



Research Article

Development and Optimization of a Meal Planning Exchange List of Commonly Consumed Breakfast in Peshawar

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Abstract | Nutrient composition data is essential for the development of meal planning exchange list of frequently consumed breakfasts of Khyber Pakhtunkhwa (KPK). Twelve (N=12) commonly consumed breakfast were selected. Breakfasts were prepared according to averaged and standard recipe. Following an approximation method recommended in literature Exchange lists were developed. Data on the nutritional composition of commonly consumed breakfast in Peshawar Khyber Pakhtunkhwa can be used by health care workers, nutritionists and dietitians to calculate energy and nutrient intakes. It will help addressing the major nutritional disorders that are related with the diet of community. The research study was a challenging one as it was an exploratory study it gave an insight both to the cultural relevance of commonly consumed breakfast in Peshawar and its macro-nutrient content.

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Keywords | Meal planning exchange list (MPEL), Commonly consumed breakfast (CCBF), Nutrient intakes, Peshawar



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Introduction

Breakfast is considered as a one of the utmost meals of the day and has been concerned with weight control, cognitive performance and cardio-metabolic risk factors and remained as inconclusive in relation with health benefits of breakfast, Food compositions tables are the primary device for the work of human nutritionist and dietitians. Each nutritional prescription is constructed in accordance with the data in the food tables. Every study of the relationship between diet and health depends

on the use of food composition tables to calculate nutrient intake (Baker and Robertson-Wilson, 2003). Food composition tables provide detailed information about the concentration of nutrients and nutritionally important components in food. Food composition tables have a wide variety of uses, which include assessment of health and nutritional status of individual at regional, national and international levels (Khan *et al.*, 2013).

According to the recent research 15-25% of total energy intake is consumed by healthy breakfast intake

(Spencer *et al.*, 2017). Food exchange list is a tool for inculcating healthy eating habits besides managing those chronic and non-communicable diseases for which dietary modification is a corner stone of treatment. Research was conducted to develop a meal planning exchange list for traditional combination dishes in Jordan, traditional dishes were selected and cooked according to averaged recipes. Significant correlation was found between carbohydrates, protein and fats (Bawadi *et al.*, 2008).

The study was aimed to develop a Meal Planning Exchange List (MPEL) for commonly consumed breakfast in Peshawar. The entire list will incorporate details of associated energy and macronutrient content along with the appropriate serving size and food groups. Commonly consumed breakfast (CCBFs) will be grouped in such a manner so that one breakfast could be replaced by another breakfast within the same group in the proportion stated and will yield similar amount of energy and macronutrients. Moreover, the commonly consumed breakfasts could be consumed interchangeably without any change in estimated amounts of macronutrients (carbohydrate, protein and fats) and total kilo calories supplied by a breakfast.

The current study takes into consideration the cultural relevance of the breakfast as all the breakfast have been drawn out from within the Peshawari population. The Pakistani dietitians frequently use MPEL developed by the American Dietetic Association for estimation of nutrient content of planned meals but face difficulties and constraints as they are unable to include commonly consumed breakfast in their dietary prescription. This research, thus, will enable the practitioners all over Peshawar to take into consideration Commonly Consumed Breakfasts (CCBFs) to set realistic and practical meal plans. Additionally, it can be useful for practitioners outside Peshawar working with Pakistani immigrant community. This study will contribute in:

Policy impact: Offer recommendations that could influence local food policies or public health initiatives, contributing to improved dietary practices and health outcomes.

Scalability: Develop a model that could be adapted for use in other regions or countries with similar cultural and dietary contexts, enhancing the broader

applicability of your findings.

Educational framework: Create an educational framework based on the exchange list that can be used in schools, community centers, and health programs to promote better nutrition.

Awareness campaigns: Design targeted awareness campaigns to educate the public about the nutritional value of traditional breakfasts and encourage healthier eating habits.

Localized focus: Offers specific insights into Peshawar's breakfast foods, combining nutritional analysis with cultural context.

Advanced analysis: Utilizes modern nutritional tools and detailed profiling.

Cultural integration: Bridges traditional food practices with contemporary nutritional guidelines.

Practical application: Provides a tailored meal planning exchange list and educational resources.

Community-centric: Engages local stakeholders and incorporates their feedback.

By emphasizing these novel aspects, the conducted research will contribute valuable, context-specific knowledge and practical tools for improving nutritional practices in Peshawar, offering a unique and impactful addition to the field.

Use of exchange list in health and disease

There are numerous diseases, for instance, diabetes; cancer etc. obesity has been widespread internationally. These diseases can be eliminated or diminished due to healthful diet (Bewadi and Al-Sahawneh, 2008).

Exchange list and weight management

Up to five decades, the exchange lists have been considered for diabetes related people and weight-loss people (Wheeler *et al.*, 1996). It was perceived a powerful receipt for persons with diabetes. It assumes good nutrition and weight management (Daly *et al.*, 2003).

Meal planning exchange list and diabetes

Diabetes is a growing all over the world like wild-fire. The expected population of diabetes is 366

million in 2030 which is a red alarm for world health organization (Wild *et al.*, 2004). Findings from epidemiologic studies indicate that there are links between breakfast consumption and a lower risk of type 2 diabetes mellitus and metabolic syndrome, prompting interest in the influence of breakfast on carbohydrate metabolism and indicators of diabetes risk. The complication of diabetes, in Pakistan, is also a phenomenon in current century. It is a major challenge for health care system to deal with (Basit *et al.*, 2015).

