Current Research

A Novel Dysphagia Diet Improves the Nutrient Intake of Institutionalized Elders

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ABSTRACT

Objectives Dysphagia affects 35% to 60% of the institutionalized elderly population. This study aimed at evaluating the nutrient intake of frail institutionalized elderly persons with dysphagia and to assess the impact of Sainte-Anne's Hospital Advanced Nutritional Care program on dietary intake and weight.

Design A 12-week intervention study.

Subjects/setting Ninety-three individuals residing in a Montreal, Canada, long-term care facility who were aged at least 65 years were evaluated. Seventeen subjects with a body mass index (BMI; calculated as kg/m^2) $<$24 or weight loss $>$7.5% within 3 months and with dysphagia were included.

Intervention The treated group (n=8; aged 82.5±4.41 years, weight 55.9±12.1 kg, BMI 22.4±3.93) received Sainte-Anne's Hospital reshaped minced- or pureed-texture foods with thickened beverages where required. The control group (n=9; aged 84.6±3.81 years, weight 54.3±7.49 kg, BMI 21.2±2.31) maintained traditional nourishment.

Main outcome measures Macronutrient and micronutrient intake, weight, and BMI were measured at baseline, 6 weeks, and 12 weeks.

Statistics Student t tests were performed to evaluate change within and between groups.

Results The treatment and control groups were similar at baseline, having a mean age of 82.5±4.41 years vs 84.6±3.81 years and BMI of 22.4±3.93 vs 21.2±2.31, respectively. The average weight in the treated group increased compared to the control group (3.90±2.30 vs −0.79±4.18 kg; P=0.02). Similarly, the treated group presented an increased intake of energy, proteins, fats, total saturated fats, monounsaturated fats, potassium, magnesium, calcium, phosphorus, zinc, vitamin B-2, and vitamin D compared to control subjects (P<0.05).

Conclusion Institutionalized elderly patients with dysphagia can eat better and increase body weight via a diversified, modified in texture, and appealing oral diet that meets their nutrition needs.

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Dysphagia, a dysfunction of the swallowing process that involves the oral, pharyngeal, and/or esophageal stages of the swallowing route, is a prevalent symptom in degenerative diseases such as stroke, dementia, Parkinson's disease, and Alzheimer's disease and has been reported to affect up to 60% of the institutionalized elderly population (1,2). The institutionalized elderly population is also known for its high prevalence of undernutrition (3-5) with reported prevalence rates as high as 76% (3-8). Frequent consequences of undernutrition include confusion, dehydration, pressure ulcers, constipation, infections, and decreased overall quality of life (3,7,9).

Providing adequate nutritional intake for institutionalized elders with dysphagia is a challenge. However, the experience of eating can be facilitated if the foods are modified to a minced or pureed texture and if the consistency of liquids is thickened (10-18). These changes in the diet often result in foods that are less appealing and that are often nutritionally diluted. Although several dysphagia diets and feeding strategies have been described (9-11,15,19-22), studies of their clinical efficacy are scarce (23).

Sainte-Anne's Hospital (Veterans Affairs Canada, Québec, Canada), developed a dysphagia diet that included three standardized thickened beverages (Nectar, Honey, and Pudding) and minced and pureed foods that are shaped into normal-looking food items very similar to their regular-texture counterpart. Particular care was given to the nutrient content to avoid diluting nutrients and provide foods that are energy appropriate. In this long-term care institution, almost 45% of patients receive a modified-texture diet (minced or pureed) and 10% of patients receive thickened liquids.

Given the high prevalence of dysphagia and malnutrition in the institutionalized elderly population and the limited information concerning the clinical efficacy of the various dysphagia diets, a study was undertaken at Marie-Rollet Center. The goal of this 12-week study was to improve dietary intake by elderly persons with dysphagia as a means of improving health. Two treatments were

Table 1. Baseline characteristics of institutionalized elders with dysphagia included in a study evaluating nutritional intake and assessing the effects of Sainte-Anne's Hospital Advanced Dysphagia Nutritional Care program

Characteristics	Control group (n=9)		Treated group (n=8)	
	←——— *mean±standard deviation* ———→			
Female subjects				
n	5		5	
%	56		63	
Age (y)	84.6±3.81		82.5±4.41	
Weight (kg)	54.3±7.49		55.9±12.1	
Body mass index (calculated as kg/m^2)	21.2±2.31		22.4±3.93	
Time post admission (y)	4.8±1.90		3.9±1.66	
Primary diagnosis	**n**	**%**	**n**	**%**
Alzheimer's disease	5	56	3	38
Parkinson's disease	1	11	0	
Other dementias	2	22	4	50
Stroke	1	11	1	13
Current smokers	0		1	13
Dietary prescriptions, following the RIC[a] evaluation of dysphagia (n=17)				
Soft+clear liquids		2		12
Minced-texture foods		8		47
Minced-texture foods+clear liquids		6		
Minced foods+honey texture liquids		2		
Minced/pureed-texture foods		4		24
Minced/pureed-texture foods+clear liquids		1		
Pureed-texture foods+clear liquids		3		
Pureed foods+honey texture liquids		3		18

[a]RIC=Rehabilitation Institute of Chicago.

compared in elders with dysphagia: a control group receiving Marie-Rollet Center's standard dysphagia regime, and a treatment group receiving Sainte-Anne's Hospital's new dysphagia diet, at the Marie-Rollet Center. The objectives were to assess dietary intake and weight in both treatment groups at baseline, 6 weeks, and 12 weeks, and to compare changes over time in both groups for dietary intake and weight.

