

# Determinants of Dietary Patterns in Minority Women in North West Pakistan

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## Abstract

Dietary patterns vary greatly by race, ethnicity and region. Assessment of the dietary patterns of specific population groups improves our understanding of the complex relationship between diet and risk of chronic diseases. This cross-sectional study was conducted to identify major dietary patterns among minority women and to assess socioeconomic, lifestyle and health factors associated with them. Total of 250 women aged > 18 year, in pre-menopausal stage, non-pregnant and non-lactating, were randomly selected. Data on required parameters was collected using standardized questionnaires and tools. Factor analysis was conducted to extract major dietary patterns while analysis of covariance was fitted to investigate association between socioeconomic, lifestyle and health factors and adherence to these dietary patterns. Two major dietary patterns, 'nutrient-dense' and 'energy rich' were extracted. Factors positively associated with 'nutrient-dense' dietary pattern included women's age ( $\beta=0.04$ , 95% CI=0.009-0.07,  $p<0.05$ ), women's husband or head of household education level > 10 year ( $\beta=0.35$ , 95% CI=0.09-0.59,  $p<0.001$ ), nuclear family system ( $\beta=0.31$ , 95% CI=0.03-0.59,  $p<0.05$ ), positive medical history of chronic diseases such as hyperglycemia and hypertension ( $\beta=0.61$ , 95% CI=0.31-0.90,  $p<0.001$ ) and existence of leisure time physical activity ( $\beta=0.37$ , 95% CI=0.16-0.58,  $p<0.001$ ) while BMI was negatively associated with it ( $\beta=-0.04$ , 95% CI=-0.07- -0.02,  $p<0.001$ ). The study findings supported association between socioeconomic, lifestyle and health factors and adherence to a 'nutrient-dense' dietary pattern. It is therefore suggested considering all of these important factors when nutrition policies and programs are designed for women in general and those from minority community in specific.

## Keywords

Socioeconomic Health, Determinants, Dietary Patterns, Minority Women, Pakistan

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## 1. Introduction

Dietary patterns have emerged as an effective way of describing and quantifying eating behavior, examining the distribution of food by frequency or amount in the habitual diet [1]. Dietary patterns enable the estimation of the cumulative effect of several food items consumed together,

instead of single approach that ignores the integration of nutritional interaction by the dietary components [2]. Examination of dietary patterns more closely parallels the real-world conditions as they represent a broader picture of nutrient consumption that occurs together in common foods.

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Assessment of the dietary patterns of specific population groups improves our understanding of the complex relationship between diet and risk of chronic diseases. Moreover, appropriate knowledge of overall food choices is essential for providing nutrition guidance to the consumers and may help policy making processes to promote an affordable, healthy diet [3].

Dietary pattern in any population are influenced by biological, nutritional, socioeconomic and demographic characteristics, climatic conditions, food availability, personal liking and disliking, culture and respective religious preferences [4, 5]. Assessment of food groups consumed helps in the determining whether the current dietary pattern of a population group is consistent with the dietary recommendations or not; thus it is related to a particular health outcome [5]. Such information is important for assessing the requirements of community-based interventions and defining health strategies in different populations. Very limited information is available from developing countries that are facing epidemiologic transition with double burden of diseases.

In Pakistan, minorities are playing significant role in the development and prosperity of the country. The Hindus, Sikhs, Christians and Qadianis are the dominant group among minorities. The Hindus constitute 5.5% of the total population of Pakistan [6]. Various surveys have been conducted in Pakistan regarding social, economic and demographic aspects at the community and household levels but none provide information regarding dietary pattern, particularly in minority women. Women are generally neglected as compared to men in all aspects of human life and across all socio-economic and cultural settings which is reflected by the high incidence of malnutrition and high mortality rates among them. To our knowledge, the present study is first of its kind in attempting to determine the socio-economic and health characteristics associated with major dietary patterns in Hindu minority women living in the remote region of North West Pakistan.

