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Energy Assessment of Some Nuts and Dried Fruits Grown in Pakistan's Climate and Their Role for Weight Control Management

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ABSTRACT

The aim of the present study is to assess the energy contents of different dry fruits consumed in Pakistan. Six samples of tree nuts (walnut, almond, pine nut, pistachio, cashew nut, and coconut), one sample of the ground nut (peanut), and four samples of dried fruits (figs, apricot, dates, and raisins) were selected for this purpose. The energy contents of nuts and dried fruits were estimated using oxygen bomb calorimeter. Peanut was identified as the energy rich fruit (875.86 Cal/100g), followed by walnut (818.84 Cal/100g), coconut (787.36 Cal/100g), almond (785.61 Cal/100g), pine nut (772.31 Cal/100g), Pistachio (624.72 Cal/100g), and the cashew nut (616.46 Cal/100g). The energy values of the dry fruits were found higher in nuts (875.86–616.46 Cal/100g), compare to dried fruits (352.04–505.31 Cal/100g). Protein and fats contribute to the energy values of nuts; while carbohydrates make a valuable contribution to the energy content of dried fruits. The recommended serving of dry fruits was found to fulfill 20.26−4.40 % of the minimum estimated energy requirement (EER) of persons of different life styles. On the basis of the caloric content of the studied dry fruits, one can easily calculate the required amount of a particular dry fruit per day in accordance to gender, age and PAL life style. Therefore, the study would be helpful to plan weight balance strategies for individuals interested in energy dense food.

Keywords: caloric content, nuts, dried fruits, macronutrients, physical activity level

1. INTRODUCTION

"Dry fruits" cover tree nuts, ground nuts and dried form of some soft pulpy fruits. Tree nuts are dry, one-seeded oleaginous fruits consisting of an edible kernel enclosed in a shell which becomes hard at maturity. The most popular tree nuts in Pakistan include almond, cashew, pine nut, pistachio, coconut and walnut. Peanut is generally considered as a groundnut but botanically it is a legume. It resembles to tree nuts in their nutrient profile (Cassandra et al. 2023).Dried fruits are the fruits from which majority of the original water content of the fresh fruits has been removed either naturally, through the sun drying, or dehydrators. For example, raisins, dried apricots, and figs, are dense sources of energy, vitamins, minerals, and anti-oxidants.

The large varieties of dry fruits are grown in Khyber Pakhtunkhwa and Baluchistan provinces due to their diverse climatic and soil conditions. Major items of export trade of Pakistan are dry dates, pine nuts, peanuts and raisins. The export of almonds, walnuts and pistachios has also been improved during recent years. Besides providing a delicious flavor, dry fruits are considered an excellent source of energy, macro nutrients, antioxidants, and fibers. These energy-dense fruits are commonly used as a snack food in harsh winters. Dry fruits were long perceived as being unhealthy food led to excessive weight gain due to their high caloric value and fat content (Baer et al. 2023). However, this perception is not accepted by health professionals. The recent literature provides evidences that the intake of dry fruits decreased low-density lipoprotein (LDL) cholesterol, and therefore has been associated with lower body mass Index (BMI), reduced weight, and prevents from several diseases such as coronary heart disease, cancer, stroke, atherosclerosis, type 2 diabetes, etc. (Park et al. 2021, Cardoso et al. 2021 & Balakrishna et al. 2022). In contrast to this concern, several epidemiologic research studies show no apparent association between moderate nut consumption and obesity (Guarneiri et al. 2021, Eslami et al. 2022 & Tasci et al. 2021).

The health claim for nuts and cardiovascular disease, released by the U.S. Food and Drug Administration (FDA) states ''scientific evidence suggests but does not prove that eating 1.5 ounces (~42 g) per day of most nuts as part of a diet low in saturated fat and cholesterol, may reduce the risk of heart disease" (Wang et al. 2020).The FDA reported that the level of scientific validity supporting this claim is relatively low and scientific evidences are inconclusive. The European Union has also accepted a specific health claim that "Walnuts (a daily intake of 30 g) contribute to the improvement of the elasticity of the blood vessels" (Sabaté et al. 2013). These statements are generalized for most of the nuts. Moreover, the differences in dietary energy of particular nuts, and the energy requirements of various population groups are not specified in the recommended intake of nuts.