METHODS

Ethical approval was given by the Minister of the Health and Social Services Department of the Québec Government and by McGill University. Both these approvals were issued for both cognitively intact and impaired subjects.

Study Population and Design

The 12-week study took place at Marie-Rollet Center, a long-term care facility in the Montreal region (Québec, Canada) where 93 elderly individuals resided. Individuals between 65 and 90 years of age who had been at the Center for more than 3 months and experienced an involuntary weight loss >7.5% of usual weight during the past 3 months or presented with a body mass index (BMI) of less than 24 were considered as potential subjects (24). Subjects were not excluded by type of diet or diet consistency. Individuals with an active cancer or a chronic intestinal disease, such as Crohn's disease, were excluded, as were terminally ill patients.

After obtaining signed consent, evaluations using the Rehabilitation Institute of Chicago Clinical Evaluation of Dysphagia (25) were conducted by a registered dietitian with more than 10 years experience in dysphagia assessment. Dysphagia was identified when an individual presented difficulties eating or swallowing solids or liquids. Eligible subjects were randomly allocated to the experimental group (reformed foods and thickened beverages supplied by Sainte-Anne's Hospital at Marie-Rollet Center) or the control group (Marie-Rollet Center traditional foods) using a blocked allocation strategy. Sealed envelopes indicating subject assignment were prepared off-site.

Demographic information including sex, age, weight, height, smoking status (past and current), and principal diagnosis was collected from the medical charts. When a subject presented more than one diagnosis, the diagnosis leading to institutionalization was retained as the primary diagnosis (Table 1).

At baseline, 6 weeks, and 12 weeks, the nursing staff weighed subjects wearing indoor clothing, without shoes, on a pedestal scale, on a scale lift, or on a chair scale, according

Category	Specific food items	
Marie-Rollet Center		
Pureed vegetables	Carrots	Carrot and turnip
	Green beans	Mixed vegetables
	Green peas	Waxed beans
Pureed fruits	Fruit cocktail sauce	Pineapple sauce
	Peach sauce	Applesauce
	Pear sauce	
Meats/main entrees (pureed[a])	Coriander pork	Roast turkey
	Honey mustard ham	Stroganoff beef
	Lemoned chicken	Tarragon chicken
	Old-fashion beef	Turkey à la king
	Roast beef	White fish Newburg
	Roast chicken	
Meats/main entrees (minced/soft)	Hamburger steak	Minced pork
	Minced beef	Minced turkey
Sweets/desserts	Ice cream and puddings	Jell-O[b]
Supplements	Chocolate (liquid)	Butterscotch (pudding)
	Fieldberries (liquid)	Chocolate (pudding)
	Vanilla (liquid)	Vanilla (pudding)
Sainte-Anne's Hospital		
Dairy products	Enriched milk	
Pureed vegetables	Broccoli P/F[c]	Asparagus P/F
	Carrots P/F	Green beans P/F
	Cauliflower P/F	Lettuce P/F
	Green peas P/F	Fresh tomato P/F
	Waxed beans P/F	
Pureed fruits	Halves of pear P/F	Pineapple slices P/F
	Slivers of peach P/F	Applesauce
	Strawberries P/F	
Meats/main entrees (pureed and/or minced)	Bourguignon beef P/F or M/F[d]	Beef slices P/F or M/F
	Fall stew P/F or M/F	Chicken breasts P/F or M/F
	Soukiaki stew P/F or M/F	Cold ham slices P/F or M/F
	Stroganoff stew P/F or M/F	Hamburger steak P/F or M/F
	Vegetable stew P/F or M/F	Hot ham slices P/F or M/F
	Meat pie P/F or M/F	Lamb cutlet P/F or M/F
	Lasagna P/F	Pork cutlet P/F or M/F
	Salmon pie P/F	Turkey slices P/F or M/F
	Shepherd's pie P/F	Veal slices P/F or M/F
Sweets/desserts	Carrot cake P/F	Apple cake P/F
	Choco-moka cake P/F	Bagatelle cake P/F
	Oatmeal cookies P/F	Black forest cake P/F
	Peach cake P/F	Chocolate cake P/F
	Vanilla cake P/F	
Supplements	Banana (liquid)	Butterscotch (pudding)
	Chocolate (liquid)	Chocolate (pudding)
	Strawberry (liquid)	Vanilla (pudding)
	Vanilla (liquid)	

[a]When the main dish cannot be pureed, Campbell TrePuree (Campbell Company of Canada, Etobicoke, Canada) is served.
[b]Kraft Holdings, Northfield, IL.
[c]P/F=pureed formed.
[d]M/F=minced formed.