## 2. Methods

### 2.1. Study Design and Sample

This cross-sectional study was conducted in Districts Swat and Buner located in the North West of Pakistan. About 5% of the population in the study area is minorities; Hindus make the major portion, mostly settled in the urban areas.

Sample size was calculated using Yamane equation [7]. A total of 250 Hindu women aged > 18 years, pre-menopausal stage, non-pregnant, non-lactating and free from any chronic disease were randomly selected. Ethical approval to conduct

this cross-sectional survey was obtained from the Directorate of Advance Studies and Research (DASAR), the University of Agriculture, Peshawar - Pakistan. Before data collection, consents of respondents to participate in the study were sought.

### 2.2. Measurements

Standardized questionnaires were used to collect relevant data by trained research team. Data on demographic socioeconomic status, dietary intake, leisure time physical activities, medical history and health status of the respondents were collected interviewing them in person.

Demographic socioeconomic data included age; marital status; education level of respondent's and their husband or father; family size; family type (whether living in a joint or nuclear family system); monthly family income and house ownership status. Questionnaires on 'medical history and health status' contained questions whether the respondent currently used any supplement and she had ever been diagnosed for raised blood pressure, blood sugar level or lipid profile.

A Food frequency questionnaire (FFQ) was developed by the research team including almost all locally consumed food items and beverages (total food items were 93; however empty space was also provided to add any skipped or missed food item during interview) and pretested. The participants were asked to recall the number of times each food item was consumed per day, week and month, or rarely/never during the past month.

Leisure time physical activities (such as walking, jogging and indoor sports), time spent in sedentary activities (as watching television or videos, reading, sitting, cooking) and medical history of the women were assessed using a validated self-report questionnaire. All questions were in accordance with the prevailing culture and customs of the study area where, women usually do not get involved in outdoor leisure time physical activities.

Women height and weight were measured after completion of all questionnaires. Height was measured using an ordinary measuring tape with the participants wearing no shoes, and it was recorded to the nearest 0.1 cm. Weight was recorded in light, indoor clothing with a calibrated and standardized digital scale to the nearest 0.1 kilogram. Both measurements were used to calculate body mass indexes (BMI) of the women ( $BMI = \text{Weight (kg)} / \text{Height (m)}^2$ ).

### 2.3. Statistical Analysis

All data were analyzed using the statistical package for the social sciences, SPSS Version 18 (SPSS Inc. Chicago, IL, USA). Descriptive analysis was first performed to clean the

data from entry errors. Appropriate statistical tests were performed at the significant level of 0.05 for continuous and categorical variables.

Based on similar nutrients profile, food items listed in the FFQ were grouped into 26 food groups. Two major dietary patterns, 'nutrient-dense' (characterized by nutrient dense food items) and 'energy-rich' (characterized by energy rich food items) were identified based on the frequency of consumption of each of the 26 food groups using factor analysis. Data adequacy and possibility to perform factor analysis were assessed using the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) [8] and Bartlett Test of Sphericity (BTS) [9]. A high KMO (maximum 1.0; minimum acceptable 0.5) indicates that data are likely to factor well since correlations between pairs of variables can be explained by the other variables. The factor analysis model was appropriate (KMO: 0.82; BTS showed a  $p < 0.001$ ). A correlation matrix was then constructed. Correlation coefficients were analyzed by principal component analysis (PCA) and subsequent rotation according to the standard varimax criterion [10]. Two interpretable factors were retained based on the Scree test [11]. Food groups with factor loadings  $> 0.30$  were retained in the patterns identified. Standardized factor score coefficients (mean  $\pm$  standard deviation, SD:  $0 \pm 1$ ) were estimated by regression after PCA and saved for each dietary pattern. Dietary patterns were labeled based on interpretability and characteristics of the items retained in each pattern.

Analysis of Covariance (ANCOVA) was then used to assess the association between socioeconomic, lifestyle characteristics and health factors, and dietary patterns. In the multivariate ANCOVA models, factor scores were entered as *dependent* while other variables were entered as *independent variables*. Results were simultaneously adjusted for all variables in the models.

