International Journal of Medical, Medicine and Health Sciences
ISSN: 2517-9969
Vol:13, No:1, 2019

Assessment of Menus in a Selected Social Welfare Home with Regard to Nutritional Recommendations

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***Abstract*—**The aim of the study was to assess diets of residents of nursing homes. Provided by social welfare home, 10 day menus were introduced into the computer program Diet 5 and analyzed in respect of protein, fats, carbohydrates, energy, vitamin D and calcium. The resulting mean values of 10-day menus were compared with the existing Nutrition Standards for Polish population. The analysis menus showed that the average amount of energy supplied from food is not sufficient. Carbohydrates in food supply are too high and represent 257% of normal. The average value of fats and proteins supplied with food is adequate 85.2 g/day and 75.2 g/day. The calcium content of the diet is 513.9 mg/day. The amount of vitamin D supplied in the age group 51-65 years is 2.3 μg/day. Dietary errors that have been shown are due to the lack of detailed nutritional guidelines for nursing homes, as well as state-owned care facilities in general.

***Keywords*—**Assessment of diet, essential nutrients, social welfare home, nutrition.

I. Introduction

ADEQUATE nutrient supply, covering protein, fats, carbohydrates, vitamins, as well as micro- and macro-nutrients, is a prerequisite for good health and physical fitness. Importantly, either excessive or inadequate nutrient supply may cause various diet-related diseases, such as cardiovascular diseases, diabetes or obesity, and lead to malnutrition [1]-[4]. A healthy diet is one that warrants regular intake of necessary nutrients according to individual needs.

Currently, as world population is rapidly aging and there is a wide prevalence of disabilities of various types, institutions like nursing or care-and-board homes play an important role, providing day-to-day care, assistance, nursing, and education [5], [6]. Apart from the provision of relevant medical care, the ability to offer a sustaining, healthy diet should be considered one of their primary roles [6].

In Poland, dietary recommendations which should be included in the daily meal plan have been developed by the National Food and Nutrition Institute [7]. They list referential values for energy and nutrient requirements [7].

All physiological functions, body growth and physical activity require adequate energy supply. Individual calorie needs vary depending on a combination of factors, such as a person's sex, age, health status, weight, height and their physical activity level [7].

Unless daily food intake is adequate in terms of calorie supply, the body is unable to function properly. When the calorie supply is too high, the body stores it in the form of excessive fat tissue, becoming overweight or obese [7], [8].

As the basic structural component of every cell, protein is crucial for proper body functioning. It supports the functions of the immune system, and is involved in multiple metabolic processes [7], [11]. Just like with calorie intake, the required protein intake depends on a number of factors, such as a person's age, health status, metabolism, level of physical activity and the nutritional value of the dietary protein consumed. The metabolic rate for protein is closely associated with the body's energy expenditure [7]. Protein sources may be classified as animal- and plant-based. The main sources of dietary protein in daily diet include meat, fish, eggs, milk and other dairy products [10], [11].

Protein and calorie shortage initially induces weight loss, but subsequently leads to adipose tissue atrophy, muscle wasting, immune deficiency, poor digestion and inhibited nutrient absorption. Protein deficiency is typically accompanied by shortage of other nutrients [7], [9]. Intake of excessive amounts of protein-rich foods, rich in fat and calories, causes weight gain and adipose tissue buildup. To ensure wellbeing and optimal health, it is vital to consume a well-balanced diet containing adequate protein supply [12]. According to dietary guidelines, the recommended daily protein intake falls in the range of 45-81 g [8].

Fats are a source of essential nutrients and dietary unsaturated fatty acids. They also facilitate the absorption of vitamin A, D, E and K. Excessive fat intake combined with a low level of physical activity results with overweight and cardiovascular diseases [7], [10], [13], [14]. The actual source of fat is also important, as animal-based fats contain large amounts of saturated fatty acids [13], [15]. They are found in meat, processed meat products such as ham and sausage, eggs, fish and dairy foods or lard [10].