It has also been observed that the energy profile of dry fruits is limited to peanut, pistachio, almond, hazelnut, and walnut and lacking too their dry fruits. This deficiency suggests to assess the energy profile of other dry fruits objectively to ensure recommendations to their use. Therefore, an accurate value of calories of dry fruits is essential for making diet-based strategies and dealing with problems of under nutrition as well as obesity. The objective of this study is to investigate energy content of different dry fruits. This study will guide the people of every stage of life who are involved in a particular physical activity to attain or maintain an appropriate weight, and promote overall health.

2. MATERIALS AND METHODS

Samples of ten dry fruits (raisins, almond, pine nut, pistachio, cashew nut, coconut, apricot, dates, figs, and peanuts) were collected in the second half of January 2022 from local markets of the country. Raisins were golden seedless. Dry samples of coconut, apricot, dates, and figs were used for the study. All the samples assessed belong to local cultivars except the cashew nut which was imported from Iran and India.

The shells of tree nuts and ground nuts were removed and their kernels were used for analysis. The gross calorific values of pre-weighed samples were determined directly by burning them in an oxidative environment of 425 psi pressure using isoperibol bomb calorimeter (Parr 6300, USA). The calorimeter was calibrated against a benzoic acid standard prior to analysis.

The percentage of total Calories from fat was calculated using the equation[11]:

$$\%\ of\ total\ Calories\ from\ fat = \frac{number\ of\ g\ of\ fat \times number\ of Calories/g\ of\ fat}{total\ Calories\ in\ serving\ of\ food}$$

where, number of Calories/g fat =9, The contribution of Calories from other macronutrients (protein and carbohydrate) were calculated using the same formula taking number of Calories/g carbohydrate and protein = 4. The number of g of carbohydrates, proteins, and fats in each dry fruit was taken from literature (Gebhardt et al. 2022& Kwon et al. 2020).

All the measurements were made in triplicate to ensure reproducibility and repeatability of the measurement.

3. RESULTS AND DISSCUSION

The total energy contents of the dry fruits are summarized in Table 1. The kernels of nuts show higher calorific value (787.36 – 915.51 Cal/100g) than dried fruits (352.04-505.31 Cal/100g).The highest caloric content was observed in peanut followed by walnut, almond, pine nut, pistachio, cashew nut, and coconut.

It is evident from Table 1 (Brufau et al. 2006 & Calories info. 2006) that energy contents of indigenous dry fruit samples show higher calories than the reference samples. This difference may be attributed to different cultivars and difference in environmental and cultivation conditions. Therefore, the estimated energy requirement (EER) of each dry fruit for the persons of different physical activity level (PAL) is of high concern.

During the digestion of macronutrients of food (carbohydrates, proteins, and fats), carbohydrates are broken down into sugars, proteins into amino acids, and fats into fatty acids and glycerol. These basic units provide energy to human body for growth, maintenance and activity. Figure 1(a) shows an energy breakdown of dry fruits in terms of the contribution of carbohydrates, fats, and proteins in the total caloric content. It is evident from the figure that fat and protein are the main macronutrients which contribute in dietary energy of nuts. Figure 1(b) shows the average macronutrient contribution (%) for different age groups (W. A. M. 2013).

