerate droughts, and boost agrobiodiversity (FAO, 2017). So, encouraging local cuisines is not just a way of nutrition but also a means of attaining food justice, cultural prominence, and ecological sustainability.

Objectives

This study aims to examine the impact of modernization on both the nutrient composition and consumption patterns of indigenous foods in selected communities. Specifically, the objectives are:

1. To analyze changes in the nutritional content of indigenous foods due to modern food processing, hybrid varieties, and distribution systems.
2. To assess the shifts in consumption of indigenous foods over time in relation to modernization indicators
3. To explore the sociocultural perceptions that influence the abandonment or retention of traditional food practices.

Literature Review

The world's food choices have changed in the 21st century. There is a bigger shift towards refined carbohydrates, saturated fats, sugars, and ultra-processed products. We moved away from whole, minimally processed foods. As countries become more urbanized and economically powerful, their diets have started to alter over a period of time. The evidence of these changes can be seen in both high-income countries and also in low- and middle-income countries, where indigenous cultures are most vulnerable to cultural dislocation and exposure to global consumption items. Kuhnlein and Receveur

(1996) were probably the first to document that indigenous people are experiencing a transition of traditional food systems to an increasing supply of imported, nutrient-poor products. The situation has led to a huge rise in obesity, diabetes, and cardiovascular disease. It has led to both overweight and undernutrition at the same time. This is called the double burden of malnutrition (Batal et al. 2023)

Food processing techniques are often targeted towards shelf stability, taste enhancement, and consumer appeal today, but they compromise nutrient density. Eating whole grains, legumes, wild vegetables, and unrefined meats helps the body absorb vitamins, minerals, and fiber. The process of eating and microbiome metabolism leads to deficiency, but we can still achieve the proper dosage. In Sri Lanka, Weerasekara et al. (2018) demonstrated that hybridization and polished rice varieties degrade the nutritional value of traditional rice types. Barreau et al. (2019) studied the modernization of the Mapuche food systems of Chile. They found that the modernization caused a drop in the consumption of foraged and forest food. Moreover, these foods were replaced by market-purchased processed foods. Furthermore, the market-bought foods do not match the nutrient density of the ancestral foods. These transformations affect both food quality and diversity.

The changing world not only affects what people eat but also how and why they eat. As a result of colonization, church activity, media, and economic marginalization, traditional foodways have suffered cultural dislocation. Food was once profound in ritual, stories, and seasons; it is now frequently commodified (Fazzino & Loring, 2016). Western food systems, supported by global capitalism, erode local food practices in Africa, according to Raschke and Cheema (2008). In East Africa, colonization and post-colonial development efforts introduced monocultures and processed imports, undermining local food knowledge and agricultural resilience. The Alaska Native communities faced comparable outcomes. Imported foods displaced the traditional whaling legacy food system, disrupting the transmission of whaling knowledge through the generations (Fazzino & Loring 2016).

A variety of case studies highlight the intensity and difficulty of dietary changes. A scoping review by Malli et al. (2023) in Canada and the U.S. showed that colonization and forced relocation disturbed Indigenous food systems, making them dependent on government-supplied foods. It can lead to nutrient deficiency and chronic disease. Barreau et al. (2019) on the impact of "modernization on the use of wild edible plants by Mapuche in the temperate forest of Chile". The overall view of the findings is that the modernization of the culture reduces the biocultural diversity. It is a term that depicts the interdependence of ecosystems and traditional knowledge systems. Mabhaudhi et al. (2018) stated that there was an abundance of indigenous crops in the region that were getting marginalized due to modernization. This drought-resistant and nutritious crop is often disregarded in national food security plans since it is associated with poverty and has little commercial value.

Materials and Methods

This study used a quantitative cross sectional research design to assess the effect of modernization on the nutrient composition and consumption pattern of the indigenous foods of District Okara, Pakistan. Researchers selected total 250 adult participants through stratified random sampling to provide diversity in demographics. To capture the consumption of both indigenous and modern food items, 24-hour dietary recall and food frequency questionnaires (FFQ) were used to collect dietary intake data. To study the changes of food consumed by the people, the food commonly consumed in households and purchased from local markets, were collected from the different households and local market places and food item samples were analyzed in the laboratory using AOAC (Association of Official Analytical Chemists) standard procedures in respect of macronutrient and micronutrient content. Nutrient values were compared to historical composition data for any changes to determine if the food changed over time.