Figure 1. Menu selections specific to Marie-Rollet Center and Sainte-Anne's Hospital, Québec, Canada.

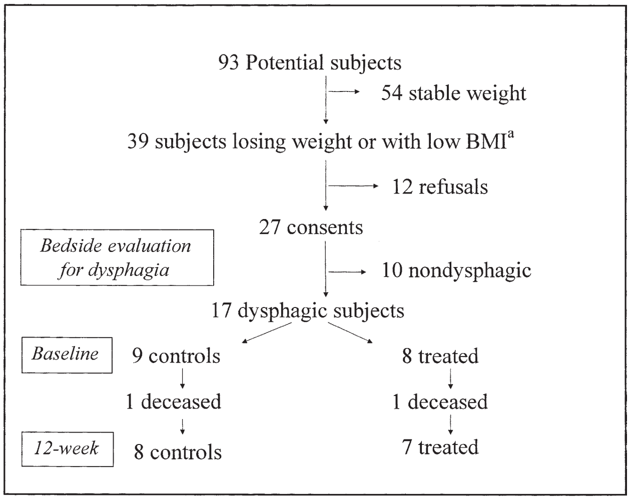

Figure 2. Selection of subjects for a study assessing the effects of Sainte-Anne's Hospital Advanced Dysphagia Nutrition Care program on dietary intake and weights among institutionalized elderly persons. [a]BMI=body mass index.

to patient health status. Heights from the charts were confirmed by knee height measurements. The knee height measurement was obtained by using the Ross Caliper (Ross Laboratories, Abbott Laboratories Canada, Quebec, Canada) according to a standard protocol (26). BMI was calculated by dividing weight (kg) by height (m^2) (27).

For the baseline dietary evaluations, all subjects received traditional Marie-Rollet Center foods. The time required to complete each meal was recorded. The feeder, when necessary, was identified (eg, orderly, the patient, or a family member). The 3-week-cycle menu was maintained and the diet texture was adjusted for all subjects, when needed, according to bedside assessment results (Rehabilitation Institute of Chicago Evaluation of Dysphagia [25]) and the clinical evaluation of the registered dietitian. Dietary intakes of 2 consecutive weekdays were obtained at baseline, 6 weeks, and 12 weeks. Items served on the trays were weighed before and after the meal. Resulting differential weights were considered the eaten portion. When items were stirred together, the weight of the remaining portion was evaluated according to a pro-rata ratio compared with the original quantity of each food item served. The nursing staff listed snacks. Nutritionally balanced commercial formula was given when necessary and included in the calculations of the dietary intake. Dietary analyses were performed by the NutriWatch software package (NutriWatch Nutrient Analysis Program, version 6.1.4F-Delphi 1 for Windows, 2000, PEI, Canada). Nutritional values absent from the Canadian food file were entered following the values provided by the manufacturer whenever possible. Nutrient compositions for existing recipes developed at Sainte-Anne's Hospital and Marie-Rollet Center were added to the Canadian food file.

INTERVENTION

Control Group

The traditional Marie-Rollet Center meals were planned via a menu of 21 days according to each patients' nutrition needs, specific diet, allergies, preferences, and aversions on Micro Gesta software (DOS version, 1999, Micro Gesta, Québec, Canada). Marie-Rollet Center offered traditional modified textured diets presenting three levels: Minced-70, Minced-3, and Pureed diet and offered one consistency of thickened beverages designated Honey. The beverages' consistency was not systematically controlled.

Experimental Group

For the duration of the study the subjects of the treated group were provided with Sainte-Anne's Hospital's nutrition approach. It included Sainte-Anne's Hospital's reformed foods (ie, pureed fruits, vegetables, and desserts along with pureed and minced meats), thickened beverages, as needed, and dietary supplements when necessary. Although prepared at Sainte-Anne's Hospital, these foods were delivered daily at Marie-Rollet Center. Sainte-Anne's Hospital also offered three levels of modified-texture diets: Minced diet, Minced/Pureed diet, and Pureed diet (see Figure 1) and Sainte-Anne's Hospital's thickened beverages offered in their three consistencies named Nectar, Honey, and Pudding. The consistencies were standardized and controlled using the Bostwick consistometer as part of the quality assessment routine.