Carbohydrates are commonly referred to as the body's basic fuel, with their primary function being the provision of energy. They control blood glucose and insulin levels, as well as hunger and satiation mechanisms. Carbohydrates, especially glucose, are crucial for normal brain functioning. The type of supplied carbohydrates influences the body's glycemic response. Excessive carbohydrate intake, however, has a negative impact on an individual's health, leading to conditions such as diabetes, overweight ad obesity [7], [16]. Carbohydrates are provided with refined sugar, honey, potato flour, dried fruit, as well as cereal and sweets. The bulk of daily carbohydrate intake comes from cereal [10], [16], [17]. The recommended carbohydrate intake is 130 g/day [8].

In Polish population, vitamin D and calcium deficiency are

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common across different age groups [18]-[21].

Calcium stimulates nervous impulses and muscle contractility. It is also vital for healthy cardiac function, with its deficiency leading to hypertension, hyperexcitation and tetany. Outdoor physical activity on sunny days is vital to facilitate vitamin D production by the body itself [7], [22], [23]. Individual vitamin D requirements depend on sunlight exposure, the mutual proportion of calcium and phosphorus in the daily diet and their uptake from food [24]. Sea fish are the most important source of vitamin D, followed by meat and dairy products, yet to a much lesser degree. 90% of vitamin D within the human body, however, is generated by sunlight [7], [21].

The main calcium sources are milk and dairy products [7].

II. Aim of the Study

The study has been aimed at evaluating the meal plans offered by a selected state-run nursing home, identifying calorie, protein, fat, carbohydrate, calcium and vitamin D intake of the residents.

III. Material and Method

The study was carried out in a selected state-run nursing home in the Silesian voivodeship, with 60 permanent residents. The facility provides 24/7 care for residents with intellectual disabilities. Its residents are male, aged 21-65 years old, accounting for large discrepancies in their dietary needs.

The 10-day meal plans provided by the facility were entered into Dieta 5 software developed by the National Food and Nutrition Institute, and their protein (g), fat (g), carbohydrate (g), energy (kcal), vitamin D (μg), and calcium (mg) contents were analyzed, with mean values calculated. The results were compared with the recommended daily intake values (reference values) for Polish population, an updated version [9].

To facilitate relevant calculations and compare the results with the reference values, 70 kg was assumed as the residents' mean body weight, and their physical activity level was identified as 1.6.

The meal plan designed for the residents at this nursing facility is based on a normal diet meal plan.

The calculations were performed with Statistica software (parametric data) and in R software environment for statistical computing and graphics (nonparametric data). The diagrams were generated with Excel software.

Shapiro-Wilk test was applied to test data for normal distribution. Parametric data were tested with the single sample t-test, comparing the mean to a specified value. Nonparametric values were analyzed with Wilcoxon signed rank test. The statistical significance level was set up at $\alpha = 0.05$.

IV. Results

The mean daily energy intake was 2296.117 kcal, with the minimum and maximum value being 1980.528 kcal and 2590.566 kcal, respectively (Table I). The single sample t-test, comparing the mean to the specified value, showed the differences between the data and the reference value to be statistically significant, at p= 0.00.

TABLE I
Calorie Content of Daily Meal Plans According to Season

Winter	Calorie content of daily meal [kcal]	Spring	Calorie content of daily meal [kcal]
1	2291,362	1	2338,057
2	2257,338	2	2230,152
3	2368,668	3	2231,722
4	2363,846	4	2413,873
5	2291,891	5	2440,984
6	2334,445	6	2590,566
7	2138,608	7	2334,902
8	2046,094	8	2399,411
9	2124,914	9	2355,083
Summer	Calorie content of daily meal [kcal]	Autumn	Calorie content of daily meal [kcal]
1	2136,989	1	2229,11
2	2201,765	2	2362,255
3	2307,786	3	2315,615
4	2233,106	4	2312,13
5	2203,348	5	2283,092
6	1980,528	6	2273,172
7	2294,119	7	2309,485
8	2303,739	8	2278,052
9	2513,101	9	2435,078

The mean daily carbohydrate intake was 334.5788 g, with the minimum and maximum value being 274.7107 g and 417.4075 g, respectively (Table II). The differences between the data and the reference value were statistically significant, at p=0.00.