Revision of exchange list

Since the mid of 20th century, many experiments have been done by researchers. Lists of foods or serving sizes are evaluated to justify the results. Sometimes the average energy or protein values are being evaluated for justification of results. All these variables are being justified by nutrient databases. Caso and Stare performed a test on carbohydrate which was the restructured test of Olmsted's group. They restructured the first ELs in 1986 which was established by prepared database. It was updated again in 1995. The average group summaries it and was published. Later in 2003, it was again restructured and given access to every professional for evaluation (Wheeler, 2003). In last decade, with a sophisticated title "Choose Your Foods: Exchange Lists for Diabetes" it has been again updated (Geil, 2008).

Why new exchange list is important

Food selection has been influenced by ethnic differences and cultures. It is therefore, people are mostly influenced to adopt culturally accepted foods. The Jordanian dietitians utilized exchange lists of American Dietary Association (ADA). But they included their cultural foods in the meal plans by developing an exchange list for traditional Jordanian cuisines. It justifies that cultural dish has important influence on eating habits. Therefore, culture has a major influence on the nutrition practices (Bawadi *et al.*, 2009).

Research objectives

Primary goal of the current study was to analyze the nutritive value and composition of commonly consumed breakfasts in Peshawar and to develop a meal planning exchange list that reflects the nutritional needs and cultural preferences of the local population.

Customized exchange list: Create a meal planning exchange list specifically for Peshawar's breakfast foods. This list can be tailored to local dietary needs and preferences, offering a practical tool for meal planning and nutrition education.

Nutritional balancing: Develop an exchange list that balances traditional foods with recommended dietary guidelines, ensuring it meets nutritional needs while respecting cultural preferences.

Optimization techniques

The following Optimization Techniques were applied for the creation of food exchange lists.

Calorie adjustment: For weight management, adjustment of the portion sizes done on the basis of caloric needs.

Variety: Included options to vary the meal plan while maintaining cultural relevance (e.g., replacing paratha with roti or naan).

Cultural sensitivity: Ensured that the meal plan respects local customs, religious practices (e.g., halal meats), and seasonal food availability.

By developing an exchange list with these considerations, meal planning was tailored to the dietary patterns in Peshawar, promoting healthier eating while respecting traditional food choices.

The present study could be useful for practitioners outside Peshawar working with Pakistani immigrant community, health care professionals in providing healthier food choices within customized meal plan. Furthermore, practitioners and community workers elsewhere in the world may also benefit from this work both during epidemiological studies and while managing the diet of patient.

Materials and Methods

Collection of samples

For sample collection prepared questionnaires were distributed among 440 house wives from different area of Peshawar by using Stratified Random Sampling method.

Data collection

Peshawar district was divided into four strata and 100

questionnaires were distributed in each stratum. The Respondents were asked to name twenty breakfast they regularly consume and cooked at home. The names of breakfast were recorded in questionnaire. Most frequently mentioned breakfast (N=12) was selected to be included in the exchange list for further analysis.

Sample selection: The identified representative samples of breakfast items were selected which are commonly consumed in Peshawar. This was involved food surveys, local market research, and interviews with residents.

For sample collection, a questionnaire was prepared and distributed among four hundred house wives in urban areas of Peshawar. Sixty house wives from urban areas of Peshawar were randomly short listed. Housewives from different urban areas of Peshawar i.e. (Hayatabad, University town, Saddar and Husht Nagri) were randomly selected. The respondents were asked about the name of twenty breakfasts more often served at home. The various names of breakfast were recorded in a questionnaire. Most frequently mentioned breakfast (N = 12) was selected to be included in the exchange list. The above-mentioned areas were selected on the criteria that these communities are located at a distance from each other. Also, the selected areas covered the cultural and geographic variation in the province.

$$\begin{aligned} \text{Number of households} &= \text{Total number of sample size} \\ \text{Selected number of UC} &= 440 \text{ households} \\ 18\text{UC} &= 24 \text{ households per UC} \end{aligned}$$

Study scope

The current study aims to develop a Meal Planning Exchange list for commonly consumed breakfast in Peshawar. The dietitians and healthcare experts are using developed exchange list to check individuals portion sizes of food as well as their energy intake. Moreover, commonly consumed breakfast could consume interchangeably without any change in estimated amounts of macronutrients (Carbohydrates, protein, and fats) and total kilo calories supplied by a breakfast.

Study design

Type of study: Descriptive study design was applied in a combination of quantitative and qualitative methods.

Approach: Cross-sectional analysis of commonly consumed breakfast items was followed.

Nutrient analysis

Food sampling: Collected samples of the identified breakfast items.

Laboratory analysis: Test samples for macronutrients (carbohydrates, proteins, fats) and micronutrients (vitamins, minerals) were undertaken.

Cultural data

Interviews/Focus groups: Conduct interviews or focus groups with local residents to gather qualitative data on eating habits and preferences.

Field observations: Observe local eating practices and food preparation methods.

