

Estimation of Macronutrient Content of Traditional Pakistani Chapatti/ Roti as Part of Food Exchange List

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Abstract: This is a small base-line study where the researcher has made a unique attempt to disseminate the varying size of chapatti into the exchange list. Chapatti as it is a staple food of Pakistan and was assessed for its size and corresponding weight so that it could be incorporated as part of the carbohydrate exchange list. Though chapatti is served with the main course of every Pakistani cuisine yet its size and weight has not been standardized and difference in size and weight will lead to varying nutrient content and consequently number of exchanges. Chapattis of three different sizes were prepared in the Food Laboratory of Food Science & Human Nutrition Department, Kinnaird College for Women, Lahore. 9 experiments were carried out and three chapattis large, medium and small were prepared using 100grams, 75 grams and 50 grams of dry flour respectively. The results revealed that small chapatti (6inch diameter) contributed 37.5 grams of carbohydrate which in turn were converted to 2.5 carbohydrate exchanges. Similarly, medium chapatti (56.25 grams carbohydrate) and large chapatti (75 grams carbohydrate) were converted into 4 and 5 carbohydrate exchange respectively. The study concluded that chapatti could be converted into carbohydrate exchange provided the recipe of chapatti was standardized and the weight, size and thickness specified. Further research could also be carried out in the same light for traditional Pakistani meals.

Key words: Food Exchange List, Macronutrient, Chapatti, Traditional Food

I. Introduction

Adequate nutrition is vital to good health and is absolutely essential for the healthy growth and development of a nation. Recent studies have co-related economic development and health, indicating that better health is associated with improved labor market outcomes, particularly in low income settings [1]. In order to obtain a measure of nutrient intake, a measure or estimate of the amount of food consumed is required [2]. Misjudging food serving sizes is one of the most common mistakes people make. Understanding a food guide serving size is important because people seem to think that a unit of some entity is the appropriate and optimal amount to eat at a given time [3]. The food exchange systems help individuals control their energy intake by monitoring their food portion sizes. Exchange system or the food exchange list is simply a tool that translates scientific knowledge into a useable form [4] which adds variety to the meal as foods listed in the same group can be used interchangeably without changing the approximate amounts of macronutrients [5]. But for this tool to be effective cultural variations and traditions have to be taken into consideration as this has a major effect on the selection of food by individuals. Therefore, a culturally sensitive food exchange list would help individuals adhere to their dietary commitments, as a first step towards healthy eating [6]. Exchange lists also help health professionals to advice a meal plan that is easy to make, affordable and is culturally sensitive [7]. Thus, there is a need to develop user-friendly guides that are culturally sensitive so that individuals are able to monitor their daily food intake while enjoying their traditional meals [8].

The food exchange system was developed by the American Diabetic Association in 1950 to aid diabetic patients in meal planning. Later, the American Dietetic Association adapted the food exchange list as a meal planning device for the general population.

However, due to cultural differences in food preparations and social behaviors, there is a considerable need for the adaptability of the exchange system for every country and culture. A meal-planning exchange list was modified for the Samoan society to include their culturally appropriate food in order to manage their diet related problems such as obesity, hypertension, cardiovascular diseases and diabetes. This was done so that the Samoan community can better administer their health issues [9]. Similarly, meal-planning exchange list for Middle Eastern foods was prepared which included common foods in the Jordanian cuisine [10] and likewise Nigeria has also developed its own exchange list which includes Nigerian local foods [11].

Different exchange lists have been developed in different parts of the world yet little have been done for modifying these lists in perspective of the Pakistani culture.

Pakistan is an Asian country known for its hospitality, culture and rich cuisine. The Pakistani cuisine does not only have its unique flavor with a blend of spices but is also known to serve its main course

with chapatti (roti). Chapatti is an unleavened flatbread from Pakistan, India and Nepal and is also a common staple for South Asia as well as amongst South Asian expatriates throughout the world. The focus of the study would only be on the nutrient content of chapatti as chapatti is served with the main course of every Pakistani cuisine yet its size and weight has not been standardized and difference in size and weight will lead to varying nutrient content and consequently number of exchanges as part of the cereal and starch group. This study would serve as the basis of planning traditional meals in Pakistan.

II. Methodology

Chapatti which is amongst the staple food of Pakistan was assessed for its size and corresponding weight. A total of 9 experiments were carried out to standardize 3 chapattis of varying sizes. All the research conducted in ethically proven and no human trials are being involved.

Measurement of the Ingredients

Weight: Arshia weighing scale machine was used to measure the weight of the ingredients (flour) and chapatti with the no error point adjusted with the bowl.

Liquids: The water used for preparation of the dough was measured with the standard measuring cup (ml) and spoons

Estimation of the Size and Thickness of Chapatti

The thickness of the chapatti was estimated by a caliper whereas the size of the chapatti was determined by measuring the diameter with a scale (Figure 1).



Figure 1 Determining the Size

Procedure

Chapatti was prepared using different amount of dry flour listed in table 1.