### 3. Results

Two main patterns with larger variance explained, 17.1% and 19.3%, were identified (table 1) and labeled as, 'nutrient-dense' and "energy-rich" dietary patterns. 'Nutrient-dense' pattern was composed of white meat (chicken, mutton and fish), egg, whole cereal food products, fresh fruits and non-starchy vegetables; most of these groups were nutrient dense and provide sufficient amount of dietary fiber. 'Energy-rich' pattern was composed of refined cereals, sweets, confectionery and bakery products, fast / junk food items, soft drinks, starchy vegetables and deep fried foods such as *paratha* (fried pan-cake); most of them were predominantly highly energy rich and low dietary fiber foods.

**Table 1.** Factor loading matrix for 'Nutrient-dense and Energy rich' dietary patterns identified through food frequency questionnaire data.

Food groups	Factor Loads	
	Dietary Patterns	
	Nutrient-dense Pattern	Energy rich Pattern
Salad	0.72	--
Green leafy vegetables	0.68	--
Whole grain	0.61	--
Fresh fruits	0.61	--
Pulses	0.59	--
Dairy products, low fat	0.57	--
Poultry & mutton	0.42	--
Fish	0.40	--
Colored Vegetables	0.35	--
Egg	0.31	--
Refined cereals & rice	--	0.68
Fried foods	--	0.62
Starchy vegetables	--	0.52
Sweets/added sugar	--	0.51
Confectionery / bakery products	--	0.50
Fat/oil	--	0.49
Junk/fast foods	--	0.46
Desserts	--	0.39
Nuts	--	0.37
Dairy products, high fat	--	0.35
Soft drinks	--	0.32
Organ meat	--	--
Salt	--	--
Red Meats	--	--
Tea	--	--
Fruit juices	--	--
% of explained variance	17.1%	19.3%

Values  $< 0.30$  were excluded for simplicity

Table-2 depicts results on multivariate-adjusted regression analysis of factors (socioeconomic, health and nutritional status and leisure time physical activity) associated with adherence to the two dietary patterns. In these analyses, the factor score from each dietary pattern was modeled as a continuous variable. The regression coefficients and confidence intervals (95% CI) for each variable associated with the adherence to both patterns along with the respective p-values are shown in the table. The 'nutrient-dense' pattern was positively associated with age ( $\beta = 0.04$ , 95% CI: 0.009; 0.07,  $p < 0.05$ ), women's husband or head of the household education level ( $\beta = 0.35$ , 95% CI: 0.09; 0.59,  $p < 0.001$ ), nuclear family type ( $\beta = 0.31$ , 95% CI: 0.03; 0.59,  $p < 0.05$ ), history of ever raised blood pressure, lipid profile or glucose level ( $\beta = 0.61$ , 95% CI: 0.31; 0.90,  $p < 0.001$ ), and leisure time physical activity ( $\beta = 0.37$ , 95% CI: 0.16; 0.58,  $p < 0.001$ ); however negative association between 'nutrient-dense' dietary pattern and BMI was evident ( $\beta = -0.04$ , 95% CI: -0.07; -0.02,  $p < 0.001$ ). On the other hand, monthly family income ( $\beta = 0.02$ , 95% CI: 0.006; 0.03,  $p < 0.05$ ) and BMI ( $\beta = 0.06$ , 95% CI: 0.03; 0.09,  $p < 0.001$ ) were positively; while age ( $\beta = -0.05$ , 95% CI: -0.07; -0.02,  $p < 0.001$ ), women's husband / or head of the household education level ( $\beta = -0.57$ , 95% CI: -1.06; -0.08,  $p < 0.05$ ), and leisure time physical

activity ( $\beta=-0.41$ , 95% CI: -0.62; -0.19,  $p<0.001$ ) were negatively associated with the ‘energy-rich’ dietary pattern’.

