THE DEVELOPMENT AND EVALUATION OF THREE PREVENTIVE DENTAL HEALTH EDUCATIONAL PROGRAMMES, UTILIZING DIFFERENT RESOURCE MATERIALS, DESIGNED TO IMPROVE THE SNACK HABITS AND NUTRITION AND DENTAL HEALTH KNOWLEDGE OF GRADE 5 SCHOOL CHILDREN

by

HELEN IRENE HALE

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES

IN PARTIAL FULFILLMENT

OF THE REQUIREMENTS FOR THE DEGREE

OF MASTER OF SCIENCE

DEPARTMENT OF FOODS AND NUTRITION

UNIVERSITY OF MANITOBA

WINNIPEG, MANITOBA

SEPTEMBER, 1977

THE DEVELOPMENT AND EVALUATION OF THREE PREVENTIVE DENTAL HEALTH EDUCATIONAL PROGRAMMES, UTILIZING DIFFERENT RESOURCE MATERIALS, DESIGNED TO IMPROVE THE SNACK HABITS AND NUTRITION AND DENTAL HEALTH KNOWLEDGE OF GRADE 5 SCHOOL CHILDREN

BY

HELEN IRENE HALE

A dissertation submitted to the Faculty of Graduate Studies of the University of Manitoba in partial fulfillment of the requirements of the degree of

MASTER OF SCIENCE

ABSTRACT

THE DEVELOPMENT AND EVALUATION OF THREE PREVENTIVE DENTAL HEALTH EDUCATIONAL PROGRAMMES, UTILIZING DIFFERENT RESOURCE MATERIALS, DESIGNED TO IMPROVE THE SNACK HABITS AND NUTRITION AND DENTAL HEALTH KNOWLEDGE OF GRADE 5 SCHOOL CHILDREN

Three nutrition and dental health educational programmes were developed with the purpose of evaluating the effectiveness of several resource materials in changing the behaviour of grade 5 children. The objectives of the educational programmes were to: (1) improve knowledge about nutrition and dental health, (2) increase or maintain the consumption of nutritionally and/or dentally acceptable snack foods, (3) decrease the frequency of sucrose-snack consumption between meals, and (4) increase or maintain the selection of nutritionally and/or dentally acceptable snack foods. Grade 5 teachers in Portage la Prairie were trained at a workshop to teach one of the three programmes. The NuDent Programme used resources which actively involved the students (puppets, comic/activity books), the Muncher Programme used a resource which relied on passive involvement (film) and the Basic Programme did not include resource materials. The three educational groups were compared with a Control Group which did not receive any programme. The effectiveness of the programmes/resources were evaluated with a nutrition and dental health knowledge test, a three-day food record and a simulated snack selection activity. Students who participated in an educational programme significantly improved nutrition and dental health knowledge but did not dramatically improve the quality of the snack foods they consumed and did not significantly improve the quality of the snack foods selected in the simulated activity. However, the frequency with which sucrose-snacks were consumed between meals was significantly decreased. The NuDent Programme appeared to be the most effective programme in improving knowledge and was the only programme which had a significant positive effect on the consumption of nutritionally and dentally acceptable snack foods. The success of the NuDent Programme was attributed to the preventive effect it had on those students who already had good snack habits. It was concluded that participation in a nutrition and dental health programme improved knowledge and decreased the frequency with which children consumed sucrose-snacks between meals. Furthermore, improvement in knowledge and maintenance of positive snack food consumption behaviour appeared to be related to the degree with which the resource materials actively involved the children in the programme.

ACKNOWLEDGEMENTS

The author wishes to thank all those who helped during the course of the study for their assistance, direction and encouragement, especially Professor M. Campbell, Department of Foods and Nutrition, Professor R. Diamant, Department of Foods and Nutrition, Dr. D. Berg, Department of Family Studies, Dr. V. Bruce, Department of Foods and Nutrition and Dr. K. Mount, Department of Statistics.

Sincere appreciation is also extended to Marguerite Molgat, Judy Sinclair, Lesley Hancock, Diane Michaels, Pat McCarthy, Judy Beaudry and Marsha Morris who assisted in collecting the dietary data, and to Mr. V. E. Holmes, Superintendent of Portage la Prairie School Division No. 24, the principals, teachers and students whose co-operation made this study possible.

