Developing a meal-planning exchange list for commonly consumed Pakistani dishes

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Summary. In the present study, thirty commonly consumed Pakistani dishes were prepared using standard recipes and analyzed for their proximate composition. Meal planning exchange lists were then developed for those dishes. Significant variations in macronutrient content were observed among the dishes. The fat content varied from 5.2% in chicken biryani to 20.7% in bitter gourd. The protein content ranged from 1.24% in okra to 18.06% in fish while carbohydrate content ranged from 4.83% in fish to 28.9% in simple rice. The energy value ranged from 128 kcal/100 g in haleem to 280.5 kcal/100 g in chapli kabab. Correlation analysis between macronutrient content obtained from proximate analysis and those obtained from nutrient analysis software showed significant correlation for carbohydrate r = 0.80 (P < 0.01) and protein content r = 0.682 (P < 0.01) and non significant correlation for fat content r = 0.295 (P = 0.113). Data from the present study can be used as a meal planning tool by dietitians and nutritionists in planning normal and therapeutic diets. Further research on the nutritional contributions of other traditional dishes in the region is needed.

Key words: traditional dishes, meal planning, exchange list, macronutrient content, diabetes

Introduction

The prevalence of chronic conditions including diabetes and obesity is increasing worldwide with diet plays an important role in their development and prevention (1). Therefore planning a healthy diet may help to prevent development of these conditions. A number of food guidance systems are available for planning diet for diabetic and obese individuals including the carbohydrate counting system and exchange list system (2).

Exchange list system is a food guided tool for meal planning that enables people to exchange foods without disturbing their macronutrient or energy content (3, 4). The American Diabetes Association and the American Dietetic Association developed it for the first time in 1950. Since that the food exchange system has been used in meal planning and dietary counseling for people with diabetes and those on weight loss programs (5).

The exchange list system has been modified from time to time and according to the need of individuals new exchange lists have been developed in other countries (3, 6, 7). For example, Samoans are known to be the most overweight population in the world and an exchange list has been developed based on this need using different Samoan foods (7). Similarly, exchange lists have been developed for different traditional dishes, desserts and appetizers commonly consumed in Jordan (3, 8). In another study, a food exchange list based on West African local foods has been developed which is used by diabetes educators in West Africa (9). However, no such national or regional exchange lists have yet been developed for commonly consumed tra-

ditional dishes in Pakistan. The lack of regional food exchange lists has made it difficult for nutritionist and dietitians to incorporate traditional dishes when planning meals for diabetic individuals.

Therefore, the objective of this study was to determine the proximate composition of traditional dishes commonly consumed in Khyber Pakhtunkhwa (KP), Pakistan and to develop meal planning-exchange lists for these dishes based on the results obtained from the proximate composition.

Materials and methods

Selection of dishes

For the selection of dishes, one hundred and fifty housewives were randomly selected from different areas of KP. Each housewife was requested to provide the names of at least twenty dishes she commonly cook at home. The names of the dishes were recorded in a questionnaire. Most frequently named dishes (N = 30) were chosen to be included in the present study.

Dish recipe and preparation method

In order to minimize the variation in dish recipe and preparation method, a sub sample of five housewives was randomly selected and asked to provide a detailed recipe and method of preparation for each dish. The five recipes for each dish were then averaged using the summation method. Each ingredient in the average recipe was reported in both kitchen and standard measurements. Major ingredients of the dishes are presented in Table 1.

Dishes preparation

Dishes were prepared using the averaged recipes and were cooked under optimized cooking conditions (cooking time and temperature). Researchers used the same facilities and utensils for dishes preparation. The aim of cooking was done to get exact weight of the ingredients and net weight of the cooked dish.

