

بسم الله الرحمن الرحيم

**Sudan University of Science and Technology
College of Graduate Studies**

**Assessment of the Nutritional and Health
Status of Basic School Children
In Khartoum State**

A

Thesis Submitted to Sudan University of Science and Technology in

Fulfillment for the Requirements of the Degree of PhD

(In Community Nutrition)

By

FATIMA OMER NABAG

Supervised by

Prof. OMER AHMED DAFALLA DIAB

Co-supervised by

Dr. YOUSIF MOHAMMED AHMED

APRIL 2006

CONTENTS

	Page No.
DEDICATION	vi
ACKNOWLEDGEMENTS	vii
LIST OF TABLES	viii
LIST OF FIGURES	xi
ABSTRACT	xiii
ABSTRACT IN ARABIC	xv
 CHAPTER I: INTRODUCTION	
1.1 Concept of the study	1
1.2 Statement of the problem	1
1.3 Significance of the Study	3
1.4 Objectives of the study	3
1.5 Questions to be answered by the study	4
1.6 Assumptions of the study	4
1.7 Limitations of the study	4
 CHAPTER II: REVIEW OF LITERATURE	
2.1 The balanced diet	5

2.1.1 Water	5
2.1.2 Proteins	5
2.1.3 Fats and lipids	6
2.1.4 Carbohydrates	6
2.1.5 Vitamins	7
2.1.6 Minerals and Micro elements	7
2.2 Nutritional needs of School Children	8
2.3 Nutritional status	11
2.4 Factors affecting health and nutritional status	11
2.4.1 Individuals	11
2.4.2 The households	12
2.4.3 Community	12
2.4.4 Family planning	12
2.4.5 Birth order	13
2.4.6 Age of child	13
2.4.7 Food habits and dietary practice	13
	Page No.
2.4.8 Source of water and availability of toilet facility	14
2.4.9 Employment status of parents	15
2.4.10 Educational status	15
2.4.11 Infectious diseases of the child	16
2.4.12 Poverty	17
2.4.13 Urbanization	17
2.5 Assessment of nutritional status	17
2.5.1 Clinical examinations	18
2.5.2 Anthropometric data	19
2.5.2.1 Weight	20
2.5.2.2 Weight-for-age (W/A)	20
2.5.2.3 Height	20
2.5.2.4 Height-for-age (H/A)	21
2.5.2.5 Weight-for-height (W/H)	21
2.5.2.6 Mid-upper-arm circumference (MUAC)	22
2.5.2.7 Skin fold thickness (SFT)	22
2.5.3 Biochemical (laboratory) tests	23
2.5.4 Dietary surveys	23

2.5.4.1 Weighing method of observation	23
2.5.4.2 Food record or inquiry or recall method	23
2.5.4.2.1 24-hour recall method	24
2.5.4.2.2 Food frequency questionnaire	24
2.5.5 Vital statistics	25
2.6 Studies in Sudan	25

CHAPTER III: MATERIALS AND METHODS

3.1 The sample design	31
3.2 The sampling procedure	31
3.2.1 Sample size determination	33
3.3 Procedures of the study	34
3.4 Data collection	34
3.4.1 Questionnaires data	34

Page No.

3.4.2 Nutritional status assessment	35
3.4.2.1 Weight	35
3.4.2.2 Height	35
3.4.2.3 Skin-fold thickness	35
3.5 Body mass index	36
3.6 Dietary assessment	36
3.7 Data analysis	36
3.7.1 z-scores	37

CHAPTER IV: RESULTS AND DISCUSSION

4.1 Nutritional status of the School Children	38
---	----

4.1.1	Weight for age	40
4.1.2	Height for age	43
4.1.3	Weight for height	48
4.1.4	Body mass index	52
4.1.5	Skin folds thickness triceps	61
4.1.6	Nutritional status of School Children according to sex	64
4.1.7	Nutritional status of School Children according to places of the study	74
4.2	Factors influencing the nutritional status of School Children (socioeconomic factors)	74
4.2.1	Educational level of parents	74
4.2.2	Parent's occupation	77
4.2.3	Household properties	81
4.2.4	Family size	85
4.3	Physical activities	85
4.4	Health	88
4.5	School Children food intake	91
4.5.1	The 3 meals intake	94
4.5.2	Dietary intake (food groups)	97

Page No.