TABLE II
Daily Carbohydrate Intake (10-Day Meal Plans, According to Season)

Winter	Daily carbohydrate intake [g]	Spring	Daily carbohydrate intake [g]
1	338,4852	1	337,2797
2	329,76507	2	323,7548
3	326,8373	3	363,6841
4	358,1678	4	333,18
5	367,4727	5	344,8711
6	417,4075	6	356,5218
7	317,0771	7	284,2021
8	341,4734	8	274,7101
9	345,9164	9	285,9193
Summer	Daily carbohydrate intake [g]	Autumn	Daily carbohydrate intake [g]
1	309,1552	1	314,4176
2	293,5729	2	347,1796
3	318,2843	3	346,273
4	325,5245	4	346,4761
5	322,0649	5	336,5706
6	280,0777	6	345,0738
7	335,0549	7	333,8083
8	335,6463	8	355,4286
9	387,2903	9	363,7039

The mean daily fat intake was 85.17845 g, with the minimum and maximum value being 76.24910 g and 104.6031 g, respectively (Table III). The differences between the data and the reference value were statistically significant, at p=0.00.

TABLE III
DAILY FAT INTAKE (10-DAY MEAL PLANS, ACCORDING TO SEASON)

Winter	Daily fat intake [g]	Spring	Daily fat intake [g]
1	85,34976	1	83,2211
2	77,9018	2	81,57992
3	79,62897	3	81,00533
4	87,99186	4	87,8897
5	83,11887	5	78,76257
6	80,55928	6	78,35633
7	104,6031	7	89,71253
8	88,46483	8	85,68529
9	90,23794	9	86,15569
Summer	Daily fat intake [g]	Autumn	Daily fat intake [g]
1	81,12249	1	86,98768
2	92,86431	2	89,77875
3	94,23639	3	81,31024
4	82,59933	4	84,93865
5	81,51501	5	86,19743
6	77,18277	6	79,80018
7	84,60308	7	87,5087
8	87,56807	8	76,2491
9	89,85361	9	87,37566

The mean daily protein intake was 75.10864 g, with the minimum and maximum value being 65.99079 g and 84.12192 g, respectively (Table IV). The differences between the data and the reference value were statistically significant, at p=0.00

TABLE IV
DAILY PROTEIN INTAKE (10-DAY MEAL PLANS, ACCORDING TO SEASON)

Winter	Daily protein intake [g]	Spring	Daily protein intake [g]
1	78,03525	1	73,45432
2	74,69839	2	80,06784
3	76,49764	3	71,85848
4	72,47082	4	83,25403
5	82,69354	5	75,99057
6	77,15968	6	76,14645
7	84,12192	7	73,31558
8	73,47631	8	69,94437
9	81,77648	9	74,32036
Summer	Daily protein intake [g]	Autumn	Daily protein intake [g]
1	69,37256	1	79,90434
2	71,14986	2	72,61237
3	76,96504	3	80,34953
4	73,02839	4	69,30605
5	74,16763	5	71,15059
6	65,99079	6	70,98381
7	75,5152	7	73,23945
8	74,21252	8	72,93704
9	73,03756	9	78,88425

It was determined that daily calcium intake ranged from 421.4636 mg- 694.8719 mg, with the mean value of 513,9247 mg (Table V), and thus was not consistent with the recommended daily intake. The difference was statistically significant, at p= 0.00.

TABLE V
DAILY CALCIUM INTAKE (10-DAY MEAL PLANS, ACCORDING TO SEASON)

Winter	Daily calcium intake [mg]	Spring	Daily calcium intake [mg]
1	493,6963	1	505,7887
2	592,9727	2	471,2771
3	439,6272	3	486,352
4	481,8043	4	518,221
5	514,5024	5	451,4672
6	572,9122	6	421,4636
7	551,4552	7	484,1046
8	589,3422	8	474,364
9	694,8719	9	497,6635
Summer	Daily calcium intake [mg]	Autumn	Daily calcium intake [mg]
1	486,0781	1	541,8821
2	551,4694	2	515,8711
3	555,0862	3	456,3796
4	511,5841	4	501,1107
5	506,9821	5	561,7343
6	429,8378	6	443,1497
7	486,8314	7	432,9521
8	471,7578	8	602,0603
9	504,7117	9	600,7303

The analysis showed an insufficient daily vitamin D intake, with the minimum and maximum value being 1.483430 µg and 4.324780 µg, respectively, and the mean value of 2.368716 µg (Table VI). The difference between the data and the reference value was statistically significant, at p=0.00.