For the treated group, the Sainte-Anne's Hospital's reformed minced or pureed foods were introduced at Marie-Rollet Center and a new 3-week cycle menu was developed. This new menu reflected the item selection of the regular-texture menu offered at Marie-Rollet Center. Menus were revised for each subject of the treated group. Two subjects were able to inform us of their food preferences and dislikes. Their menus were adapted accordingly. To reduce perceivable changes on the tray and possible bias, 63 menu cards (3 meals×7 days×3 weeks) were reproduced using Microsoft Excel software (version 5.0, 1995, Microsoft Inc, Redmond, WA) for each treated subject to match the menu cards usually printed for Marie-Rollet patients and limit the influence of the overall tray aspect.

At each meal, the patient had a choice of two types of reformed meats (menu of the day or a substitute), two reformed vegetables and a choice of reformed cake and/or reformed fruit, and other regular items when possible for their condition. If these choices were not to their liking, the patient could receive an item from the à la carte menu that remained the same each day: reformed pork cutlet, reformed beef or ham slices, and pureed sandwiches (egg and ham).

STATISTICAL ANALYSES

The data obtained at baseline were compared using the unpaired Student t test to assess any difference between the groups at baseline. This procedure was repeated with the data gathered at week 6 and week 12. An assessment of change over time was done to measure the change in nutrient intake (paired t test). The change in weight and dietary intake from baseline to midway evaluations and from baseline to final assessments was compared between the groups using the unpaired Student t test. Due to some missing data, analysis of variance was not used to

Table 2. Baseline energy intake and nutrient composition for control and treated elderly subjects with dysphagia receiving standard hospital modified-texture diet at Marie-Rollet Center

	Control Group (n=9)		Treated Group (n=8)		
Variables	Mean±SD[a]	% Energy	Mean±SD	% Energy	*P* value
Energy and macronutrients					
Energy (kcal)	1,566±323		1,374±235		0.19
Protein (g)	56.0±16.8	14	52.5±14.6	15	0.66
Carbohydrate (g)	238±45.2	59	211±23.4	59	0.15
Fat (g)	47.4±13.7	27	39.3±12.2	26	0.22
Total saturated fat (g)	11.3±4.95		11.7±6.03		0.88
Monounsaturated fat (g)	10.8±4.87		13.2±7.46		0.44
Polyunsaturated fat (g)	5.84±2.67		6.72±3.39		0.56
Cholesterol (mg)	131±70.8		123±15.4		0.79
Total fiber (g)	16.9±6.78		12.6±4.68		0.16
Minerals					
Sodium (mg)	2,519±624		2,580±820		0.86
Potassium (mg)	2,885±625		2,704±637		0.56
Magnesium (mg)	256±50.8		240±76.2		0.61
Calcium (mg)	757±209		639±312		0.37
Phosphorus (mg)	1,107±251		975±299		0.34
Iron (mg)	13.5±4.97		12.2±2.84		0.52
Zinc (mg)	8.88±3.50		7.9±4.16		0.61
Vitamins					
Vitamin B-1 (mg)	1.63±0.74		1.39±0.58		0.46
Vitamin B-2 (mg)	1.93±0.97		1.38±0.47		0.16
Vitamin B-3 (NE[b])	22.3±6.54		22.9±7.52		0.86
Vitamin B-12 (μg)	2.57±1.39		2.82±1.49		0.73
Vitamin C (mg)	155±51.4		136±74.9		0.55
Vitamin D (μg)	4.45±1.81		3.39±2.46		0.32

[a]SD=standard deviation.
[b]NE=niacin equivalents.

assess changes over the 12-week period. Data analysis was completed using the SAS software package (version 6.12 for Windows, SAS Institute, Inc, Cary, NC). Probability of $P<0.05$ was considered as statistically significant.

RESULTS

Screening and Evaluations

The screening resulted in the allocation of eight patients (five women) to the treatment group and nine patients (five women) to the control group (Figure 2).

Baseline Characteristics

The groups were comparable for age, BMI, and medical profile (Table 1). The principal diagnoses were representative of an elderly institutionalized population, with Alzheimer's disease (55.6% and 37.5% for control and treated subjects, respectively) and dementia (22.2% and 50% for control and treated subjects, respectively) as main medical diagnoses. No one required tube feeding or amputation during the study.

At baseline, the mean intake of the control group was 1,566±323 kcal whereas the treated group ingested 1,374±235 kcal (Table 2). The analysis of the baseline dietary intakes for macronutrient breakdown and micronutrients revealed no statistical difference between the groups. The control group received a daily average 1.00 g/kg protein per day whereas the treated group consumed 0.97 g/kg/day.

Dietary Intake at Week 6

The change in dietary intake for each group over the 6 weeks was compared (Table 3). The treated group presented an increased energy intake over baseline of 563 kcal compared to a decline of 79 kcal in the control group. The increased energy was a function of increases in all macronutrients. The increases were also observed for most minerals and vitamins.