**Table 2.** Factors associated with adherence to the dietary patterns.

Factors	Multivariate Regression Coefficients, $\beta$ (95% CI) <sup>1</sup>	
	Nutrient-Dense Pattern	Energy-Rich Pattern
Age	0.04 (0.009; 0.07)*	-0.05 (-.07; -0.02)**
Respondent education	< 10 years	Ref
	> 10 years	0.05 (-0.21; 0.31)
Husband education <sup>2</sup>	< 10 years	Ref
	> 10 years	0.35 (0.09; 0.59)**
Marital status	Single	Ref
	Married	-0.13 (-0.43; 0.17)
Family type	Joint	Ref
	Nuclear	0.31 (0.03; 0.59)*
Family size	< 5	Ref
	> 5	-0.08 (-0.31; 0.14)
Monthly income (RS)	-0.002 (-0.011; 0.007)	0.02 (0.006; 0.03)*
House ownership	Owner	Ref
	Rent	0.14 (-0.11; 0.39)
Medical history <sup>3</sup>	No	Ref
	Yes	0.61 (0.31; 0.90)**
Body Mass Index		-0.04 (-0.07; -0.02)**
		0.06 (0.03; 0.09)**
Current use of medicine <sup>4</sup>	No	Ref
	Yes	-0.05 (-0.33; 0.24)
Physically active	No	Ref
	Yes	0.37 (0.16; 0.58)**

<sup>1</sup> Adjusted for all variables listed in the table <sup>2</sup> Formal education level of the women’s husbands or head of household <sup>3</sup> Medical history of ever raised blood pressure, lipid profile and / or sugar. <sup>4</sup> Use medicines / supplements currently

\* $p<0.05$  \*\* $p<0.001$

## 4. Discussion

This study examined various socio-demographic, life style and health characteristics in relation to dietary patterns in a cohort of women from minority living in a semi-urban mountainous area of North West Pakistan. Two major dietary patterns, ‘nutrient-dense’ and ‘energy rich’ were extracted; former one can be considered as *healthy* while the latter one as *unhealthy* dietary pattern based on their overall nutritional quality. The study identified factors influencing dietary patterns of minority women. Factors influencing women dietary patterns included age, formal education of women’s partners (if married) or head of household (if single), family type, family monthly income, women’s medical history of ever raised blood pressure, blood lipid profile or glucose levels, BMI and leisure time physical activity.

Respondents with advanced age were more likely to have

adherence with ‘nutrient-dense’ dietary pattern. In previous studies, young age has been found in association with adherence to ‘energy-rich’ dietary patterns [12]; a similar trend was also observed in the current study. Women having formal education (husband or heads of the household) > 10 year, nuclear family type, positive history of ever raised blood pressure, blood lipid profile and glucose level, leisure time physical activities and low BMI, were more like to have a ‘nutrient-dense’ dietary pattern. No impact of participants’ formal education with adherence to either dietary pattern was evident. Our respondents belonged to the far flung area of Pakistan, where formal education in women is not common. In general, literacy rate in rural areas of North West Pakistan is 31% in female compared to 70% male of age 10 years and above [13]. However, formal education of the husbands or household head was associated with an increased adherence to ‘nutrient-dense’ dietary pattern ( $p<0.001$ ) indicating the significant role of education in dietary choices for household consumption.

More interestingly, family income was associated with the adherence to ‘energy-rich’ dietary pattern. High income has been previously found positively associated with healthy dietary intake (characterized by consumption of nutrients rich food items) in both young and adults [14, 15]. These contrasts in findings suggest the existence of other factors in addition to socio-economic status that might significantly influence dietary patterns of the study cohort. Previously, various factors have been identified related to dietary intake and choices of healthy foods; such as in addition to socio-economic, attitudes [16] and nutritional knowledge [17] were reported as major factors influencing an individual’s food choices and behaviors at community level. Lack of nutritional awareness, especially in individuals with high income may lead to adopt unhealthy dietary preferences [18]. Though in the current study, no data on nutritional awareness was collected; however, it can be postulated that women with high income were likely to consumed energy rich food items which might be link to lack of nutritional awareness. Findings of a previous study showed a positive association between income and ‘western pattern’, being principally characterized by a high consumption of red meats, poultry, processed meats, refined cereals, and dessert in comparison to ‘prudent pattern’ being characterized by a diet rich in vegetables, fruits, and fish and seafood [19].