Proximate composition of dishes

Proximate composition of the dishes was carried out in Food Technology and Agriculture Chemistry laboratory of Agricultural Research Institute, Tarn-

ab, Peshawar and Human Nutrition laboratory at The University of Agriculture Peshawar, Pakistan. Association of Official Analytical Chemists (AOAC) procedures were used for the determination of moisture, ash, protein, fat and carbohydrate content of the dishes. Moisture content was determined by drying the sample until constant weight in an air oven at 105 $^{\circ}$C, as described in the approved method No. 930.15 (10). Moisture content was calculated by the difference in wet and dry sample weights. For further analysis the dried samples were ground using a commercial grinder. The ground samples were stored in sealed plastic jars for further analyses. Ash content was determined by the official method No. 942.05 of AOAC, (2003) using a muffle furnace. Determination of crude protein was done by official Kjeldahl method No. 984.13 of AOAC (2003). Total fat (ether extract) was analyzed by official method No. 920.39 of AOAC (2003) using a Soxhlet apparatus. Nitrogen free extract (total carbohydrate) was calculated by difference. The energy content from macronutrients was calculated by multiplying the amount of carbohydrate, fat and protein in grams by factors 4, 9 and 4, respectively (11).

Exchange lists development.

For determination of number of exchanges for fat, protein and carbohydrate the values of macronutrients per 100 g of food that were obtained from proximate analysis were used. Rounding off method proposed by Wheeler and colleagues in literature were used for fitting dishes into exchange list (6).

A food portion was not counted as a serving if it had 1-5 g carbohydrate. If it contained 6-10 g carbohydrate, it was considered as half a serving and if it contained 11-20 g carbohydrate, it was counted as one carbohydrate serving. A food portion with 0-2 g fat was not counted as serving. If it contained 3 g fat, it was considered as half a serving and if there were 4-7 g fat, it was counted as one fat serving. A food portion was not considered to be a serving if it had 0-3 g protein from meat substitutes and meat lists while food portion with 4-10 g was counted as one serving.

Statistical analysis

All data were expressed as mean ± standard deviation of duplicate analyses. Statistical analysis was