Table 1 Amount of Dry Wheat Flour and the Corresponding Chapatti Size

Size of Chapatti	Weight of Flour	Measurement of Flour	Amt/Measurement of Water used
Large	100 grams	¾ cup	83 ml 1/3 cup
Medium	75 grams	2/3 cup	62.5 ml ¼ cup
Small	50 grams	1/3 cup	45 ml 3 tbsp

The weighed flour was sifted in the mixing bowl and mixed with water and kneading it for three minutes. The dough was left to stand for two minutes before it was rolled out into a chapatti. The chapatti was cooked on a hot plate (tawa) for one minutes each side.

Standardization

The United States Department of Agriculture (USDA) defines a standardized recipe as the one that has been tried, adapted and retired several times for use by a given food service operation and has been found to produce the same good results and yield every time when the exact procedures are used with the same type of equipment and the same quantity and quality of ingredients.

Three chapattis were prepared large, medium, small and was subjected to the process of standardization so that the same amount of flour will produce the same yield in terms of size and weight of the chapatti every time when the exact procedures are used with the same type of equipment and the same quantity and quality of ingredients (Figure 2).

Estimation of Nutritive Value

The nutritive value of chapatti was calculated by using the food composition table for Pakistan of 2001[12].

Estimation of Chapatti as Part of Meal-Planning Exchange List

Determination of the Serving Size: The standard measure of 1 chapatti will be considered as 1 serving.

Befitting Chapatti in the Exchange List: The meal-planning exchange list will be formulated in conformity with the American Dietetic Association and the American Diabetes Association [13] exchange system based on the macronutrients' content of the dish. Chapatti is made up of whole wheat flour and therefore is part of the carbohydrate group and as such only the carbohydrate exchange list will be considered in this study.

Rounding-off Method: The rounding-off method described by [14] will be used to get the best possible fit of chapatti in the exchange system.

Carbohydrate Exchange: If one serving of chapatti had:

1-5 grams carbohydrates = 0 exchange
 6-10 grams carbohydrates = 1 exchange
 11-20 grams carbohydrates = 1 exchange
 1/2 exchange

III. Results And Interpretation

Table 2 Different Amount of Dry Wheat Flour and the Corresponding Chapatti Size

Wt. of Flour	Amount of Water Used	Wt. of Dough	Size of Dough	Wt. of Chapatti	Size of Chapatti
100 grams	1/3 cup	140 grams	1/2 cup	120 grams	Dia. 24cms/9 1/2 inches. Thick 4mm/0.15
75 grams	1/4 cup	120 grams	1/3 cup	100 grams	Dia. 19cms/7 1/2 inches. Thick 4mm
50 grams	3 tbsp	70 grams	1/4 cup	60 grams	Dia. 15cms/6 inches. Thick 4mm

Table 3 Composition of macro nutrient of Chapatti

Chapatti Size	Flour Grams	CHO Grams	Protein Grams	Fat Grams	Energy Kcal
Large	100	75.1	10.0	1.2	357.00
Medium	75	56.25	7.5	0.9	267.75
Small	50	37.5	5.0	0.6	178.50



Figure 2 Finalized form of Chapatti

Exchange List

One Carbohydrate exchange = 15 grams carbohydrate, 2 grams protein, 0-1 gram fat and 70 kcals.

Table 4 Carbohydrate Exchange and Size of Chapatti

Chapatti Size	Measure	Weight Grams	Carbohydrates Grams	CHO ex. Number	Rounding off Number
Large	9 1/2	120	75	5.00	5.00
Medium	7 1/2	100	56	3.73	4.00
Small	6	60	37.5	2.50	2.50

IV. Discussion

Chapatti which is a staple food of Pakistan was assessed for its size and corresponding weight so that it could be incorporated as part of the carbohydrate exchange list. This study focuses on the nutrient content of only chapatti as it is served with the main course of every Pakistani cuisine yet its size and weight has not been standardized and difference in size and weight will lead to varying nutrient content and consequently number of exchanges. Research studies have been documented as regard the rheological properties of dough and its effect on the quality of making chapatti [15] but little has been done on the standardization of chapatti size and its corresponding contribution to the number of carbohydrate exchange.

Only one study was documented in which chapatti was translated in terms of carbohydrate exchange [16] and 1 small chapatti (6 inches diameter) was equated as 1 exchange of carbohydrate. However, the result of the present study are not in consistence with the above (Table 4) where 1 small chapatti (6 inches diameter) equals 2.5 exchange of carbohydrate probably because the thickness was not taken into consideration neither the weight of the chapatti was specified. The present study further focused on the different sizes of the chapatti (Table 2) and also converted them into carbohydrate exchange thus determining medium and large size chapatti along with the number of carbohydrate exchange (Table 4). The different sizes of chapatti and the number of carbohydrate exchanges is imperative as this and many other Pakistani recipes are not available either in the food composition tables [17] or food exchange list. This information is also vital for epidemiological studies where the nutrient intake has to be assessed.

V. Conclusion

The study concluded that a small size chapatti contributes 2.5 carbohydrate exchange while a medium and large chapatti yields 4 and 5 carbohydrate exchange respectively (Table 4; Table 3). This would serve as the basis of planning traditional meals in Pakistan while recommending development of an exchange list for traditional Pakistani meals and its nutrient composition validation by chemical analysis.

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