Data analysis

Quantitative analysis: Nutrient profiling: Analyze the nutritional content of each breakfast item and compare it with dietary guidelines.

Statistical tools: Use statistical software to analyze nutrient data and identify patterns or correlations.

Qualitative analysis

Thematic analysis: Was used to analyze interview and focus group data to understand cultural preferences and practices.

Content analysis: Review field notes and observational data to contextualize nutritional findings.

Development of exchange list

Categorization: Group breakfast items into categories based on their nutrient content (e.g., carbohydrate sources, protein sources, fat sources).

Portion sizes: Define standard portion sizes for each food item based on average consumption and nutritional needs.

Nutritional balance: Ensure that the exchange list provides a balanced mix of nutrients and aligns with dietary guidelines.

Validation and refinement

Expert review: Was taken to present findings to local nutritionists, dietitians, and public health experts for

feedback and validation.

Community feedback: Was taken to share the proposed meal planning exchange list with community members to ensure it meets their needs and preferences.

Revisions: The research work was revised to make necessary adjustments based on expert and community feedback.

Implementation and dissemination

Educational materials: Develop educational materials (e.g., brochures, workshops) to inform the community about the new meal planning exchange list.

Integration into programs: Work with local health organizations or schools to integrate the meal planning exchange list into nutrition programs.

Monitoring and evaluation: Set up a system to monitor the implementation and impact of the exchange list on dietary habits and health outcomes.

Ethical considerations

Informed consent: Was taken to ensure that participants in interviews or focus groups provide informed consent.

Data confidentiality: Was applied to maintain confidentiality of all participant data and research findings.

Collection of recipes

First priority was given to minimize the variation in breakfast preparation methods. Therefore, five respondents were enquired to deliver a detailed recipe for each breakfast. The type and amount of each ingredient was recorded in a questionnaire. The quantity of each ingredient was then averaged using the summation method. Each item in the mean recipe was reported in both kitchen and standard measures.

Preparation and analysis of breakfast

Chemical composition of breakfast: Association of Official Analytical Chemists (AOAC) procedures were followed for analysis of chemical composition of breakfast. It assumes the amount of moisture, ash protein, fat and carbohydrate. Duplicate standardized samples (300 g) from every breakfast were chemical

analysis of short-listed Breakfasts was carried out in human nutrition laboratory at The University of Agriculture Peshawar Pakistan.

Breakfast preparation

One of the mean batch recipes was cooked. Keeping cooking conditions controlled in all aspect. Researcher utilized same kitchen and facilities during cooking. The cooking was done to get exact weight of the ingredients and net weight of cooked Breakfast.

Results and Discussion

There have been very limited studies conducted on nutritional composition of commonly consumed breakfast in Peshawar that collected averaged recipes, cooked breakfast according to standardized recipe and nutritionally analyzed breakfast for development of meal planning exchange list. Housewives from different urban areas (Hayatabad, University town, Saddar and Husht Nagri) Peshawar were randomly selected and the key study protocols are summarized in [Table 4](#).

In total, 12 different breakfasts have been analyzed for their proximate composition. Protein, fat and carbohydrate content per 100 g for 12 conventional breakfasts analyzed in this study are given in [Table 2](#). On the basis of data in [Table 2](#), meal planning exchange list for commonly consumed breakfast of Khyber Pakhtunkhwa is currently available and prepared for use by public and the health professionals. [Table 3](#) presents the protein, fat and carbohydrate exchanges of the study. Significant variations were observed in the nutritional composition of the studied breakfast due to different method of preparation and variety of ingredients. In general, commonly consumed breakfast of Khyber Pakhtunkhwa included in this study have high protein, adequate fats and variable carbohydrate ([Table 2](#)).

Strong correlation was found for carbohydrate and protein content and weak correlation was found for fat. Correlation coefficients were 0.80($p < 0.01$) for carbohydrate, 0.682 ($p < 0.01$) for protein and 0.295 ($p = 0.113$) for fat. It is important to note that in the Nutrient analysis software ingredients entered were in uncooked, raw form; while in lab proximate examination results obtained were from the cooked breakfast. The data from nutrient analysis software was obtained from the addition of the all constituents

in their crude, uncooked form. For that reason, the differences may be obviously seen in breakfast that needs extensive heat up and cooking treatment. The amount of moisture ranged from 34.9 in halwa puri to 78.6% in porridge. Moisture content was moderately high in all breakfast analyzed in this study. The moisture is directly related to the amount

of water in the breakfast, the ingredients and time of cooking (Musaiger *et al.*, 2007). Therefore, the recipe and cooking method may have resulted in such differences. In addition, Hurtado *et al.* (2001) have revealed that food has good storage stability and low microbiological activity if it has low water activity and moisture.

Table 1: Major ingredients of twelve commonly consumed breakfasts in Peshawar.