Table 1. Major ingredients of the dishes

Local name	Common Name	Major Ingredients
Aloo gosht	Potato meat	Potato, beef, onion, tomato, garlic & ginger paste, green chili, cooking oil, spices, coriander, salt, water
Gosht korma	Beef korma	Beef, slit chick pea lentils, onion, tomato, garlic & ginger paste, green chili, cooking oil, spices, salt, coriander, water
Baingan	Bringels	Bringles, onion, tomato, green chili, cooking oil, salt, spices, coriander
Bhindi	Okra	Okra, onion, tomato, green chili, cooking oil, salt, spices, coriander
Channa daal	Slit chick pea lentils	Slit chick pea lentils, onion, tomato, garlic & ginger paste, green chili, cooking oil, spices, salt, coriander, water
Chapli kabab	Chapli kabab	Minced beef, onion, tomato, ginger & garlic paste, spices, egg, maize flour, cooking oil, coriander, salt
Chicken biryani	Chicken biryani	Rice, chicken, onion, tomato, yogurt, green chili, cooking oil, salt, ginger & garlic paste, biryani masala, water
Chicken karahi	Chicken karahi	Chicken, tomato, ginger & garlic paste, green chili, coriander, cooking oil, salt, spices
Vegetable rice	Vegetable rice	Rice, capsicum, cabbage, carrot, peas, green onion, vinegar, chili sauce, soya sauce, china salt, salt, chicken cube, cooking oil, black pepper, garlic paste, water
Choley	Gram/ Chick pea	Chick pea, onion, tomato, green chili, ginger & garlic paste, spices, salt, cooking oil, coriander, soda, water
Daal kadu	Slit chick pea lentil with bottle gourd	Bottle gourd, slit chick pea lentils, onion, tomato, ginger & garlic paste, green chili, salt, spices, cooking oil, coriander, water
Daal mash	Mash bean	Mash beans, onion, tomato, green chili, garlic & ginger paste, cooking oil, salt, spices, coriander, water
Machli	Fish	Fish, fish masala, lemon, ginger & garlic paste, salt, cooking oil, vinegar
Haleem	Haleem	Meat, onion, mash bean, masoor lentils, wheat, slit chick pea lentils, moong lentils, ginger & garlic paste, green chili, haleem masala, salt, cooking oil, coriander, lemon, tomato, water
Kachalo qeema	Colocassia with minced beef	Colocassia, minced beef, onion, tomato, green chili, ginger & garlic paste, spices, salt, coriander, cooking oil
Kaleji	Liver	Liver, tomato, green chili, ginger & garlic paste, spices, cooking oil, salt, coriander, lemon
Karella qeema	Minced beef with bitter gourd	Bitter gourd, minced beef, onion, tomato, salt, cooking oil, ginger & garlic paste, spices, green chili
Kadhi pakora	Yogurt curry with pakoras	Yogurt, garlic & ginger paste, onion, tomato green chili, cooking oil, spices, salt, chick pea flour, potato, coriander, soda, water
Koftay	Meat balls curry	Ground beef, onion, ginger & garlic paste, green chili, salt, cooking oil, spices, tomato, coriander, egg, chick pea flour, yogurt, water
Lobia	Kidney beans	Kidney beans, tomato, onion, garlic paste, salt, cooking oil, coriander, spices, green chili, water
Macroni qeema	Macroni with minced beef	Macroni, minced beef, onion, tomato, green chili, cooking oil, salt, spices, capsicum, black pepper, vinegar, soya sauce, chili sauce, ginger & garlic paste, coriander, water
Peeti	Mix masoor and moong lentils	Moong lentils, masoor lentils, onion, tomato, ginger & garlic paste, salt, cooking oil, green chili, coriander, water
Mix sabzi	Mix vegetable	Peas, cauliflower, carrot, potato, onion, tomato, salt, cooking oil, green chili, spices, coriander, water
Mutton karahi	Mutton karahi	Mutton, tomato, ginger & garlic paste, green chili, salt, cooking oil, spices, coriander, water
Nihari Gosht	Beef nihari	Beef, onion, tomato, ginger & garlic paste, green chili, nihari masala, wheat flour, coriander, cookimg oil, salt, water
Palak	Spinach	Spinach, onion, tomato, garlic paste, green chili, salt, cooking oil, spices
Pulao gosht	Beef pulao	Rice, beef, onion, tomato, green chili, salt, cooking oil, ginger & garlic paste, spices, water
Shimla mirch qeema	Minced beef with capsicum	Capsicum, ground beef, onion, tomato, green chili, salt, cooking oil, ginger & garlic paste, spices
Chawal	Simple rice	Rice, onion, tomato, garlic & ginger paste, salt, cooking oil, china salt, water
Tori	Ridge gourd	Ridge gourd, onion, tomato, salt, spices, green chili, coriander, garlic paste, cooking oil

performed using SPSS for windows (version 20; SPSS Inc., Chicago, Illinois, USA). Association between the values obtained from the results of proximate analysis and nutrient analysis software was carried out using Pearson's correlation. One-way analysis of variance (ANOVA) and Fisher's least significant difference *post hoc* test were used to determine significant differences in proximate composition and energy data among the dishes.

Results

Proximate composition

Data on the proximate composition per 100 g of each dish is presented in Table 2. Moisture content ranged from 52.5 in chapli kabab to 75% in mix vegetable. Moisture content was moderately high in all the vegetable dishes analyzed in the present study. The protein content ranged from 1.24% in okra to 18.06% in fish. In general all the vegetable based dishes had low