TABLE VI
DAILY VITAMIN D INTAKE (10-DAY MEAL PLANS, ACCORDING TO SEASON)

Winter	Daily vitamin D intake [µg]	Spring	Daily vitamin D intake [µg]
1	1,878	1	2,57386
2	1,93384	2	2,60524
3	2,47194	3	2,53405
4	1,92213	4	3,25138
5	1,94859	5	2,40228
6	1,63102	6	3,01902
7	2,35068	7	2,22661
8	2,41985	8	2,80778
9	2,17742	9	2,30971
Summer	Daily vitamin D intake [µg]	Autumn	Daily vitamin D intake [µg]
1	2,16148	1	2,42685
2	2,06127	2	2,83687
3	2,6093	3	1,86791
4	1,8203	4	2,25564
5	1,48343	5	1,78439
6	4,32478	6	3,69947
7	1,91831	7	2,097
8	2,13527	8	2,13079
9	1,85162	9	3,4014

V. DISCUSSION

The evaluation of 10-day meal plans offered in the studied

state-run nursing home showed the residents' mean daily calorie intake to be 2296.1 kcal, which was inadequate for all age groups, younger residents in particular. The daily energetic requirement in the 31-50 years old age group is 2700 kcal, whilst in this case the mean daily calorie intake made up for 85% of this reference value. A similar result was obtained in the PONS study, where inadequate calorie intake was also shown [25]. A similar problem is also apparent in studies by authors from other countries. For example, Crogan and Pasvogel found that approximately 38.6% of residents living in three nursing homes based in eastern Washington (USA) were malnourished.

The residents of the nursing home in our study ate diet that was carbohydrate-rich, with a daily carbohydrate intake of 334.5 g, accounting for 257% of the reference value. Carbohydrate intake exceeded the reference value in all meal plans offered throughout the year, with the mean daily carbohydrate intake at 347.9 g in the winter and 322.9 g in summer season. Fat intake of residents aged 51-65 years old was consistent with the recommendations, whilst in the other age groups it accounted for 90% of the reference value.

The mean daily protein intake was 75.2 g, falling within the recommended range of 45-81 g/day. Our results are similar to those from studies performed in other countries, which also showed a widely varying daily calorie intake, yet the proportion was reversed, with an insufficient percentage of carbohydrate-derived energy and excessive percentage of fat-derived energy [26]-[29].

The residents' daily calcium intake was 513.9 mg, accounting for 64% of the reference value. According to the literature, in other countries the mineral intake of the elderly also tends not to be consistent with the recommendations, with calcium deficits, just as demonstrated in our study [30]-[33].

Daily vitamin D intake in 51-65 year old age group was 2.3 µg, accounting for 23% of the reference value. In the winter season, the mean daily vitamin D intake was 2.1 µg, and in the summer season it was 2.2 µg. This is a dramatically low result. In other age groups, vitamin D intake accounted for 47% of the recommended daily amount. Dietary vitamin intakes of the elderly in other countries also range widely, frequently also not being consistent with the recommended values. However, in those countries the daily vitamin D intake of the elderly is supplemented [30], [34]-[37]. It is estimated that vitamin D deficiency is found in approximately 50% of the population, contributing to the wide prevalence of diabetes and increasing the risk for cardiovascular diseases and cancer [8].

The nursing home residents' daily diet low in calcium and vitamin D may lead to osteoporosis and the resulting frequent bone fractures [17], [19].

VI. Conclusions

- Nutrient intakes in the analyzed meals plans varied according to the season (summer vs. winter).
- A number of dietary shortcomings were found in the analyzed meal plans, i.e. insufficient calorie, calcium and vitamin D intakes and excessive carbohydrate intake.
- The dietary errors indicated above are caused by a lack of mandatory dietary guidelines for state-run care facilities such as nursing homes.

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