Local name	Common name	Major ingredients
Choley	Chick pea curry	Chick pea, onion, tomato, garlic and ginger paste, green chili, cooking oil, spices, coriander, salt, water, soda
Omelate	Omelate	eggs, onion, tomato, green chili, cooking oil spices, salt, coriander, water
Potato paratha	Aloo ka paratha	potatoes, onion, tomato, green chili, cooking oil, salt, spices, coriander, wheat flour
Halwa	Halwa	suji, sugar, saffron, cooking oil, salt, cardamom, water
Puri	Puri	whole wheat flour, water, salt, cooking oil
Shami kabab	Minced meat and lentil patties	Minced mutton, daal channa, onion, tomato, garlic and ginger paste, green chili, cooking oil, spices, salt, coriander, water, lemon juice
Siri paya	Siri paya	Beef trollers, onion, tomato, ginger and garlic paste, spices, Black paper, cooking oil, coriander, salt
Nihari Gosht	Beef nihari	Beef, onion, tomato, ginger and garlic paste, green chili, nihari masala, wheat flour, coriander, cooking oil, salt, water
Kaleji	Liver	Liver, tomato, green chili, ginger and garlic paste, spices, cooking oil, salt, coriander, lemon
Haleem	Haleem	Meat, onion, mash bean, masoor lentils, wheat, slit chick pealenticils, moong lentils, ginger and garlic paste, green chili, haleem masala, salt, cooking oil, coriander, lemon, tomato, water
Khagina	Scrambled egg	eggs, onion, tomato, green chili, turmeric powder, spices, salt, cooking oil, coriander, soda, water
Dalia	Porridge	Broken wheat, sugar, milk, chopped nuts, raisins cardamom, honey, banana
Fried minced meat	Bhuna keema	minced beef, onion, tomato, green chili, ginger and garlic paste, spices, salt, coriander, cooking oil, lemon juice

Table 2: Energy content (per 100g wet weight) of commonly consumed breakfast in Peshawar.

Dish	Protein		Fats		Carbohydrate		Total energy
	Kcals	% of total	Kcals	% of total	Kcals	% of total	Kcals
Choley	4.2	9.4	9.3	46.5	18.6	41.3	179.9
Omelate	3.8	15.2	16	59.03	10.1	91.2	99.6
Aloo Paratha	3.6	10.6	3.9	26	21.3	63.2	134.7
Halwa	1.1	1.3	15.8	42.7	46.5	55.9	332.6
Puri	5.5	2.6	40	72.2	32.5	45.6	289.5
Seri Paya	12.9	31	7.4	40	12	28.8	166.2
Haleem	10.9	27.7	6.3	35.8	14.5	36.6	158.3
Nihari	8.9	16.6	11.6	48.7	18.6	34.7	214.4
Shami Kabab	6.7	10	18.1	60.9	19.4	29	267.3
Kaleji	18.1	23.1	16.8	48	22.8	28.9	314.8
Khagina	5.9	16.1	9.2	56.5	10	27.3	146.4
Bunna Keema	15.7	21.1	16.8	51	20.6	27.8	296.4
Porridge	4.4	14.9	2.5	19	19.4	65.7	118

Table 3: Proximate analysis of twelve breakfast commonly consumed in Peshawar Khyber Pakhtunkhwa (g per 100 g).

Dish name	Moisture	Ash	Fat	Protein	Carbohydrate	Energy
Choley	67.6±0.1 h	1.4± 0.1 d	9.3± 0.0 cd	4.2±0.0 e	18.6± 0.1 b	179.9±0.1 e
Omelate	68.1± 0.1e	2.5±0.1 i	16.0± 0.2 k	3.8±0.0 h	10.1± 0.2 f	99.6±0.4 h
Aloo paratha	68.3±0.7f	1.8± 0.1h	3.9± 0.2g	3.6± 7.1i	21.3±0.4h	134.7±7.8 e
Halwa	34.9± 0.0f	0.8± 0.2fg	15.8± 0.2i	1.1±0.0g	46.5± 0.4 e	332.6±0.5k
Puri	20.6± 0.0	1.4± 0.1	40.5± 0.2	5.5± 2.1	32.5± 0.4	289.8±0.1
Seri Paya	76.5±0.1a	0.7±0.7 e	7.4± 0.1c	12.9±0.1b	12.0±0.7cd	166.2±0.9c
Haleem	75.9± 0.0b	1.4±0.1cd	6.3±0.01i	10.9± 0.1k	14.5± 0.0g	158.3±0.2l
Nihari	64.6±0.1g	1.5±0.1bc	11.6±0.1c	8.9±7.1a	18.6± 0.1k	214.4±7.4g
Shami kabab	48.5±0.4k	1.2± 0.2b	18.1±0.3i	6.7±0.0b	19.4±0.1b	267.3±0.4a
Kaleji	4.3±0.1g	3.5±0.1a	16.8±0.2b	18.1±0.1f	22.8±0.1d	314.8±0.4f
Khagina	76.6± 0.0 d	1.8±0.1 bc	9.2± 0.1 c	5.9±0.07e	10.0± 0.1 c	146.4±0.9 j
Bunna Keema	54.4±0.5 c	4.7± 0.2 b	16.8± 0.4 f	15.7±0.2 i	20.6± 1.1 k	296.4±0.7 h
Porridge	78.6±0.0 i	0.7±0.1 a	2.5±0.1 d	4.4± 7.1 a	19.4±7.1 b	118±14.3 c

Each percent value is the mean ± SD of two independent measurements. ^hValues in the same column with different letters show statistically significant difference between the means at $p < 0.05$ tested by one-way ANOVA with LSD. [†] Carbohydrates content was estimated by subtracting the sum of moisture, ash, protein, fat and fiber contents from 100. [¥] Energy was calculated by multiplying fats, protein and carbohydrates with 9, 4, and 4, respectively.