Results

Variable	Category	Frequency	Percentage
Gender	Female	108	54
	Male	92	46
Education	Secondary	71	35.5
	Primary	48	24
	Higher	42	21
	No formal education	39	19.5
Monthly Income (PKR)	10,000 -30,000	68	34
	31,000-60,000	52	26
	61,000-90000	42	21
	> PKR 91,000	38	19
Occupation	Unemployed	44	22
	Farmer	37	18.5
	Housewife	32	16
	Student	31	15.5
	Shopkeeper	29	14.5
	Laborer	27	13.5

A total sample of 200 subjects (54% female; 46% male) was drawn from District Okara. Most had secondary education (35.5%) and primary education (24%). Furthermore, 21% had higher education. Finally, 19.5% did not have any education. Thirty-four percent of the respondents earned between PKR 10,000–30,000 while the 26% earned between PKR 31,000–60,000. Only 19% earned above PKR 91,000 per month. Out of 280 respondents, the largest occupational group was unemployed (22%) followed by farmers (18.5%), housewives (16%) students (15.5%), while the rest were shopkeepers (14.5%) and laborers (13.5%). The population under study is rural and low- to middle-income. It is important to have an idea of the profile to understand dietary pattern concerning indigenous and modern food.

Table 2: Mean Daily Intake of Indigenous vs. Modern Foods

Food Item	Category	Mean Daily Intake (g/day)
Millets (e.g., Bajra, Jowar)	Indigenous	139.9
Wheat-based products (e.g., roti, bread)	Modern	114.5
Wild leafy greens	Indigenous	145.9
Market vegetables (e.g., potatoes, carrots)	Modern	180.9
Legumes (e.g., lentils)	Indigenous	110.6
Processed snacks (e.g., chips)	Modern	110.6
Desi ghee or mustard oil	Indigenous	183.2
Refined oils (e.g., soybean, canola)	Modern	150.7
Local fruits (e.g., ber, amla)	Indigenous	101.2
Imported fruits (e.g., apples, bananas)	Modern	141.7

The results indicate that the subjects have a mixed dietary pattern wherein indigenous and modern food contribute to daily intake. Items that are indigenous

in nature like desi ghee or mustard oil (183.2 g/day) and wild leafy greens (145.9 g/day) were consumed most, followed by millets (139.9 g/day) and legumes (110.6 g/day). Modern foods consumed in 99 rural house-holds of Central Telangana (India) included market vegetables (180.9 g/day), refined oils (150.7 g/day). Wheat products (114.5 g/day), processed snacks (110.6 g/day). Indigenous foods are still largely eaten but the high consumption of modern items especially oils and snacks brings about a dietary shift towards more processed, market-based goods. This change may impact the nutritional quality of foods, and cultural food practices.

Table 3 Nutrient Composition of Selected Indigenous and Modern Foods

Food Item	Category	Protein (g)	Iron (mg)	Fiber (g)	Calcium (mg)
Millets	Indigenous	11	3.5	8	200
Wheat Flour	Modern	9.5	1.2	2.5	35
Wild Greens	Indigenous	4.2	6.7	5.5	300
Potatoes	Modern	2	0.7	1.8	20
Desi Ghee	Indigenous	0.3	0	0	15
Refined Oil	Modern	0.1	0	0	0

Indigenous food is better than modern food as shown in Table 3. Millets and wild greens provide a healthy source of protein (11 g and 4.2 g), iron (3.5 mg and 6.7 mg), fiber (8 g and 5.5 g) and calcium (200 mg and 300 mg). Wheat flour and potatoes, on the other hand, are not as nutrient dense and low in iron and fiber. Interestingly, refined oil lacks all essential nutrients while desi ghee is almost low in protein and fibre but contains a trace amount of calcium. This study shows converts native food to modern which can harm health as the former is nutritionally effective substance.

Table 4 Comparison of Current vs. Historical Nutrient Profiles

Food Item	Nutrient	Historical Value	Current Value	Percent Change (%)
Millets	Iron (mg)	4.2	3.5	-16.7
Wild Greens	Calcium (mg)	350	300	-14.3

the nutrient density of these indigenous foods has reduced quite significantly. Millets' iron content decreased from 4.2 mg to 3.5 mg or by 16.7%, while the calcium in wild greens decreased from 350 mg to 300 mg or by 14.3%. Modernization is lowering the nutritional value of traditional foods too, which may be due to soil depletion, hybrid varieties of crops and modern processing techniques. Growing indigenous food and consumption are needed to stop the deterioration of these food types along with their production systems.