Dietary Intake at Week 12

Table 4 summarizes the nutritional profile at Week 12 and the changes in nutrient composition of the diet compared to baseline. There was one death between 6 and 12 weeks, in each group. The changes observed between baseline and 6 weeks were maintained at 12 weeks. When comparing the mean nutrient intake of the two groups

Table 3. Energy intake, nutrient composition, and change observed in nutrients at 6 weeks, among elderly subjects with dysphagia receiving Sainte-Anne's Hospital Advanced Dysphagia Nutritional Care program modified-texture diet (treated group) or standard hospital modified-texture diet (control group)

	Energy and Nutrient Intake at 6 Weeks					Change in Energy and Nutrient Intake from Baseline to 6 Weeks		
	Control Group (n=9)		Treated Group (n=8)			Control Group (n=9)	Treated Group (n=8)	
Variable	**Mean±SD[a]**	**% Energy**	**Mean±SD**	**% Energy**	***P* value**	**Mean±SD**	**Mean±SD**	***P* value**
Energy and macronutrients								
Energy (kcal)	1,487±506		1,937±490		0.08	−79±296	563±429	<0.01*
Protein (g)	54.8±23.7	15	84.4±26.3	17	0.03*	−1.22±14.4	31.9±23.4	<0.01*
Carbohydrate (g)	222±66.0	57	275±68.2	56	0.13	−16.24±45.1	63.8±62.0	<0.01*
Fat (g)	45.9±24.8	28	59.1±15.6	27	0.21	−1.51±13.0	19.9±14.8	<0.01*
Total saturated fat (g)	9.37±6.00		18.0±6.66		0.01*	−1.92±2.14	6.31±4.47	<0.01*
Monounsaturated fat (g)	9.21±6.39		18.4±6.21		<0.01*	−1.60±2.51	5.19±5.14	<0.01*
Polyunsaturated fat (g)	4.85±3.54		7.77±2.78		0.08	−0.10±2.01	1.05±3.40	0.15
Cholesterol (mg)	125±88.7		191±71.0		0.11	−6.44±27.5	6.74±65.1	0.02*
Total fiber (g)	17.6±9.97		10.8±4.27		0.09	0.70±3.98	−1.88±4.98	0.25
Minerals								
Sodium (mg)	2,475±974		3,338±1,396		0.16	−43.8±517	758±816	0.03*
Potassium (mg)	2,726±861		3,885±1,142		0.03*	−159±498	1,181±978	<0.01*
Magnesium (mg)	255±121		377±112		0.05*	−0.78±78.7	137±107	<0.01*
Calcium (mg)	701±287		1,331±671		0.04*	−56.1±187	692±455	<0.01*
Phosphorus (mg)	1,087±369		1,651±606		0.03*	−19.8±266	675±423	<0.01*
Iron (mg)	13.6±7.26		15.4±4.93		0.57	0.16±1.83	3.26±4.16	0.09
Zinc (mg)	8.72±5.96		14.5±4.97		0.05*	−0.17±6.43	6.57±5.40	0.03*
Vitamins								
Vitamin B-1 (mg)	1.56±1.00		2.00±0.77		0.33	−0.07±0.40	0.61±0.55	0.01*
Vitamin B-2 (mg)	1.73±0.84		2.91±1.24		0.03*	−0.20±1.39	1.53±0.87	<0.01*
Vitamin B-3 (NE)[b]	22.4±11.5		37.4±12.5		0.02*	0.05±7.33	14.5±12.1	<0.01*
Vitamin B-12 (μg)	3.08±2.06		6.23±2.23		<0.01*	0.51±1.45	3.41±2.35	<0.01*
Vitamin C (mg)	162±68.0		174±43.2		0.68	6.67±46.0	37.5±48.9	0.20
Vitamin D (μg)	4.73±2.36		8.89±5.85		0.09	0.28±2.44	5.50±4.02	<0.01*

[a]SD=standard deviation.
[b]NE=niacin equivalents.
**P*<.05.

after 12 weeks, values of protein, lipids, total saturated and monounsaturated fats, potassium, magnesium, phosphorus, and zinc as well as vitamins B-2, B-3, B-12, and D were higher in the treated group ($P<0.05$). The percentage of energy provided by lipids remained below 30%. Furthermore, the changes in the mean intake of total energy, protein, lipid, total saturated and monounsaturated fats, potassium, magnesium, calcium, phosphorus, zinc, riboflavin, and vitamin D were all significant in the treated group ($P<0.05$).

The higher dietary intake in the treated group appears to come mainly from the higher number of portions of reformed pureed cakes (Baked Goods Group), reformed pureed vegetables (Vegetable Group), reformed pureed meats (Meats Group) and from a higher number of portions of milk and enriched milk (Dairy Products Group), although there was not adequate statistical power to detect statistical significance in relation to changes in numbers of portions of the various food groups.