Table 2. Proximate analysis of the dishes (g per 100 g wet basis)*

Dish name	Moisture	Ash	Fat	Protein	Carbohydrate
Potato meat	67.5±0.71	1.71±0.06	15.23±1.04	4.76±0.01	10.80±0.39
Beef korma	65.50±0.71	1.28±0.07	12.21±0.20	7.85±0.38	13.16±0.05
Bringels	69.5±0.71	1.46±0.08	18.50±0.28	1.93±0.24	8.61±0.59
Okra	73±1.41	1.97±0.03	11.64±0.25	1.24±0.14	12.15±1.00
Slit chick pea lentils	63.5±0.71	1.37±0.00	17.74±0.40	2.48±0.06	14.91±0.37
Chapli kabab	52.5±0.71	2.21±0.07	19.52±0.31	12.16±0.32	13.61±0.77
Chicken biryani	65±1.41	1.49±0.08	5.23±1.15	6.43±0.48	21.85±0.30
Chicken karahi	57.5±0.71	2.19±0.23	15.85±0.02	13.37±0.49	11.09±0.42
Vegetable rice	67.7±1.41	1.52±0.05	5.52±0.19	3.54±0.32	21.99±1.04
Gram/ Chick pea	64±2.83	2.72±0.24	9.88±0.70	4.15±0.00	19.26±1.89
Slit chick pea lentil with bottle gourd	69.5±0.71	1.27±0.05	13.11±0.13	2.33±0.23	13.79±0.75
Mash bean	53±1.41	1.46±0.02	17.98±0.44	6.36±0.37	21.21±1.37
Fish	65±1.41	3.08±0.22	9.04±0.66	18.05±0.28	4.83±0.24
Haleem	73±1.41	1.65±0.05	5.38±0.19	5.38±0.36	14.60±0.82
Colocassia with minced beef	65.5±0.71	0.93±0.07	11.71±1.31	5.42±0.08	16.45±0.59
Liver	53±4.24	1.74±0.09	19.09±1.92	16.04±1.71	10.13±0.52
Minced beef with bitter gourd	61±1.41	1.14±0.04	20.74±1.57	7.70±0.93	9.42±1.04
Yogurt curry with pakoras	71.5±0.71	1.44±0.02	13.85±0.26	2.92±0.03	10.29±0.46
Meat balls curry	60.5±0.71	1.96±0.12	18.28±1.30	11.14±0.09	8.13±0.80
Kidney beans	70.5±0.71	1.12±0.07	11.60±0.44	3.67±0.02	13.11±0.21
Macroni with minced beef	67.5±0.71	1.20±0.07	9.25±0.32	4.70±0.31	17.35±0.15
Mix masoor and moong lentils	67±1.41	1.57±0.09	11.49±0.63	4.90±0.00	15.05±0.69
Mix vegetable	75±1.41	1.80±0.17	9.81±0.61	2.34±0.11	11.04±0.75
Mutton karahi	62.5±0.71	2.33±0.10	20.35±0.52	9.02±0.41	5.81±0.31
Beef nihari	71.5±0.71	1.99±0.01	13.21±0.31	6.24±0.86	7.06±0.47
Spinach	73.5±0.71	2.36±0.03	14.18±0.34	2.49±0.14	7.47±0.20
Beef pulao	63.5±0.71	0.82±0.04	7.65±0.84	5.82±0.02	22.21±0.16
Minced beef with capsicum	71.5±0.71	0.39±0.07	15.19±0.66	5.99±0.31	6.93±0.33
Simple rice	59±1.41	1.29±0.02	6.94±0.08	3.86±0.54	28.91±0.78
Ridge gourd	77±1.41	1.65±0.04	10.45±0.56	1.36±0.15	9.54±0.67

*Values are mean ± SD of duplicate analysis

protein content while all the meat based dishes had high protein content. The fat content ranged from 5.2% in chicken biryani to 20.7% in bitter gourd. The average ash content ranged from 0.38%-3.08%. There were extensive differences in the carbohydrate content among the analyzed dishes. The carbohydrate content of the dishes ranged from 4.83% in fish to 28.9% in rice.

Energy content

The energy content (per 100 g wet basis) of the dishes is presented in Table 3. The energy density of the dishes ranged from 128 kcal/100 g (haleem) to 280.5 kcal/100 g (chapli kabab).