Protein provides 4 Cal/g energy to form important parts of human muscles, bone, blood, enzymes, and cell membranes (Gebhardt et al. 2022 & Kwon et al. 2020). It also repairs tissues, regulate water and acid-base balance. If a body is getting enough calories, it does not use protein to form energy. Moreover, protein rich diet is not recommended as a healthy diet because the body breaks extra protein and stores its components as fat. Adults require about 15-25% of total calories (W. A. M. 2013). Athletes, swimmers, and the adults who are interested to build muscle need slightly more. Children also need more protein because they are growing. The highest contribution of protein (13.41 % of total Calories) was estimated in pistachio, followed by peanut (10.81%), almond (10.80%), cashew (9.93%), walnut (7.44%), and pine nut (7.09%). The adequate amount of protein in pistachio, peanut, almond, and cashew makes them an attractive source of plant protein for the growing age children, and adults trying to build their body. Somewhat little contribution of protein in total Calories was observed in figs (3.75%), apricot (3.56%), coconut (3.49%), and dates (2.27%). Literature shows that threonine and lysine protein of nuts are limited; but in contrast to other vegetable proteins, nuts ae high in arginine (Vega-Lopez et al. 2010). Therefore, a low ratio of lysine to arginine in nuts decreases the risk of cardiovascular diseases.

Another benefit for Nuts utilization is that nuts have a lower carbon footprint than animal-based proteins because nuts and other plant-based protein sources have a far lower GHG emission count compared to animal-based food products. For example, beef, mutton, poultry and eggs emit 49.89, 20, and 5.7kg and 4.21kg CO_2eq, respectively. In the meantime, nuts emit lower (0.26kg) CO_2 eq per 100 grams of protein.

Fats are the slowest source of energy, but the most energy dense form which provides 9 Cal/g to insulate, support, and cushion organs. It also provides medium for absorption of fat-soluble vitamins. The body stores excess fat in the abdomen or under the skin and utilize it by converting into energy when needed. Sometimes, excess fats deposited in blood vessels and within organs and cause serious health issues. The recommended intake of total fats is 20-30% (W. A. M 2013). Significantly little contribution of total fat has been assessed in dates (0.81%), raisins (0.82%), apricot (1.21%), and fig (2.38%). A major contribution of total fats in dietary energy has been observed in tree nuts. Pine ranked on top with a contribution of 79.67 %, followed by coconut (73.76%), walnut (71.67%), cashew nut (67.67%), pistachio (64.57%), almond (56.62%), and peanut (51.01%). Therefore, being the slowest source of energy, the consumption of these nuts is not recommended for the people already suffering from digestion problems. Despite the beneficiary effects of nuts on human health, high fat and caloric contents are the main reasons that confused general public for their excessive use. Now it is proved that most of the fats of nuts are unsaturated, which absorbed a little and induce energy expenditure by thermogenesis (Vega-Lopez et al. 2010, Rasmussen et al. 2007. & Mukuddem-Petersen et al. 2005).

A high contribution of carbohydrate in dietary energy was assessed for figs (72.57%), dates (69.65%), apricot (65.83%), and raisins (62.95%). The contribution of carbohydrates in other dry fruits was little (6.69 – 21.21%). However, raisins, dates, apricot, and figs are characterized as low-energy food. This is due to the fact that the digestible carbohydrates supply only 4 Cal/g instant energy to cells and muscles; while dietary fiber (indigestible carbohydrate) contributes in digestion and elimination process with a very low energy density of 1.5–2.5 Cal/g. High sugar in these fruits is responsible for their sweet taste which absorbs quickly and increase the level of blood glucose (blood sugar). Therefore, a proper intake of figs, dates, apricot, and raisins is especially recommended in the daily diet of those peoples who need instant energy.

All the weight loss / gain concerns are directly related to the energy intake and energy need of a body. If energy intake and energy need are equal, the body will maintain its weight. If a person takes more energy than its energy need; it causes weight gain problem. Similarly, lower energy intake than energy need leads to weight loss problem. The calorie requirement of a person depends on a number of factors including height, weight, and physical activity level (PAL). Unfortunately, a little attention towards the knowledge of the energy requirement of people with respect to their BMI and physical activity level has been observed during the planning of dietary strategies. Regardless of their source, calories consumed in excess of the estimated energy requirement (EER) may easily be converted to fat, stored and cause obesity. Therefore, a good and healthy dietary plan should consider the contribution of each macronutrient (carbohydrates, fats, and proteins) in a balance ratio. Figure 2(a-e) shows the values of EER for different age groups and gender with respect to their physical activities as a reference to guide for consumers to plan a healthy overall diet (Baghurst et al. 2005).