Weight Changes

Six weeks into the protocol, the mean change in weight was not different between the two groups (−0.61±2.23 kg vs 1.31±2.85 kg in the control vs treated groups, respectively). However, at 12 weeks there was a decreased mean weight change for the control group whereas the treated group demonstrated a mean weight change increase (−0.79±4.18 kg vs 3.90±2.30 kg, respectively; $P=0.02$). These changes in mean weights are significantly different (Figure 3). An increase in average weight for the treated group, throughout the course of the study, resulted in a mean BMI of 24.5.

The time required for feeding meals varied in time from

Table 4. Energy intake, nutrient composition, and change observed in nutrients at 12 weeks among elderly subjects with dysphagia receiving Sainte-Anne's Hospital Advanced Dysphagia Nutritional Care program modified-texture diet (treated group) or standard modified-texture diet (control group)

	Energy and Nutrient Intake at 12 Weeks[a]					Change in Energy and Nutrient Intake from Baseline to 12 Weeks		
	Control Group (n=8)		Treated Group (n=7)			Control Group (n=8)	Treated Group (n=7)	
Variables	Mean±SD[b]	% Energy	Mean±SD	% Energy	*P* value	Mean±SD	Mean±SD	*P* value
Energy and macronutrients								
Energy (kcal)	1,603±366		1,947±317		0.08	81±169	611±408	0.03*
Protein (g)	56.6±19.8	14	83.1±21.2	17	0.03*	2.14±10.0	28.6±26.0	0.04*
Carbohydrate (g)	254±66.8	63	272±44.5	56	0.55	18.1±32.3	59.3±51.1	0.08
Fat (g)	43.3±11.1	24	62.3±11.2	29	<0.01*	−0.75±7.34	21.1±18.4	0.02*
Total saturated fat (g)	10.9±6.21		19.0±2.76		<0.01*	−1.18±2.70	5.99±3.71	<0.01*
Monounsaturated fat (g)	9.75±6.64		20.1±5.39		<0.01*	−1.75±3.32	5.18±5.58	0.01*
Polyunsaturated fat (g)	5.27±4.45		8.51±2.64		0.12	−0.92±2.97	0.91±4.26	0.35
Cholesterol (mg)	165±120		209±97.9		0.46	26.3±64.7	76.1±107	0.29
Total fiber (g)	16.2±4.57		12.2±4.01		0.10	1.19±2.53	0.61±1.95	0.63
Minerals								
Sodium (mg)	2,781±927		3,270±915		0.32	322±488	583±768	0.44
Potassium (mg)	309±689		3,913±665		0.04*	261±435	1,139±815	0.02*
Magnesium (mg)	253±74.1		366±92.2		0.02*	5.94±53.3	112±110	0.03*
Calcium (mg)	865±257		1,347±644		0.10	108±161	674±480	0.02*
Phosphorus (mg)	115±270		1,640±450		0.03*	100±187	628±410	<0.01*
Iron (mg)	13.9±3.95		15.6±4.34		0.45	1.76±1.92	3.27±3.97	0.36
Zinc (mg)	7.69±3.44		14.6±4.42		<0.01*	−0.83±3.50	5.93±4.65	<0.01*
Vitamins								
Vitamin B-1 (mg)	1.54±0.40		1.92±0.68		0.20	38.1±53.7	38.4±62.1	0.99
Vitamin B-2 (mg)	1.78±0.56		3.00±1.22		0.02*	0.71±1.93	6.48±3.97	<0.01*
Vitamin B-3 (NE[c])	22.2±8.01		36.2±10.9		0.01*	0.12±0.27	0.48±0.73	0.26
Vitamin B-12 (μg)	2.8±1.53		6.12±1.82		<0.01*	0.99±3.80	11.7±12.4	0.06
Vitamin C (mg)	182±76.1		175±44.4		0.82	0.06±0.46	0.84±1.03	0.07
Vitamin D (μg)	5.19±2.01		10.1±5.35		0.05*	0.28±0.77	2.98±2.37	0.02*

[a]Loss of one subject in each group due to death.
[b]SD=standard deviation.
[c]NE=niacin equivalents.
*$P<0.05$.

21 minutes to 33 minutes. There were no statistical differences in times to complete the meals between the two groups.

DISCUSSION

This study is the first to compare nutrient intake and weight of institutionalized elderly persons with dysphagia receiving a traditional modified-texture diet and a dysphagia-specific nutrition care program. This investigation included elders with dysphagia requiring minced foods as well as subjects in need of pureed foods, and differs from one previous study in that those only requiring pureed foods were included (28).