Table 4: Summary of research methodology.

Objectives	Research question	Sample/ Participants	Data collection tools	Data analysis technique
To identify most common BFs along with their recipes.	What are the most common BFs and how are they cooked?	Sample size: 400 participants. Participants: 60 housewives	Qualitative data	Distribution of questionnaire to identify commonly consumed BFs in Peshawar.
To evaluate the recipes through quantifying the amount of ingredients in BFs.	What is the exact quantity of the ingredients (in terms of grams and measuring cups/spoons) used for preparation of the specific BFs?	Sample Size: 12 BFs were identified using a cutoff point of 60% prevalence.	Quantitative data recipe verification through preparation of the BFs .	Selection of participants by random sampling method
To estimate the amount of macro-nutrient (carbohydrates, proteins and fats) content of the prepared BFs through proximate analysis.	What is the quantity of macro-nutrients in BFs per 100 grams?	Sample Size: 400 experiments were conducted in duplicates.	Quantitative data (Proximate analysis) and (Mineral analysis) ash crude fiber moisture protein fat carbohydrate (by difference)	Mean and standard deviation of duplicates was calculated using Microsoft office Excel and presented in tabular form.
To categorize BFs into their representative food groups.	What will be the representation of BFs in terms of food groups?	Sample Size: 12 BFs	Results of qualitative data (recipe extraction) were used as part of duplicates.	BFs were disseminated into its basic food groups.
To benefit serving size of BFs in the exchange system.	What will be the exchange unit per serving size of the prepared BFs?	Sample Size: 12 BFs.	Results of quantitative data (proximate analysis) were used.	Serving size of BFs was fitted in the exchange system.
To develop a MPEL for BFs.	What will be the MPEL for BFs?	Sample Size: 12 BFs.	Results of qualitative and quantitative data were used.	ANOVA was used to determine no significant statistical difference within the breakfast for each macro-nutrient so that mean values could be representative of the breakfast.

The protein content ranged from 1.1-18% as predictable the least was in halwa puri and the highest foods based on meats. Protein proportion was lowest in Halwa Puri (1.1%) and highest in Kaleji (18%). These differences can be linked to the amount of the protein obtained from the ingredients that are used in breakfast preparation. The nutritional composition of puri comprised of 4 gms of Protein, 32.25 gms of Carbohydrates and 40.5 gms of Fats, (Table 2 and 3). Kaleji has the maximum proportion of protein (18%), this result is similar with the findings of Dashti *et al.* (2001) on fish based dishes commonly used in State of Kuwait (Dashti *et al.*, 2001). Bunna Keema, Shami Kabab, Nihari, Seri Paya, Haleem, are breakfasts adequate in protein content. A diet is considered to be adequate if 12% of the energy is supplied from protein. Further, Murray *et al.* (1991) have reported that the proportion of protein is higher in leaner meat (Williamson *et al.*, 2005). In all the meat foods the amount of protein was high. The addition of other ingredients like suji, flour and vegetables lower the protein content in 100 g portion of the breakfast. The amount of fat was lowest in porridge (2.5%), followed by alu Paratha (3.9%) and Haleem (6.3%) and highest in Shami Kabab (18.1%), followed by Omlette (16. %). The high fat in Shami Kabab is mainly due to the frying process thus results in increased intake of energy. However, variations in fat content are the result of the different quantities of hydrogenated oil used for processing and fatty acid profile of ingredients. Excessive intake of fat in diet is associated with increased risk of certain types of cancer, obesity, hypertension and coronary heart diseases (FAO, 1994). It is suggested that adults should consume less than 30% of their energy from fat, chiefly if it is derived from animal sources and contain high amount of saturated fatty acids (WHO and Consultation, 1990). According to The Food and Nutrition Board recommendations the energy from total fat should not exceed 35% of total energy (Dietary Allowances, 1980) only. Most of the breakfast was fried in hydrogenated oil which resulted in a considerable contribution from fat to the total energy. This finding is comparable to that observed among fried foods of other cultures (Sharma *et al.*, 2007, 2008). As a dietary intervention an alternative cooking method should be considered in this community to reduce fat consumption. It is understood that food cooked in hydrogenated vegetable oils contain trans unsaturated fats (TFA), and the ingestion of TFA is connected with poor cardiovascular wellbeing (Motard-Bélanger

et al., 2008). The averaged ash content ran from 0.38%-3.08%. The ash proportion of food is a measure of the aggregate sum of minerals present furthermore relies on upon the measure of included salt. The values of ash in all breakfast of meat were similar with little variety between the foods studied. The addition of vegetables and different ingredients to the meat reduces ash values, which could be because of dilution of the aggregate mineral substance (Musaiger *et al.*, 2007).