Generally, a PAL <1.4 shows an inactive lifestyle such as a hospital patient, or a person of limited physical mobility. A sedentary life style has PAL 1.4-1.55 represents the people have little physical activity like an office work. PAL 1.6 and 1.7 recommends moderately active life style for female and male, respectively. A very active life style (PAL 1.7-2.0) represents the persons involved in manual work like construction or agriculture jobs. PAL 2.0-2.4 is for military, or fitness trainers. PAL > 2.4 showing extremely active life style of athletes, sportsman, or swimmers. A 2,000 Calorie level is recommended for moderately active women, teenage girls, and sedentary men, and 2,500 Calories is the target level for men, teenage boys, and active women. Many older adults, children, and sedentary women select target energy of 1,600 Calories a day. The persons having an extremely active lifestyle may need 2,800 Calories per day.

At the recommended consumption level of 42.5 g of most tree nuts, peanut supplies 20.26–10.98% of EER per day for 19-30 years' male of PAL 1.2-2.2, respectively (Figure 2(f)). Walnut provides 18.93-10.27% of EER per day for PAL 1.2-2.2, respectively; followed by almond and coconut (18.16-9.85%), pine nut (17.83-9.67%), pistachio (14.41-7.81%), cashew nut (14.24-7.72%). A relatively lower contribution of dietary calories was estimated from figs (8.11-4.4%), apricot (8.78-4.76%), dates (9.94-5.39%), and raisins (11.65-6.32%) of EER per day for PAL 1.2 – 2.2, respectively.

Table 1: Energy content of the studied dry fruit samples

S. No	Dry Fruits			Calorific value		Calorific value		Calorific value	
	Sample Name	Sample ID	Scientific Name	(Cal/100g)	(kJ/100g)	(Cal/100g)	(kJ/100g)	(Cal/100g)	(kJ/100g)
1	Figs	Fig.	*Ficus Carica*	352.04	1472.94	ND	ND	ND	ND
2	Apricot	Apri.	*Prunus Armeniaca*	380.58	1592.35	ND	ND	ND	ND
3	Dates	Date.	*Phoenix Dactylifera*	430.91	1802.93	ND	ND	ND	ND
4	Raisins	Rais.	*Vitis Vinifera*	505.31	2114.22	ND	ND	ND	ND
5	Coconut	Coco.	*Cocos Nucifera*	787.36	3294.31	ND	ND	ND	ND
6	Cashew nut	Cash.	*Anacardium Occidentale*	616.46	2579.27	553	2314	553	2313.75
7	Pistachio	Pist.	*Pistacia Vera*	624.72	2613.83	557	2332	562	2351.41
8	Pine nut	Pine.	*Pinus Gerardiana*	772.31	3231.35	629	2632	673	2815.83
9	Almond	Alm.	*Prunus Dulcis*	785.61	3286.99	581	2431	575	2405.80
10	Walnuts	Waln.	*Juglans Regia*	818.84	3426.03	618	2584	654	2736.34
11	Peanut	Pean.	*Arachis Hypogaea*	875.86	3664.59	567	2374	567	2372.33