Correlation between macronutrient content

Significant correlation was found between proxi-

Table 3. Energy content of the dishes (per 100 g wet basis)

Dish	Protein		Fat		Carbohydrate		Total Energy*
	Kcals	% of total	Kcals	% of total	Kcals	% of total	Kcals
Potato meat	19.05	9.56	137.04	68.76	43.23	21.69	199.34±7.81
Beef korma	31.40	16.19	109.92	56.67	52.65	27.14	193.95±3.54
Bringels	7.75	3.71	166.48	79.80	34.40	16.49	208.63±3.91
Okra	4.97	3.14	104.85	66.21	48.55	30.65	158.33±6.79
Slit chick pea lentils	9.93	4.33	159.65	69.65	59.64	26.02	229.22±4.80
Chapli kabab	50.40	17.97	175.70	62.63	54.44	19.40	278.76±1.53
Chicken biryani	25.69	16.04	46.94	29.31	87.50	54.64	160.22±11.07
Chicken karahi	53.47	22.23	142.67	59.32	44.37	18.45	240.51±3.88
Vegetable rice	12.74	8.47	49.72	33.05	87.96	58.48	150.42±7.13
Gram/ Chick pea	16.63	9.11	88.94	48.72	76.97	42.17	182.52±13.86
Slit chick pea lentil with bottle gourd	9.33	5.11	118.04	64.67	55.14	30.21	182.51±3.27
Mash bean	25.47	9.36	161.80	59.47	84.79	31.17	272.06±7.95
Fish	72.24	41.80	81.27	47.02	19.32	11.18	172.85±8.07
Haleem	21.49	16.75	48.48	37.77	58.37	45.48	128.34±6.40
Colocassia with minced beef	21.67	11.24	105.26	54.61	65.83	34.15	192.81±9.12
Liver	64.11	23.19	171.74	62.12	40.61	14.69	276.51±26.22
Minced beef with bitter gourd	37.95	14.00	186.66	68.87	46.43	17.13	271.04±13.68
Yogurt curry with pakoras	11.69	6.58	124.66	70.23	41.15	23.19	177.49±4.08
Meat balls curry	44.56	18.45	164.42	68.08	32.55	13.48	241.56±8.88
Kidney beans	14.69	8.57	104.34	60.85	52.45	30.59	171.49±4.78
Macroni with minced beef	18.79	10.96	83.22	48.54	69.42	40.50	171.43±4.67
Mix masoor and moong lentils	19.60	10.70	103.36	56.43	60.19	32.86	183.16±8.46
Mix vegetable	9.40	6.63	88.31	62.26	44.14	31.12	141.86±8.01
Mutton karahi	36.08	14.88	183.09	75.53	23.25	9.59	242.42±5.02
Beef nihari	24.91	14.48	118.89	69.09	28.27	16.43	172.07±4.33
Spinach	9.96	5.95	127.60	76.20	29.89	17.85	167.45±4.43
Beef pulao	23.29	12.87	68.82	38.03	88.84	49.10	180.98±6.89
Minced beef with capsicum	23.94	12.71	136.71	72.56	27.76	14.73	188.43±5.84
Simple rice	15.42	7.97	62.45	32.27	115.66	59.76	193.52±5.99
Ridge gourd	5.50	3.99	94.08	68.32	38.13	27.69	137.64±8.32

*Values are mean±SD of duplicate analysis. Data are expressed for kcal from protein, fat and carbohydrates and kcal/100 g on a fresh weight basis for energy.

mate analysis and nutrient analysis software values for carbohydrate r = 0.80 (*P* < 0.01) and protein r = 0.682 (*P* < 0.01) while non significant correlation was found for fat content r = 0.295 (*P* = 0.113).

Exchange list

Table 4 shows the number of fat, protein and carbohydrate exchanges calculated from the macronu-

trient values obtained from proximate analysis in 100 g of each dish. Most of the dishes contained at least one exchange of carbohydrate. Potato meat, bringles, liver, yogurt curry with pakoras, meat balls, beef nihari, spanich, minced beef with capsicum and ridge gourd contained 6-10 g of carbohydrate per 100 g portion and provided half exchange of carbohydrate. Fish and mutton karahi contained less than 6 g of carbohydrate