Special thanks are expressed to the Home Economics Directorate, Manitoba Department of Health and Social Development, for financial assistance of this project and to the National Research Council who awarded the author a post-graduate scholarship.

The author also wishes to thank her parents for their support and encouragement throughout her university years.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

I. INTRODUCTION

Evaluation is very important in the teaching-learning process in order to assess whether the primary goal of education, that is behavioural change in the "desired directions", has been achieved. Unfortunately, evaluation of the effectiveness of school health programmes is probably one of the most neglected activities in the practice of public health (1,2,3). Many programmes are initiated and continued for years without a critical analysis of effectiveness.

McKenzie and Mumford (4) contend that much of what has been published concerning nutrition education consists of experiments which have been poorly designed and poorly evaluated. Firstly, many studies which report positive results are based on subjective assessments where researchers reported the instructors' impressions of the learning situation. Secondly many of the studies that deal with nutrition teaching of children in schools are evaluated for the immediate results and not for long term effectiveness of change in food habits. Thirdly, there is frequently a lack of adequate control groups, making it difficult to separate the influence of education from that of other environmental factors. Furthermore, Guba (5) maintains that a sign of failure of evaluation is the fact that it is so often incapable of uncovering any significant information. Over and over comparative studies of alternatives in education have ended in a finding of "no significant difference". If proper experimental procedures are followed, it is the contention of this author that "no finding" is a "finding", that is, that there really is no difference.

There could be many reasons for the limited extent of evaluation in nutrition education. One factor may be that most people associated

with nutrition projects usually feel that what they are doing is worthwhile, that the value is clear to all observers, and that the best has been accomplished with the resources at hand (2). Perhaps equally important is the fact that evaluation comes at the end of a programme and unfortunately many programmes never succeed in reaching completion (4). Another likely factor is that evaluation is difficult. A specialized staff is constantly required (2), considerable time is needed (4) and above all, nutritionists are not familiar with accepted varified procedures of evaluation (3). Guba (5) asserts that the blame should not fall entirely on the shoulders of educators since there is a need for professional evaluators to develop a technology of evaluation which practitioners would find operational.

In any educational programme, there are many factors which could be evaluated such as the rapport of the teacher, different teaching techniques and various resource materials. The factor evaluated in this research project was the resource material used in the educational programme.

It is important to evaluate the effectiveness of resource materials not only to improve their quality but also to determine whether the objectives for which they are being used are being fulfilled in the first place. In 1950, Ritchie (6) stated that little systematic work on this subject had been carried out. A review of the current literature indicates that there is still a lack of objective evaluation of teaching aids and educational resources. Such titles as "Puppets are Effective Teachers" (7), "Live Action Drama Teaches Nutrition" (8), and "Comic Book Approach Helps Teach Pupils to Think" (9), are typical of what is in the literature--creative ideas with subjective evaluations. The

question left unanswered is always--"Does the educational resource work?" The comments of Ritchie (6) on evaluation are pertinent to this thesis:

> "In a program of education in nutrition, efforts should be made to assess the results and the effectiveness of methods and teaching materials. The basic criteria are action and changes in behaviour which should be the real aim of any nutrition program..... Commerical companies can evaluate their advertising materials by the effects on sales, but teaching materials do not ring a cash register. To make a really scientific comparison between samples, a specific experiment or series of controlled observations is needed which measures the effects of the different materials on groups of people when all other factors are identical."

Therefore, the purpose of this study was to develop and evaluate several educational programmes, each of which utilizes different resource materials. The focus of the programmes was on the prevention of dental caries through dietary modification.

Dental health education is necessary since dental caries is a major public health problem. It has been estimated that approximately 98% of the population suffers from this disease (10). The problem is magnified by the irreversible and irreparable nature of the carious lesion which limits treatment to the removal of damaged tissue and replacement with metallic, ceramic or plastic substitutes. Furthermore, no other physical condition can profit so directly from preventive behaviour as can dental health (11).