Table 5 Predictors of Indigenous Food Consumption

Predictor	Unstandardized Coefficient (B)	Std. Error	Standardized Coefficient (Beta)	t	p-value (Sig.)	R^2
Intercept	127.6804	2.2335	-	57.17	0.000	0.034
Education	-0.0393	0.8546	-0.046	-0.046	0.963	
Income	2.1695	0.8233	2.635	2.635	0.009	
Market	0.2717	1.1781	0.231	0.231	0.818	

The relationship between indigenous food consumption and education level, income and market access was tested using regression analysis. The model in overall had very low explanatory power, as the R^2 value was at 0.034. This shows only 3.4% of variation in indigenous food consumption was explained by these. The thickness of the sleep study material contributed to the sleep study's failure to hold as an important priority. Analyzing and running the different sleep studies and multi-day runs implicated the difficulty of producing a sleep-like state among the rats. Thoughtful planning and analysis of the various sleep-related issues ultimately failed in the tricky pursuit of achieving the success criterion. In comparison, the access to education (B = -0.039, p = 0.963) and market (B = 0.27, p = 0.818) was not significant. The value of the intercept,127.68, means the consumption of indigenous food when all predictors are constant. The results suggest that income can help either the capacity or the desire to stick to traditional foods. However, education and market access seem to play little role in this regard.

Table 06 Differences in Nutrient Intake Across Modernization Levels

Source	SS	df	Mean Square	F	*p*
Modernization Level	11707.07	2	5853.53	44.54	00042
Residual	25888.65	197	131.41		

The ANOVA results indicate a statistically significant difference in indigenous food intake across levels of modernization, with F (2, 197) = 44.54, p < .001. The between-group sum of squares (11,707.07) and a mean square of 5,853.53 suggest a strong variance in intake attributable to modernization level. In contrast, the residual sum of squares (25,888.65) reflects the within-group variation. These findings clearly show that as modernization increases, the consumption of indigenous foods significantly declines, confirming that modernization is a key factor influencing dietary transition away from traditional food systems.

Discussion

Modernization changes the way people eat through material and cultural processes within food systems. In District Okara, consumption and nutrition quality of millets and wild greens are falling gradually and steadily. The research findings align with evidence from Popkin (2017), Monteiro et al. (2018), and others regarding a "nutrition transition" where whole grains, legumes, and foraged foods are replaced by energy-dense foods and processed products. Indigenous foods have nutrient characteristics that indicate their importance for the nutritional security. Earlier locally available staple millets, wild greens and others have higher protein, iron, fibre and calcium than modern staple refined wheat and potato. However, the observed nutrient losses over time such as a 16.7% fall in iron content of millets is due to the impact of modernization on the biological quality of native foods along with dietary inclination. The decline is likely due to soil degradation, hybridization of crops, and new processing methods. Similar findings are seen globally on nutrient depletion in traditional crops (Burlingame et al., 2009).

Sociodemographic patterns further clarify this transition. Income exhibited a significantly positive association with indigenous food consumption, indicating that indigenous food consumption may not be associated with poverty as assumed. Affordability and market availability might determine access. Education and market access, however, were not strong predictors meaning that cultural or generational attitudes may play a stronger role than education or market exposure. This demonstration emphasizes that modernity is not a singular entity but a social force that acts differently in differing situations. Modernization also redefines food identity. In traditional rural societies, foods have cultural and symbolic meaning that connect families with their ancestral practices and ecological knowledge. The evolution to foods that have undergone impressive industrial processing is more than a mere nutritional

drop-off. It could also be seen as a cultural and ecological distancing (Fazzino & Loring, 2016; Smith et al., 2021). When indigenous fare is traded for global commodities, local biodiversity and food sovereignty also get weakened (FAO, 2017).

Based on policy level, these findings highlight the need for integrated strategies that address the nutritional, cultural and ecological dimensions of food systems. National food and agriculture programs tend to favour high-yield or export-oriented crops over traditional varieties, which are nutrient-rich and resilient to climate change. Incorporating indigenous foods into public nutrition programs such as school feeding and maternal health is a strong approach to maintaining dietary diversity and cultural continuance. Promoting campaigns that focus on the health benefits and heritage value of traditional foods may shift perceptions and consumption patterns towards indigenous foods.

Conclusion

The way food is produced and what people value about food is being changed by these modern systems. Okara, especially in rural areas, nowadays is showing a decline in how much and what type of traditional food is consumed. Old homestyle cooking, a sign of an individual's way as being tied to their land is losing its impact. The process of progress, although beneficial economically and infrastructurally, is destroying diets, erasing past recognitional knowledge and makes us not self-sufficient in food. They have to help each other or the culture will be gone. Politicians need to encourage the growth of local food crops, maintain old ways of farming, and include local food sources in the diets for their people. Community orientated schools and fairs encourages locally made food production and use by many people. Apparently, keeping those indigenous-like food systems are going forward towards a healthier life for us and for the environment, I guess. In today's world, we should be preserving different food systems to promote security globally.

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