Table 4. Meal planning exchange lists for the dishes

DISH	Macronutrients (g/100g)			Number of exchange per 100 g food			Amount of food that provides 1 exchange (g)		
	CHO	PRTN	FAT	CHO	PRTN	FAT	CHO	PRTN	FAT
Potato meat	10.81	4.76	15.23	½	1	3	139	147	33
Beef korma	13.16	7.85	12.21	1	1	2	114	89	41
Bringels	8.60	1.94	18.50	½	*	3 ½	174	361	27
Okra	12.14	1.24	11.65	1	*	2	124	564	43
Slit chickpea lentils	14.91	2.48	17.74	1	*	3 ½	101	282	28
Chapli kabab	13.61	12.60	19.52	1	1 ½	3 ½	110	56	26
Chicken biryani	21.88	6.42	5.22	1 ½	1	1	68	109	96
Chicken karahi	11.09	13.37	15.85	1	1 ½	3	135	52	32
Vegetable rice	21.99	3.19	5.52	1 ½	1	1	76	220	91
Gram/ Chick pea	19.24	4.16	9.88	1	1	1 ½	79	168	51
Slit chick pea lentil with bottle gourd	13.79	2.33	13.12	1	*	2 ½	109	300	38
Mash bean	21.20	6.37	17.98	1	1	3 ½	71	110	28
Fish	4.83	18.06	9.03	*	2 ½	1 ½	313	39	55
Haleem	14.59	5.37	5.39	1	1	1	103	130	93
Colocassia with minced beef	16.46	5.42	11.70	1	1	2	91	129	43
Liver	10.15	16.03	19.08	½	2	3 ½	143	44	26
Minced beef with bitter gourd	11.61	9.49	20.74	1	1	4	129	74	24
Yogurt curry with pakoras	10.29	2.92	13.85	½	*	2 ½	146	240	36
Meat balls curry	8.14	11.14	18.27	½	1	3 ½	185	63	27
Kidney beans	13.11	3.67	11.59	1	*	2	115	191	43
Macroni with minced beef	17.00	4.70	9.25	1	1	1 ½	88	149	54
Mix masoor and moong lentils	15.05	4.90	11.48	1	1	2	100	143	44
Mix vegetable	11.04	2.35	9.81	1	*	1 ½	136	298	51
Mutton karahi	5.81	9.02	20.34	*	1	4	259	78	25
Beef nihari	7.07	6.23	13.21	½	1	2 ½	211	112	38
Spinach	7.47	2.49	14.18	½	*	2 ½	200	281	35
Beef pulao	22.21	5.82	7.65	1 ½	1	1	68	120	65
Minced beef with capsicum	6.94	5.99	15.19	½	1	3	217	117	33
Simple rice	28.92	3.85	6.94	1 ½	*	1	52	182	72
Ridge gourd	9.53	1.38	10.45	½	*	2	158	509	48

* Too small to be counted as a serving.

for each 100 g portion and was too small to be counted as serving. The rice dishes including chicken biryani, vegetable rice, beef pulao and simple rice contained the highest number of carbohydrate exchanges (1 ½ exchanges per 100 g portion). Vegetable dishes and other dishes including slit chick pea lentils, slit chick pea lentil with bottle gourd, yogurt curry with pakoras, kidney beans and rice contained less than 4 g of protein per100 g portion and thus these dishes were not considered as sources of protein exchanges. Fish had the highest number of protein exchanges (2 ½ protein exchanges per 100 g portion). All the dishes had at least 1 exchange of fat while mutton karahi and minced beef with bitter gourd contained the maximum number of fat exchanges (4 fat exchanges per 100 g portion).

Discussion

In the present study a total of 30 different dishes of KP were analyzed for their proximate composition and meal planning exchange lists were than developed for these dishes. To our knowledge, the data on nutritional composition of frequently consumed KP traditional dishes is very limited. No study has yet been reported the nutritional composition of KP traditional dishes that collected averaged recipes, cooked dishes according to standardized recipe and developed meal planning exchange lists for these dishes.

Strong correlation was found between proximate analysis and nutrient analysis software values for carbohydrate and protein content and not for fat content. An explanation for no correlation of fat content is not fully understood. It is important to note that in the nutrient analysis software ingredients entered were in uncooked, raw form; whereas proximate analysis results were obtained in lab using cooked dishes. In other words, the data from nutrient analysis software was obtained from the addition of all constituents in their crude, uncooked form. For that reason the differences may be obviously seen in dishes that need extensive heat up and cooking treatment.