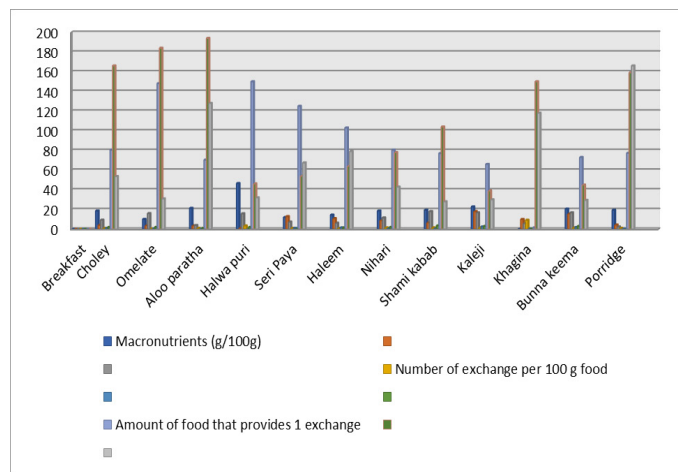


Figure 1: Meal planning exchange lists for 12 commonly consumed breakfast in Peshawar, Khyber Pakhtunkhwa.

Along with the breakfast based on cereal only, Halwa Puris, contain fewer than 4 g of protein for each 100 g portion. Therefore, this breakfast cannot be considered as a source of protein exchanges. Kaleji has the highest number of protein exchanges (2 ½ protein exchanges per 100g portion). All Breakfast contained at least 02 fat exchanges, except porridge contained 2.5 g of fats therefore porridge cannot be considered as a source of fats exchanges, while Bhunna Keema, Kaleji and Shami Kabab has the maximum number of fat exchanges (3 fat exchanges/100 g portions). Based on macronutrient composition of every breakfast, along with number of macronutrient exchanges Figure 1 also shows the amount of breakfast that will provide one exchange of fat, protein or carbohydrate. There were extensive contrasts in the carbohydrate content between the analyzed breakfasts. The carbohydrate substance of 12 Breakfast differed from 10.1% in Khagina to 46% in Halwapuri. The energy density of all the dishes ranged from 99.6 kcal/100 g (Omelete) to 332 kcal/100 g (Halwapuri), a popular Khyber Pakhtunkhwa breakfast contained 332kcal /100 g (42.7) % calories from total fat, 55.09 calories from carbohydrate and (1.03) calories from protein), which was most energy-dense among all the breakfast.

Omelete had the highest proportion of calories from total fat (59.03). Omelete had the highest proportion of calories from carbohydrate (91.2%) among the analyzed breakfast. The energy content (per 100 g wet weight) of commonly consumed breakfast in Peshawar is presented in [Table 3](#).

Conclusions and Recommendations

This research framework provides a structured approach to analyzing and developing a meal planning exchange list for breakfasts in Peshawar, ensuring that the findings are both scientifically robust and culturally relevant. The entire Meal planning Exchange List incorporate details of associated energy and macronutrients content along with the appropriate serving size and food group. Commonly consumed breakfast is grouped in such manner so that one Breakfast could be replaced by another breakfast with in the same group in the proportion stated and will yield similar amount of energy and macronutrients. The current study takes into consideration the cultural relevance of the breakfast as all the breakfast have been drawn out from within the Peshawar population. Thus, it is recommended that the developed meal exchange list for commonly consumed breakfast would be a significant tool to incorporate food option into the daily meals plans.

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Novelty Statement

This research is an integration of culturally significant optimizing portion sizes and meal composition, the study introduces an innovative framework that enables flexible, health-conscious meal planning, serving both general populations and health professionals.

Author's Contribution

Farida Bibi: Designed the study, conducted the research work.

Zahin Anjum: Major supervisor who supervised and provided guidance in the research work.

Imran Khan: Study design, critically revised the manuscript.

Shaista Ali: Helped in statistical analysis and tabulation.

Rabia Chishti: Helped in manuscript writing

Conflict of interest

The authors have declared no conflict of interest.

References

- Al-Nagdy, S., S.A. Abd-El-Ghani and M. Abdel-Rahman. 1994. Chemical assessment of some traditional Qatari dishes. *Food Chem.*, 49: 261-264. [https://doi.org/10.1016/0308-8146\(94\)90170-8](https://doi.org/10.1016/0308-8146(94)90170-8)
- Al Kanhal, M., I. Al Mohizea, A. Al Othaimen and M.A. Khan. 1999. Nutritive value of various rice based dishes in Saudi Arabia. *Ecol. Food Nutr.*, 38: 223-235. <https://doi.org/10.1080/03670244.1999.9991579>
- AOAC, 2003. Official methods of analysis (17th ed.). Gaithersburg, MD, USA: Association of official analytical chemists.
- Baker, J. and J. Robertson-Wilson. 2003. On the risks of early specialization in sport. *Phys. Health Edu. J.*, 69: 4-8.
- Basit, A., M. Riaz and A. Fawwad. 2015. Improving diabetes care in developing countries: The example of Pakistan. *Diabetes Res. Clin. Pract.*, 107(2): 224-232. <https://doi.org/10.1016/j.diabres.2014.10.013>
- Bawadi, H.A. and S.A. Al-Sahawneh. 2008. Developing a meal-planning exchange list for traditional dishes in Jordan. *J. Am. Diet. Assoc.*, 108(5): 840-846. <https://doi.org/10.1016/j.jada.2008.02.016>
- Bawadi, H.A., N.M. Al Shwaiyat, R.F. Tayyem, R. Mekary and G. Tuuri. 2009. Developing a food exchange list for Middle Eastern appetisers and desserts commonly consumed in Jordan. *Nutr. Diet.*, 66(1): 20-26. <https://doi.org/10.1111/j.1747-0080.2008.01313.x>
- Benezra, L.M., D.C. Nieman, C.M. Nieman, C. Melby, K. Cureton and D. Schmidt. 2001. Intakes of most nutrients remain at acceptable levels during a weight management program using the food exchange system. *J. Am. Diet. Assoc.*, 101(5): 554-561. [https://doi.org/10.1016/S0002-8223\(01\)00138-9](https://doi.org/10.1016/S0002-8223(01)00138-9)
- Caso, E.K., 1962. Diabetic meal planning: A good