Dental health education should start at an early age since the average child, in the United States, starts school with at least 3 decayed primary teeth (12). With development of permanent dentition, decay attacks the teeth at the rate of about one tooth per year. By age 20, the average young adult has 24 decayed, missing or filled teeth (12). While neglect of diet and oral hygiene during early years takes

a heavy toll in tooth decay, it also sets the stage for an even higher toll from periodontal disease in adulthood. This illustrates vividly the need for effective education of children in methods of preventing decay and gum disease. Since the average dentist and hygienist see a limited number of patients twice a year, the elementary school system is the likely setting for a comprehensive nutrition and dental health educational programme (13).

Dietary modification, as opposed to other approaches to dental caries prevention, was the focus of the educational programmes because this approach has not been exploited by health educators. According to Blinkhorn (14) "an apple a day keeps the dentist away" propaganda should make way for a more scientifically orientated set of simple preventive dietary procedures. In the present study, the educational programmes aimed to decrease the frequency of sucrose-snack food consumption and increase or maintain the consumption of nutritious, non-cariogenic snack foods among grade 5 children. The educational programmes also aimed to improve the students' knowledge about nutrition and dental health.

Active interest in this research was stimulated by the Home Economics Directorate, Manitoba Department of Health and Social Development who employed the author during the summer of 1975 to develop educational resources on the subject of nutrition and dental health for elementary school children. Both the Home Economics Directorate and the author were keenly interested in determining the effectiveness of these resources in changing behaviour.

II. REVIEW OF LITERATURE

A. DIET AND DENTAL CARIES

1. Etiology of Dental Caries

Dental caries, by definition, is a localized progressive process involving the loss of tooth structures such as the enamel, dentin and sometimes cementum (15). The most widely accepted theoretical cause of this process is that bacterial enzymes within the dental plaque ferment dietary carbohydrate which results in the production of organic acids; the organic acids diffuse out of the plaque, attack the enamel tooth surface and initiate demineralization of the hydroxyapatite. This is followed by dissolution of the enamel protein. The cariogenic bacteria then have access to the organic matrix of the dentin and cause its proteolytic degradation; the result is tooth cavitation (16,17,18).

Thus dental caries is fundamentally a dietobacterial disease in which there is an interplay of four principal factors, namely the host (particularly the teeth and saliva), the agent (dental plaque), the substrate (diet) and time (18,19,20). For caries to occur, conditions in each factor must be favourable. In other words, caries requires a susceptible host, a cariogenic flora and a suitable substrate which must be present for a sufficient length of time (20).

The logical approach to caries prevention, therefore, is based upon attempts to 1.) reduce the susceptibility of the tooth to decay through fluoridation of drinking water (21) and more recently by the application of occlusal sealants (22,23), 2.) lower the number of micro-

organisms in contact with the tooth by brushing and flossing (plaque control) (24), 3.) modify the substrate by selecting noncariogenic foodstuffs (19) and 4.) reduce the time the substrate is available in the mouth by limiting the frequency of intake (19). A comprehensive preventive programme should give equal weight to all factors since a hierarchy of importance has never been established. Points #1 and #2 are the realm of the dentist and dental hygienist and points #3 and #4 are the realm of the nutritionist. Having recognized the multifactorial nature of dental caries and that prevention requires a health team approach, this discussion will focus on the dietary component of the disease, culminating in dietary recommendations for prevention on the basis of the research cited.

An abundance of epidemiological and experimental evidence indicates that sucrose is a particularly cariogenic substrate. Evidence for the intimate relationship between sucrose ingestion and dental caries will be discussed under 4 categories:

- Epidemiological surveys of caries prevalence and human diets
- Industrial and consumer use of sucrose
- Studies on humans
- Experimental caries in animals

2. Epidemiological Surveys of Caries Prevalence and Human Diets

Circumstantial evidence linking sucrose consumption and human caries prevalence can be found in several epidemiological surveys. During the 1939-1945 war there was in many European countries, an

enforced change in dietary pattern (18). In general, the total consumption of carbohydrates was altered little but there was a marked reduction in the consumption of sucrose, sweets and manufactured confectionery. In the United Kingdom, these changes were accompanied by a decrease in dental caries experience in young children that continued until the rationing of sugar was eased and finally abolished (25). There was then a greater caries experience in children of the same age as those studied during the war (26). Similar findings were reported from Scandinavia (27) and Japan (28). The most likely reason, and the only common factors in all these studies, was the obligatory reduction in the consumption of easily fermentable carbohydrate, especially in the amount available for eating between meals (29).