Significant variations were observed in the nutritional composition of the studied dishes due to different method of preparation and variety of ingredients.

In general all the dishes included in the present study showed high fat, adequate protein and variable carbohydrate content. Among the thirty dishes, the moisture content was moderately high in all the vegetable dishes. It has been shown that the moisture content in various foods mainly depends on the ingredients used in their preparation and on the cooking methods (12). Therefore, the recipe and cooking method may have resulted in such differences. Regarding protein content, the fish dish showed the highest protein content and is in agreement with a previous study in which fish based dishes contained the highest protein content among the other dishes consumed in the State of Kuwait (11). Beef korma, chapli kabab, chicken biryani, chicken karahi, fish, liver, minced beef with bitter gourd, meat balls, mutton karahi, beef nihari, beef pulao and minced beef with capsicum are considered to be adequate in protein content. In general all the meat based dishes showed high protein content. The addition of other ingredients like rice and vegetables to meat based dishes lowered the protein content of these dishes as shown by chicken biryani, beef pulao, potato meat and other vegetables with minced beef.

The fat content among the dishes ranged from 5.2% (chicken biryani) to 20.7% (bitter gourd). Variations in fat content among the dishes could be due to the different quantities of hydrogenated oil used for processing and fatty acid profile of the ingredients. Most of the dishes were cooked in hydrogenated oil which resulted in a considerable contribution from fat to the total energy. This finding is similar to that observed among fried foods in other cultures (13). Foods fried in hydrogenated vegetables oils contain trans fatty acids and their consumption have been shown to increase the risk for cardiovascular diseases (14, 15). Therefore, dietary intervention such as alternative cooking method should be considered in this community to reduce high fat consumption.

Among the analyzed dishes carbohydrate content was high in rice based dishes whereas the meat dishes had low carbohydrate content. A comparative high estimation of carbohydrate in rice has been recorded in previous studies conducted in Saudi Arabia (16) and Oman (17). The present data is comparable with the data from the previous studies conducted on rice dishes in Pakistan and Saudi Arabia (18, 19). Chapli

kabab, a traditional KP dish contained 62.63% calories from fat, 19.40 calories from carbohydrate and 17.97 calories from protein and was the most energy-dense among all the dishes.

Previous studies have also shown the nutrient content of some frequently consumed Pakistani dishes however, meal planning exchange lists for those dishes were not provided (20, 21). The meal planning exchange lists developed in the present study can now be use to develop culture specific meal plans.

A limitation of the present study was that no information was provided about the type of fat (mono-unsaturated, polyunsaturated and saturated) and fatty acid profiles of the studied dishes. The consideration of total carbohydrate instead of available carbohydrate was another limitation. To get available carbohydrates as an energy providing nutrients, the fibre content should have been excluded. We were not able to measure any nutrient loss during cooking process. The mineral content of the dishes was also not investigated in the present study. Despite these limitations, the present research adds to the scientific literature on nutrient composition of the KP dishes by providing for the first time the proximate composition of thirty traditional dishes. Moreover, from the results of proximate analysis meal planning exchange lists were calculated to facilitate meal planning for diabetic and obese individuals. The present data may also help in assessing nutrient intake in epidemiological studies. The reported protein-rich dishes could serve for healthful dietary practices.

Conclusion

Exchange list for thirty traditional dishes of KPK is currently available and would serve as the basis for planning normal and therapeutic meals. It would help individuals to make better choice by comparing dishes for their macronutrient content. Data on the nutritional composition of KP dishes can also be used by health care workers, nutritionists and dietitians to calculate energy and nutrient intakes. In general, the nutritive qualities assessed in the present study recommend that most of the dishes have variable carbohydrate, adequate protein and high fat content. The total

dietary fat of the majority of the dishes surpassed 30% of the total energy.

Acknowledgments

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