- guide is not enough. *Am. J. Nurs.*, 62(11): 76-78. <https://doi.org/10.1097/00000446-196262110-00013>
- Caso, E.K. and D.M. Youland. 1955. An apple for an orange. *Am. J. Nurs.*, 55(8): 942-944. <https://doi.org/10.1097/00000446-195508000-00024>
- Coulibaly, A., H. O'Brien and I. Galibois. 2009. Development of a Malian food exchange system based on local foods and dishes for the assessment of nutrient and food intake in type 2 diabetic subjects. *South Afr. J. Clin. Nutr.*, 22(1). <https://doi.org/10.1080/16070658.2009.11734214>
- Daly, A., M. Franz, L.A. Holzmeister, K. Kulkarni, B. O'Connell and M. Wheeler. 2003. New diabetes nutrition resources. *J. Am. Diet. Assoc.*, 103(7): 832-834. [https://doi.org/10.1016/S0002-8223\(03\)00455-3](https://doi.org/10.1016/S0002-8223(03)00455-3)
- Dashti, B., F. Al-Awadi, M. Khalafawi, S. Al-Zenki and W. Sawaya. 2001. Nutrient contents of some traditional Kuwaiti dishes: Proximate composition, and phytate content. *Food Chem.*, 74: 169-175. [https://doi.org/10.1016/S0308-8146\(01\)00111-X](https://doi.org/10.1016/S0308-8146(01)00111-X)
- Dietary Allowances, R.D., 1980. National academy of sciences. Washington, DC, pp. 64.
- FAO, 1994. Dietary fats and oils in human nutrition, food and nutrition series, no. 20, Rome: FAO.
- Geil, P.B., 2008. Choose your foods: exchange lists for diabetes: The 2008 revision of exchange lists for meal planning. *Diabet. Spect.*, 21(4): 281-283. <https://doi.org/10.2337/diaspect.21.4.281>
- Gillen, L.J. and L.C. Tapsell. 2006. Development of food groupings to guide dietary advice for people with diabetes. *Nutr. Diet.*, 63(1): 36-47. <https://doi.org/10.1111/j.1747-0080.2006.00043.x>
- Habib, H.M., H.I. Ali, W.H. Ibrahim and H.S. Affi. 2011. Nutritional value of 10 traditional dishes of the United Arab Emirates. *Ecol. Food Nutr.*, 50: 526-538. <https://doi.org/10.1080/03670244.2011.620880>
- Horan, K., J. O'Sullivan-Maillet, M. Wien, R. Touger-Decker, P. Matheson and L. Byham-Gray. 2006. The impact of an individualized meal plan on diabetes management outcomes. *J. Am. Diet. Assoc.*, 106(8): A28. <https://doi.org/10.1016/j.jada.2006.05.095>
- Hurtado, M., B. Escobar and A. Estévez. 2001. Deep frying snack product of legume/cereal mixture based on corn and three varieties of beans. *Arch. Latin. Nutr.*, 51: 303-308.
- Hussain, T., 2001. Food composition table for Pakistan. Govt. of Pakistan, Ministry of P and D Islamabad, Pakistan.
- IDF (International Diabetes Federation), 2014. IDF diabetes atlas (6th Ed.). Retrieved from <http://www.idf.org/diabetesatlas>.
- Khan, M., 1981. Nutritional value of cereals in relation to human need. *Pak. J. Agric. Res. (Pakistan)*.
- Khan, E.A., A. Inayat, K.M. Ayaz, A.K. Aziz, M. Baloach, K. Qudrat, M. Jillani, K. Wasim, J. Muhammad and M. Mohibullah. 2013. Wheat response to fertilizer application techniques and nitrogen levels: II. crop growth and yield attributes. *Pak. J. Nutr.*, 12: 636-641.
- Motard-Bélangier, A., A. Charest, G. Grenier, P. Paquin, Y. Chouinard and S. Lemieux. 2008. Study of the effect of trans fatty acids from ruminants on blood lipids and other risk factors for cardiovascular disease. *Am. J. Clin. Nutr.*, 87: 593-599. <https://doi.org/10.1093/ajcn/87.3.593>
- Murray, R., D. Granner, P. Mayes and V. Rodwell. 1991. The text book of Harper's biochemistry. Appleton and Lange, Norwalk, Connecticut/ Los Altos, California.
- Musaiger, A.O., J.H. Al-Jedah and R. D'Souza. 2007. Nutritional profile of ready-to-eat foods consumed in Bahrain. *Ecol. Food Nutr.*, 46: 47-60. <https://doi.org/10.1080/03670240601093367>
- Musaiger, A.O., M.A. Ahmed and M.V. Rao. 1998. Chemical composition of some traditional dishes of Oman. *Food Chem.*, 61: 17-22. [https://doi.org/10.1016/S0308-8146\(97\)00148-9](https://doi.org/10.1016/S0308-8146(97)00148-9)
- Pastors, J.G., M.J. Franz, H. Warshaw, A. Daly and M.S. Arnold. 2003. How effective is medical nutrition therapy in diabetes care? *J. Am. Diet. Assoc.*, 103(7): 827-831. [https://doi.org/10.1016/S0002-8223\(03\)00466-8](https://doi.org/10.1016/S0002-8223(03)00466-8)
- Ramdath, D.D., D.G. Hilaire, A. Brambilla and S. Sharma. 2011. Nutritional composition of commonly consumed composite dishes in Trinidad. *Int. J. Food Sci. Nutr.*, 62: 34-46. <https://doi.org/10.3109/09637486.2010.504660>
- Schaefer, E.J., 1997. Effects of dietary fatty acids on lipoproteins and cardiovascular disease risk: Summary. *Am. J. Clin. Nutr.*, 65: 1655S-1656S. <https://doi.org/10.1093/ajcn/65.5.1655S>
- Sharma, S., J.C. Mbanya, K. Cruickshank, J. Cade, A.K. Tanya, X. Cao, G.B. Ethelbah