Undernutrition in the institutionalized elderly population has been widely reported (29,30) with prevalence rates between 10% and 60% in nursing homes and hospitals (3,6-8). The results of the Marie-Rollet Center Study concur with these findings with 39 of the 93 (41.9%) elders having a low BMI (<24) or losing weight (>7.5% in 3 months). In agreement with prevalence rates found in previous surveys (1,31), 43.5% of those at risk had dysphagia (17 of the 39 potential undernourished subjects), according to the bedside Rehabilitation Institute of Chicago Clinical Evaluation of dysphagia. This high prevalence rate confirms that a recent important weight loss and low BMI are good predictors of dysphagia in this population.

The two groups studied at the Marie-Rollet Center study presented mean weights of 54.3±7.49 kg and 55.9±12.1 kg for the control group and the treated group, respectively, at baseline whereas the mean BMI values were 21.2±2.31 and 22.4±3.93, respectively. Recent data provided by the Canadian Study of Health and Aging (32) indicate the mean weight for institutionalized elders is 59.1±13.8 kg and the mean BMI is

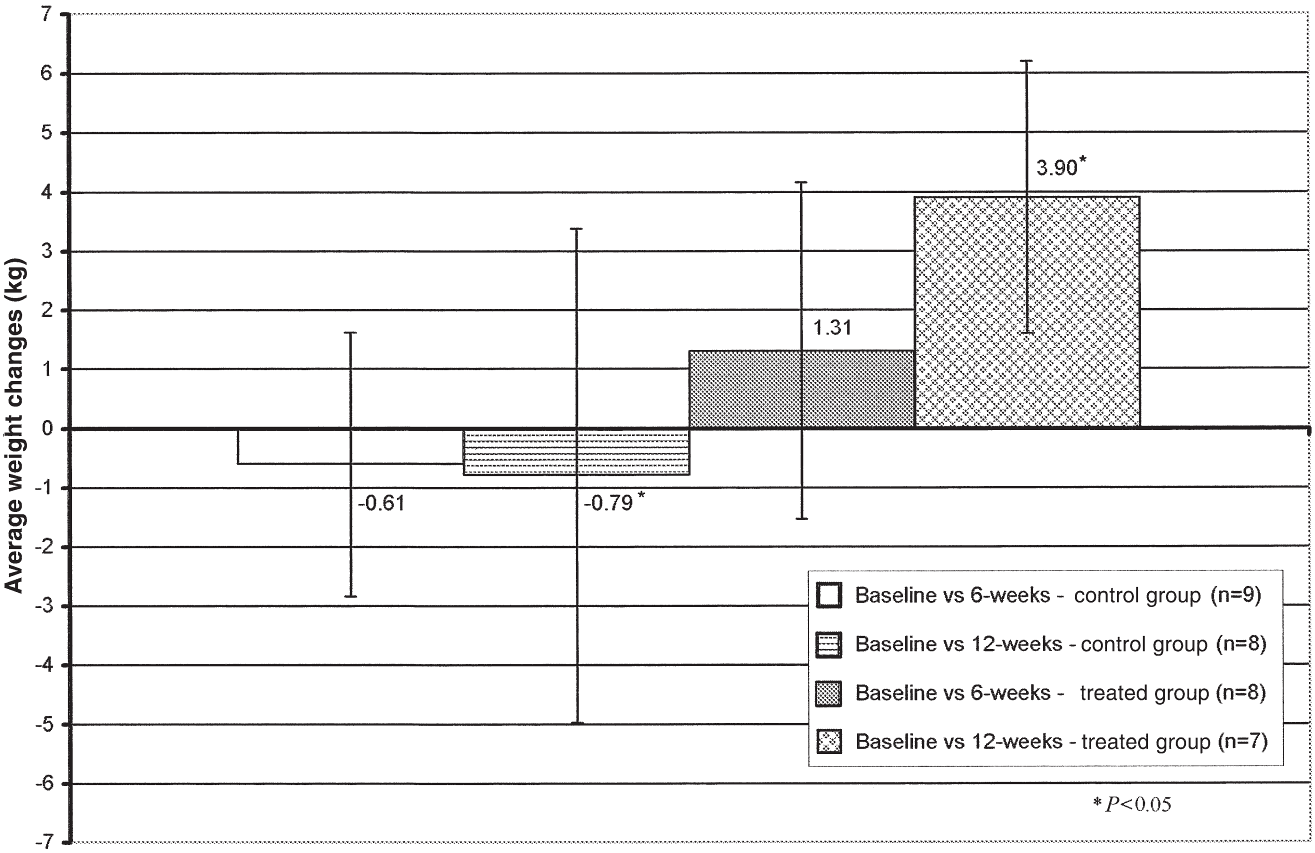

Figure 3. Average weight changes during the 12-week protocol assessing the effects of Sainte-Anne's Hospital Advanced Dysphagia Nutritional Care program on dietary intake and weights among institutionalized elderly persons with dysphagia.

23.3±5.0, indicating that the particular group studied had low body weights.