Medical history was in strong positive association with greater adherence to ‘nutrient-dense’ dietary pattern; these findings suggest that women with positive medical history were more likely to modify dietary habits and adopt healthier diets. It can also be postulated that women with medical history might have motivation from ‘healthcare service providers’ to bring modification in their diets in accordance



to their physiological health status. Similarly, women living in the nuclear family system were more likely to follow 'nutrient-dense' dietary pattern compared to those living in joint family system. Previously, nuclear family has been found an important factor that had positive effect on modification of dietary behavior [20].

Physical activity had a strong positive association with adherence to 'nutrient-dense' dietary patterns in the study cohort. Such results have also been reported previously. [12] Our results on association of physical activity and dietary pattern indicate that women following a 'nutrient-dense' dietary pattern would also understand the importance of leisure time physical activity in health maintenance. Sedentarism combined with consumption of energy rich diets eventually results in an increase in body mass and fat storage; similarly, a positive association have been reported between body mass index and socioeconomic status in both men and women from developing countries [21].

One major limitation of the study is its cross sectional nature due to which there is generally no evidence of a temporal relationship between exposure and outcome. However, cross sectional design is widely used in community based research studies because it requires a relatively shorter time commitment and fewer resources to conduct [22]. Dietary status of the women was assessed using FFQ. Though the FFQ was carefully designed and pre-tested in order to ensure its effectiveness and to remove any ambiguity; a major limitation of the FFQ is that it relies heavily on memory and may lead to biases. The FFQ have become one of the key research tools in nutrition epidemiology [23]. Dietary data collection through FFQ is the best available method to assess *habitual* dietary intakes. The FFQ used in this study appeared to be an acceptable tool for assessing dietary intakes in this particular population.

Our study has certain strengths. Study districts are located in a far flung area of North West Pakistan where the study subjects are living for a longer time. They have their own identity; though being a part of the local community, they are enjoying their religious traditions, customs and specific dietary patterns. They consume mutton and white meat and avoid red meat (beef); however most of them are *lacto-ovo-vegetarians* and also frequently use caffeinated drinks. To our knowledge, this is the first explorative study on minority population of North West Pakistan that has attempted to look at the association of socioeconomic, lifestyle and health factors with the quality of dietary patterns. Sample size was calculated using Yamane formula; this method is simple and useful in extracting a representative sample size from a specific population because it takes the total study population size into consideration. Our sample was comprised of both single and married women living in two basic family types;

thus tried to explore the impact of these important factors on dietary choices and adaptation. After marriage, women may get decision making power in a nuclear family type which she may not be able to enjoy in joint family system. Better nutritional status had been found in strong association with female household heads in a developing country, Zimbabwe, because of their access to and control over food resources [24].

## 5. Conclusion

Two major dietary patterns, 'nutrient-dense' and 'energy rich' were extracted in this study. Among the demographic socioeconomic and health related factors, women age, education level of their husbands or head of the household, nuclear family type, medical history of non-infectious health problems and level of physical activity were positively associated with the healthy dietary pattern being characterized by nutrient-dense food items. Nutrition programs specific to minority are required to be initiated in Pakistan to promote health of this important segment of the population and to eliminate ethical inequalities in health.