ND: Not detected

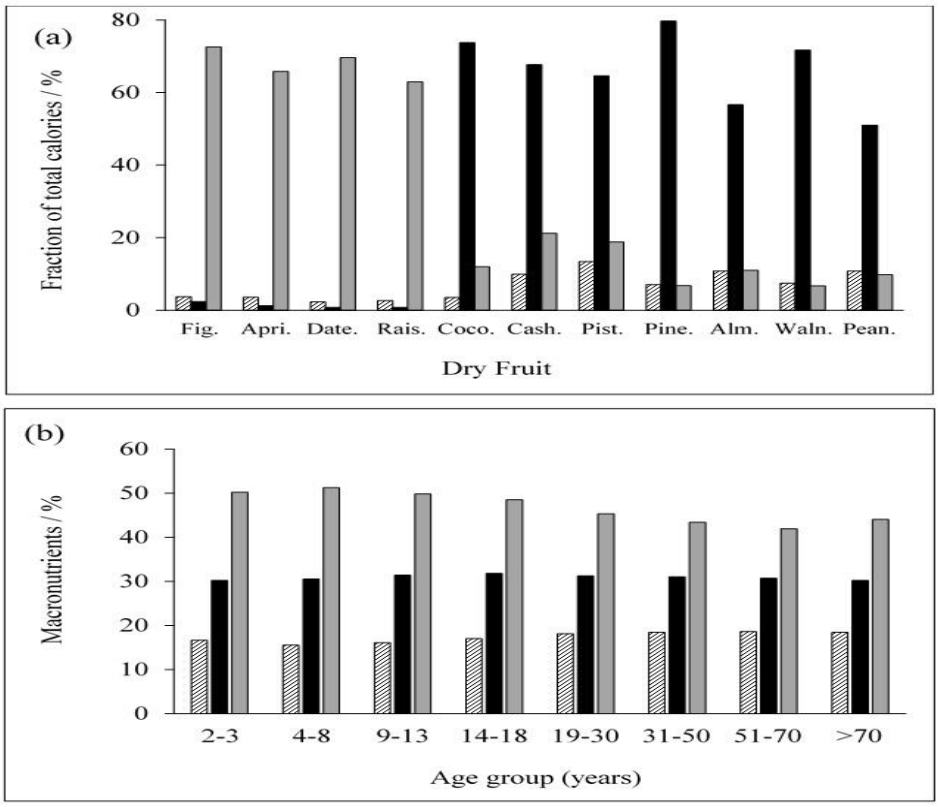

Figure 1(a) Caloric breakdown of dry fruits

protein, total fat, carbohydrate

(b) Percentage of macronutrient contribution to energy (legends show the same macronutrients as are shown in (a))