Other indirect evidence associating dietary factors with caries experience has come from the study of primitive peoples. Dramatic increases in caries activity have been noted in the Bantus, Eskimos and Maoris when they adopted a "civilized" diet, the major change being an increased sugar consumption (30).

3. Industrial and Consumer Use of Sucrose

There is evidence that the incidence of caries has increased over the past 25 years (31). Surprisingly, there has been no significant change in per capita consumption of refined sugar by Canadians over the past 25 years (TABLE 1). Similarly, in the United States, there has been no appreciable change in per capita sugar consumption during the past 50 years (TABLE 2). However, today the bulk of sugar is used in manufactured foods instead of being used in the home (31,34). Sugar is used in a wide variety of foods, but the amount that is added to carbon-

TABLE 1

Pounds Per Capita Domestic Disappearance of Sugar in Canada, 1948-1973

	AVERAGE OF 5-YEAR PERIODS					
	(1) 1948-1953	(2) 1954-1958	(3) 1959-1963	(4) 1964-1968	(5) 1969-1973	% CHANGE PERIOD (1) TO PERIOD (5)
TOTAL SUGAR	98.63[a]	94.69	91.54	99.55	100.39	1.8%

a average of 6 year period

Statistics Canada, 1976 (32)

TABLE 2

Pounds Per Capita Consumption of Sugar-Containing Foods and Total Sugar in the United States, 1925-1971

	AVERAGE OF 5-YEAR PERIODS					
	(1) 1925-1929	(2) 1935-1939	(3) 1947-1949	(4) 1957-1959	(5) 1971[a]	% CHANGE PERIOD (1) TO PERIOD (5)
Confectionery	8.0	8.2	9.8	9.4	11.0	37.0%
Cereal & Bakery	7.7	9.7	12.9	15.4	17.6	130.0%
Processed Vegetables	4.6	4.4	9.0	9.8	10.4	126.0%
Dairy Products	2.3	2.4	4.6	4.9	5.8	152.0%
Beverages	5.0	5.2	10.6	12.6	22.8	356.0%
Total Processed	28.4	31.1	48.4	50.0	70.2	105.0%
Total Sucrose	100.0	97.1	94.8	95.4	101.5	1.5%

a Data for only 1971

Page, L. and Friend, B., 1972 (33)

ated beverages and snack foods has increased most rapidly (33). Furthermore, Canadians today rely to a far greater extent on ready-to-eat snack foods than did their ancestors several decades ago. The soft-drink market is perhaps the most obvious manifestation of this shift (Figure 1). According to Bibby (31) the increased use of snack foods can contribute to increased caries in two ways. Firstly, the manufacturing and refining processes result in foods which are more cariogenic in form. Secondly, the easy availability and variety of snack foods, along with other social influences, have given rise to habits of more frequent eating of sucrose-foods that contributes to caries. Furthermore, as indicated in TABLE 3, sugar-containing foods are used less frequently with meals when they would be least destructive and more frequently as snacks when they would be most damaging. Therefore, it seems likely that, in the light of today's food habits, the time and form in which sugar is used is more important than the amount eaten.

4. Studies on Humans

A number of studies have been done comparing the frequency and amount of sugar eaten with persons whose carious state is known (37-45). These studies vary in their method of dietary collection as well as what they consider to be high and low caries occurence. However, the investigators all conclude that the frequency of eating sucrose-containing foods is causally related to caries.