## References

- [1] Newby PK, Tucker KL (2004) Empirically derived eating patterns using factor or cluster analysis: A review. *Nut Rev* 62: 177-203.
- [2] Naska A, Fouskakis D, Oikonomou E, Almeida MD, Berg MA, Gedrich K (2006) Dietary patterns and their socio-demographic determinants in 10 European countries: data from the DAFNE databank. *Eur J Clin Nut* 60: 181-90.
- [3] Jacques PF, Tucker KL (2001) Are dietary patterns useful for understanding the role of diet in chronic disease? *Am J Clin Nut* 73:1-2.
- [4] Bonomo É, Caiaffa WT, César CC, Lopes AC, Lima-Costa MF (2003) Food intake according to socioeconomic and demographic profile: the Bambui Project. *Cadernos de Saúde Pública* 19: 1461-71.
- [5] Kant AK (2004) Dietary patterns and health outcomes. *J Am Diet Assoc* 104: 615-35.
- [6] Ali S (2010) Portrayal of Minorities in Elite English Press of Pakistan: A Study of Daily Dawn and the Nation. *Pak J Soc Sc* 30: 141-56.
- [7] Yamane T (1967) *Statistics, an Introductory Analysis* (2nd Ed). New York, Harper and Row.
- [8] Kim JO, Mueller CW (1978) Factor analysis: statistical methods and practical issues. Thousand Oaks, CA. Sage Publications.
- [9] Bartlett MS (1950) Tests of significance in factor analysis. *Brit J Psych* 3: 77-85.
- [10] Armitage P, Berry G, Matthews JN (2008) Multivariate methods. In: *Statistical methods in medical research*. John Wiley & Sons.

- [11] Cattell RB (1966) The Scree test for the number of factors. *Multi Beh Res 1*: 245-76.
- [12] Sánchez-Villegas A, Delgado-Rodríguez M, Martínez-González MÁ, De Irala-Estevez J (2003) Gender, age, socio-demographic and lifestyle factors associated with major dietary patterns in the Spanish Project SUN (Seguimiento Universidad de Navarra). *Eur J Clin Nut 57*: 285-92.
- [13] Pakistan Social and Living Standards Measurement Survey (2013-2014) Pakistan Bureau of Statistics., Government of Pakistan. *available online on: <http://www.pbs.gov.pk/content/pakistan-social-and-living-standards-measurement> visited on 16th January 2016*.
- [14] Zarnowiecki D, Ball K, Parletta N, Dollman J (2014) Describing socioeconomic gradients in children's diets—does the socioeconomic indicator used matter? *Int J Beh Nut Phy Act 11*: 44-48.
- [15] Rezazadeh A, Rashidkhani B, Omidvar N (2010) Association of major dietary patterns with socioeconomic and lifestyle factors of adult women living in Tehran, Iran. *Nutrition 26*: 337-41.
- [16] Pollard J, Kirk SFL, Cade JE (2002) Factors affecting food choice in relation to fruit and vegetable intake: A review. *Nut Res Rev 15*: 373-87.
- [17] O'Brien G, Davies M (2007) Nutrition Knowledge and Body Mass Index. *Heal Edu Res 22*: 571-75.
- [18] Brown K, McIlveen H, Strugnell C (2000) Nutritional awareness and food preferences of young consumers. *Nut Food Sc 30*: 230-35.
- [19] Paradis AM, Pérusse L, Vohl MC (2006) Dietary patterns and associated lifestyles in individuals with and without familial history of obesity: A cross-sectional study. *Int J Beh Nut Phy Act 3*: 38-46.
- [20] Kapur K, Kapur A, Ramachandran S, Mohan V, Aravind SR, Badgandi M (2008) Barriers to changing dietary behavior. *J Assoc Phys India 56*: 29-32.
- [21] Nagata JM, Valeggia CR, Barg FK, Bream KD (2009) Body mass index, socio-economic status and socio-behavioral practices among Tz'utujil Maya women. *Econom Human Bio 7*: 96-106.
- [22] Rothman KJ (1998) Greenland S. *Modern Epidemiology*. Philadelphia, PA, Lippincott-Raven.
- [23] Cade JE, Burley VJ, Warm DL, Thompson RL, Margetts BM (2004) Food-frequency questionnaires: A review of their design, validation and utilization. *Nut Res Rev 17*: 5-22.
- [24] Hindin MJ (2000) Women's power and anthropometric status in Zimbabwe. *Soc Sc Med 51*: 1517-1528.