This study provides a nutritional profile of institutionalized elders with dysphagia. At baseline, total energy intake for either group was less than 1,566±323 kcal/day with a mean intake of protein of approximately 55 g/day. Similar findings were obtained in other studies (33-35) evaluating geriatric subjects and, although dysphagia had not been specifically addressed, they demonstrated that low energy and/or protein intake were associated with institutionalization and decreased rate of survival. The Nutrition Recommendations of Health Canada (36) for the energy intake of healthy individuals presenting a low activity level, in the age group of 75 and older, is of 1,700 kcal for women and 2,000 kcal for men. Both group averages were well below the recommended values.

Adequate protein intake is known to be important in maintaining the integrity of the immune system and in preventing or improving skin damage such as pressure ulcers (21,37,38). The baseline evaluations of the dietary intakes show that the treated group received a daily average of 52.5±14.6 g protein (0.97 g/kg/day) and that the control group consumed 56.0±16.8 g protein (1.00 g/kg/day). It has been suggested that protein intake should be increased with age to a 1.0 to 1.3 g/kg daily (39). The subjects we studied seem to be reaching the lower limit of these recommendations.

Sainte-Anne's Hospital's nutritional approach in the treatment of dysphagia brought a 44% increase in total energy intake where protein increased by 54%, carbohydrates by 28%, and lipids by 47% after 12 weeks of intervention. The treated subjects who received Sainte-Anne's Hospital's dysphagia-specific nutrition care, including the reformed foods and thickened beverages, for 12 weeks had a daily increase of 611±408 kcal at 12 weeks. The dietary intake increase was confirmed by an increase in weight in the treated group. This resulted in a statistically significant weight gain of 3.9 kg±2.3 kg at the final evaluation and a mean BMI of 24.5±4.14 was reached by the end of the 12th week for the treated group. An increase of more than 500 kcal/day is believed to generate an increase of 450 g fat per week (40). Theoretically, an intervention of 12 weeks would have potentially increased the weight of the experimental group by 5.4 kg. The increase in total energy obtained in the treated group was not achieved at the expense of a longer feeding time but was probably due to a diet better adapted to residents' tastes, capacity to swallow, and energy density of the food consumed.

The dietary intake results obtained for the Marie-Rollet Center study were calculated using differential weight measures (ie, weight of food items remaining on the tray deducted from the weight of food items initially served) and ensured a good quantification of the food ingested. This method is believed to be more time consuming and expensive (34); however, precision is an important factor when evaluating change in nutrient intake in a small sample. Sainte-Anne's Hospital's Advanced Nutritional Care program is also based on a more varied approach. The menu provided respected the original menu prepared by the Marie-Rollet Center but allowed for a wider selection of items every day on the à la carte menu. Dietary variety has been associated with nutritional status in the elderly institutionalized population (41). Elderly individuals with dysphagia might be expected to benefit from the same variety.

Furthermore, the pleasant appearance and flavor of the modified texture foods (reformed or traditional) has been stated as important for food intake (20,28,42,43). This particular aspect of the Sainte-Anne's Hospital's Advanced Nutritional Care program could not be completely evaluated by the subjects due to the level of cognitive impairment of the studied population. Nevertheless, the reformed foods seemed to have a positive effect on feeding personnel. Nurses and orderlies appreciated being able to recognize the foods they were serving and the positive comments might have reflected a preference for the feeder to give the entire serving, which supports the increased intake. This contradicts a previous study that attempted to evaluate the appreciation of reformed fruits (44) and found a lower rating of the molded fruits when compared with conventional pureed products.

LIMITATIONS

Results of this study cannot be generalized to all institutionalized elderly with dysphagia populations due to the small sample size and the well-known heterogeneity of this population. Most of our study subjects had some cognitive decline and could not give us their subjective ratings of the foods. It was not possible to conduct the study at Sainte-Anne's Hospital because these foods are routinely offered. Anecdotally, they are very much appreciated by those requiring texture-modified foods. Despite a significant change in weight from baseline to 12 weeks in the treated group compared with the change in weight in the untreated group, the final average weights were not statistically different owing to the high variability between subjects and the small sample size. Future studies should consider enrolling a larger number of individuals to gather subjective information on appreciation and evaluate overall health status via certain parameters, such as development of pressure ulcers, infections, or changes in medications.

CONCLUSIONS

After a thorough bedside evaluation, Sainte-Anne's Hospital Advanced Dysphagia Nutritional Care program—including reformed minced and pureed foods and consistency-controlled thickened beverages—showed a statistically significant change in mean dietary intake in a group of treated individuals compared with controls receiving traditional institutional modified-texture foods. As a result, weight was significantly increased in the treated subjects. Therefore, it is possible to reach adequate nutrient intake via the oral route when the clientele is adequately screened for dysphagia and when the food provided is well adapted to the patient's residual physical capacity, resulting in a healthful weight status in institutionalized elders with dysphagia. It is crucial that we find nutritive, varied, and appealing dietary solutions for elderly patients with dysphagia.

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