An example of this type of investigation was that of Duany et al. (37) who analyzed the dietary patterns of 46 caries-free and 40 caries-active students aged 12-14 years by means of a dietary history. Each student was given a weighted dietary score based on the frequency with

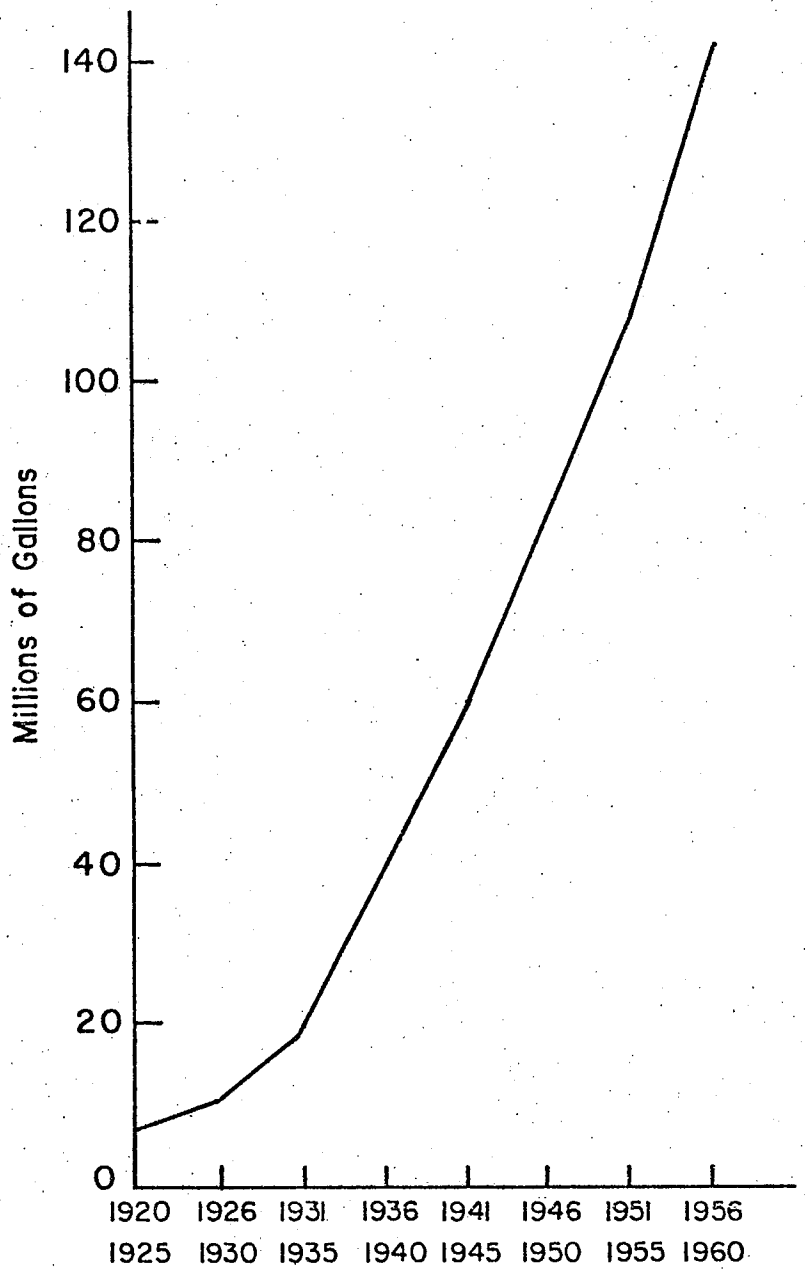

Figure 1 Physical Output of Carbonated Beverages, 1920-1960, Canada

Urquhart, M.C. and Buckley, K.A.H., 1965 (35)

TABLE 3

Changes in Per Capita Servings of Sweet (Dessert) Foods in 4,000 Homes, 1963-1968

FOOD	TOTAL %	DESSERT %	SNACK %
Soft drinks	+32.5	+114.3	+26.3
Cakes	- 9.8	- 32.8	+70.4
Cookies	-11.9	- 42.6	+39.9
Fruit	-10.9	- 38.5	+56.1
Snacks (Chips & so forth)	+28.1	+ 1.0	+63.2
Candy (Chocolate)	+29.2	- 37.2	+46.5
Other candy	+41.0	- 8.3	+48.0

U.S. Department of Commerce, 1969 (36)