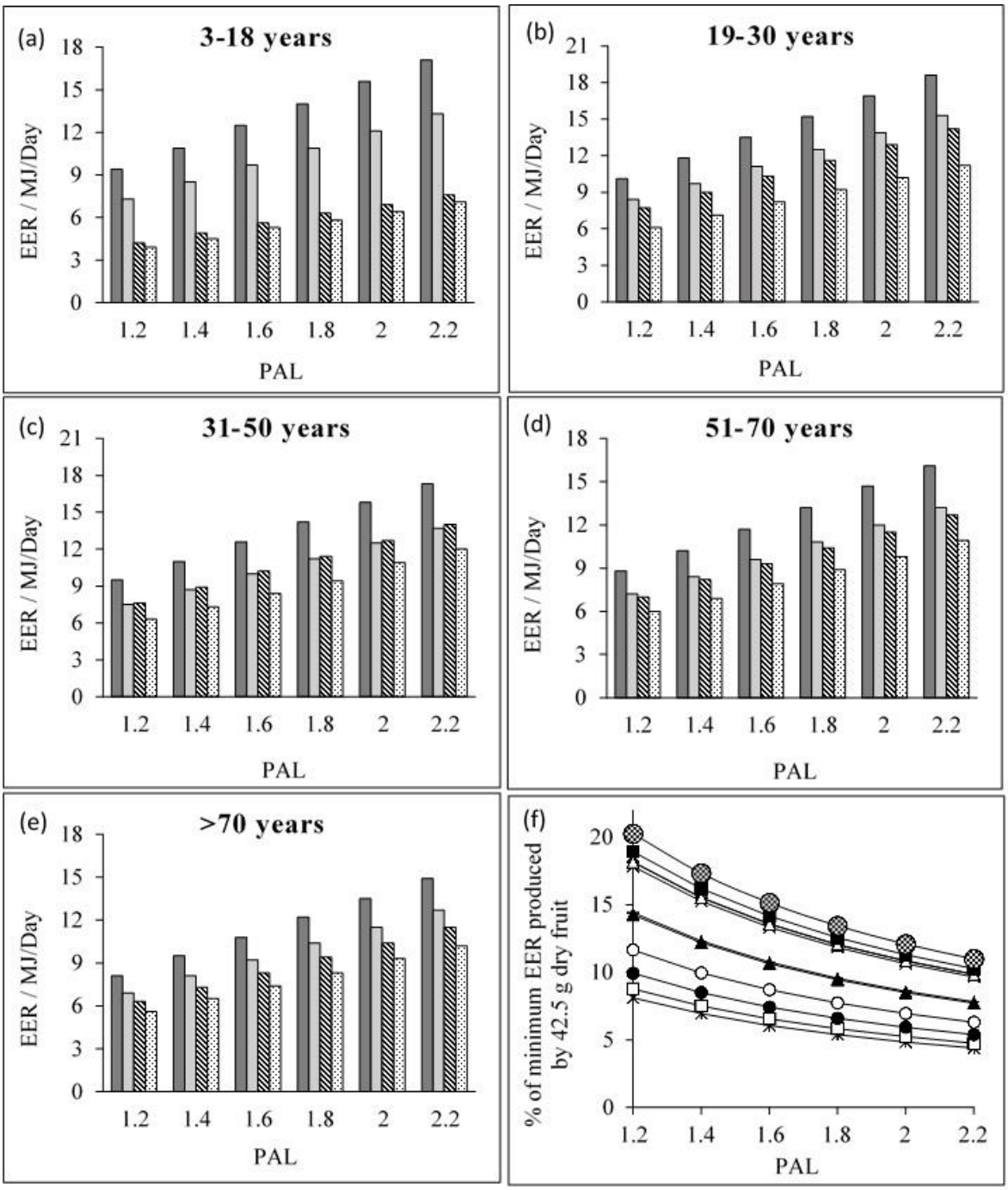

Figure 2 (a to e) Estimated energy requirements for different age groups and gender
Male: ▩ maximum, ▨ minimum, Female: ▧ maximum, ⊡ minimum

(f) % of minimum EER produced by 42.5 g dry fruit for 19-30 years male
✶fig, □ apricot, ● date, ○ raisins, ◇ coconut, ▲ cashew nut,
+ pistachio, × pine nut, △ almond, ■ walnut, ◕ peanut

The energy content of tested dry fruits makes them attractive for the peoples of all life styles. The caloric content of each dry fruit would be helpful for consumers to estimate the energy intake with respect to their particular BMI and lifestyle. Therefore, weight balance, overweight and underweight problems of consumers may be controlled by taking an appropriate amount of suitable dry fruit. On the basis of energy values, it is concluded that Calorie rich nuts are suitable mainly for those people who require high energy inputs to perform heavy physical exertion, or for children of growing age who are engaged in constant physical activities. These fruits help to keep their muscles in good shape and bones to strong. In contrast, carbohydrate rich dried fruits are suitable for the persons of low PAL or sedentary life style. The peoples of moderately active life style may

consume nuts, and dried fruits by calculating the appropriate amount with respect to their BMI, gender, and energy requirement.

4. CONCLUSIONS

Dry fruits were characterized as an excellent source of energy and macronutrients. Figs, apricot, dates, and raisins were identified as carbohydrate-rich and low-calories fruits. High Calories in peanut, walnut, almond, pine nut, pistachio, and cashew nuts are associated with high fats, and high protein. Although the study has not directly addressed the effects of dry fruit consumption on human body weight, but using the energy value of each dry fruit, one can easily calculate the amount of dry fruit required per day in accordance to gender, BMI, and PAL lifestyle. A standard serving of studied dry fruits covers 20.26-4.40% of EER per day for PAL 1.2-2.2, respectively. This study provides a simple way to understand weight balance, gain, or loss strategies using the benefits of dry fruits. Therefore, inclusion of energy-dense dry fruits into daily diet is recommended in accordance to their specific energy and macronutrient composition.

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