- and J. Anliker. 2007. Nutritional composition of commonly consumed composite dishes from the Central Province of Cameroon. *Int. J. Food Sci. Nutr.*, 58: 475-485. <https://doi.org/10.1080/09637480701288454>
- Sharma, S., R. Harris, X. Cao, A.J. Hennis, M.C. Leske and S.Y. Wu. 2007. Nutritional composition of the commonly consumed composite dishes for the Barbados National Cancer Study. *Int. J. Food Sci. Nutr.*, 58: 461-474. <https://doi.org/10.1080/09637480701288405>
- Sharma, S., X. Cao, J. Gittelsohn, B. Ethelbah and J. Anliker. 2008. Nutritional composition of commonly consumed traditional Apache foods in Arizona. *Int. J. Food Sci. Nutr.*, 59: 1-10. <https://doi.org/10.1080/09637480701525970>
- Shovic, A.C., 1994. Development of a Samoan nutrition exchange list using culturally accepted foods. *J. Am. Diet. Assoc.*, 94(5): 541-543. [https://doi.org/10.1016/0002-8223\(94\)90219-4](https://doi.org/10.1016/0002-8223(94)90219-4)
- Sidahmed, E., M. Cornellier, J. Ren, L. Askew, Y. Li and N. Talaat. 2014. Development of exchange lists for mediterranean and healthy eating diets: Implementation in an intervention trial. *J. Hum. Nutr. Diet.*, 27(5): 413-425. <https://doi.org/10.1111/jhn.12158>
- Spencer, S.J., A. Korosi, S. Layé, B. Shukitt-Hale and R.M. Barrientos. 2017. Food for thought: how nutrition impacts cognition and emotion. *NPJ Sci. Food*, 6: 7.
- Ullah, N., I. Alam, A. Zeb, N. Iqbal and A. Khan. 2006. proximate composition of the prepared dishes of district Mardan and Peshawar.
- Wheeler, M.L., 2003. Nutrient database for the 2003 exchange lists for meal planning. *J. Am. Diet. Assoc.*, 103(7): 894-920. [https://doi.org/10.1016/S0002-8223\(03\)00376-6](https://doi.org/10.1016/S0002-8223(03)00376-6)
- Wheeler, M.L., A. Daly, A. Evert, M.J. Franz, P. Geil, L.A. and P. Woolf. 2008. Choose your foods: Exchange lists for diabetes, 2008: Description and guidelines for use. *J. Am. Diet. Assoc.*, 108(5): 883-888. <https://doi.org/10.1016/j.jada.2008.02.002>
- Wheeler, M.L., M. Franz, P. Barrier, H. Holler, N. Cronmiller and L.M. Delahanty. 1996. Macronutrient and energy database for the 1995 exchange lists for meal planning: A rationale for clinical practice decisions. [https://doi.org/10.1016/S0002-8223\(96\)00299-4](https://doi.org/10.1016/S0002-8223(96)00299-4) *J. Am. Diet. Assoc.*, 96(11): 1167-1171.
- WHO, J. and F.E. Consultation. 1990. Diet, nutrition and the prevention of chronic diseases. World Health Organization Geneva.
- Wild, S., G. Roglic, A. Green, R. Sicree and H. King. 2004. Global prevalence of diabetes estimates for the year 2000 and projections for 2030. *Diabetes Care*, 27(5): 1047-1053. <https://doi.org/10.2337/diacare.27.5.1047>
- Williamson, C., R. Foster, S. Stanner and J. Buttriss. 2005. Red meat in the diet. *Nutr. Bull.*, 30: 323-355. <https://doi.org/10.1111/j.1467-3010.2005.00525.x>