CHAPTER V: CONCLUSIONS AND RECOMMENDATIONS

5.1	Conclusion	101
5.2	Recommendations	102
	REFERENCES	103
	APPENDICES	115

DEDICATION

To the soul of my father.

To my mother, brothers and sisters.

**To my small family (husband and
daughters)**

To my friends.

I owe this success.

Acknowledgments

I wish to express my gratitude to professor Omer Ahmed Dafallah and associated Professor Dr Yousif Mohamed Ahmed for their guidance, help and support throughout the course of this study and the time they devoted as supervisor and co-supervisor was in valuable.

My gratitude to the children of the basic schools in Khartoum towns (Omdurman, Khartoum and Khartoum North) who participate in the study.

My thanks are expected to the Nutrition Departments, Khartoum State Ministry of Health and the WHO office for their assistance in providing the references used in this study.

My thanks are extended to the university staff and all Departmentents that offered continuous help and assistance during the work.

My great thanks to Dr Mofida Yousif Elkalifa for their guidance and help during the work.

My thanks to Mr.Adil Issa for his help in statistical analysis of the data, gratitude to Mr.Salah Osman for typing this this manscript .

LIST OF TABLES

Table	Page No.
2.1: The weight and recommended daily intake of children	10
3.1: The number of School Children in Khartoum State	31
3.2: Number of School Children in Khartoum State according to the study area	32
3.3: Number of School Children in Khartoum State according to the type of schools	32
4.1: Distribution of students according to age and sex	39
4.2: Nutritional status of School Children based on W/A according to sex and location of school	41
4.3: Nutritional status of School Children based on W/A according to sex and type of school	42
4.4: Nutritional status of School Children based on W/A according to sex and location of school	46
4.5: Nutritional status of School Children based on H/A according to sex and types of school	47
4.6: Nutritional status of School Children based on W/H according to sex and location of school	51

4.7: Nutritional status of School Children based on W/H according to sex and type of school	53
4.8: Nutritional status of School Children based on BMI according to sex and location of school	56
4.9: Nutritional status of School Children based on BMI according to sex and type of school	58
4.10: Nutritional status of School Children based on triceps according to sex and location of school	62
Table	Page No.
4.11: Nutritional status of School Children based on triceps according to sex and type of school	63
4.12: Nutritional status of School Children based on W/A according to sex	67
4.13: Nutritional status of School Children based on H/A according to sex	67
4.14: Nutritional status of School Children based on W/H according to sex	69
4.15: Nutritional status of School Children based on BMI according to sex	70
4.16: Nutritional status of School Children based on skin fold thickness triceps according to sex	71
4.17: Nutritional status of School Children based on W/A according to sex and place of the study	75
4.18: Nutritional status of School Children based on H/A according to sex and place of the study	76
4.19: Distribution of School Children by parents' socio-economic status	78
4.20: Distribution of School Children by their family living conditions	82

4.21: Distribution of School Children by the type of activity they usually performs	87
4.22: Distribution of School Children families by domestic animals owned by the household	89
4.23: Distribution of School Children families according to the purposes of domestic animals	90
4.24: Distribution of School Children according to the type of diseases	92
Table	Page No.
4.25: Distribution of School Children according to the duration of diseases	93
4.26: Distribution of School Children by their meal intake	95
4.27: Distribution of School Children according to the number of daily meals	96
4.28: The resource of School Children breakfast	96
4.29: Dietary intake of School Children	98

LIST OF FIGURES

Figure	Page No.
1: Median rural and urban weight of School boys	

	compared to WHO reference	44
2:	Median rural and urban weight of school girls compared to WHO reference	44
3:	Median weight of governmental and private School boys compared to WHO reference	45
4:	Median weight of governmental and private school girls compared to WHO reference	45
5:	Median height for rural and urban School boys compared to WHO reference	49
6:	Median height for rural and urban school girls compared to WHO reference	49
7:	Median height for governmental and private School boys compared to WHO reference	50
8:	Median height for governmental and private school girls compared to WHO reference	50
9:	Median W/H of rural and urban School boy children compared to WHO reference	54
10:	Median W/H of rural and urban school girls children compared to WHO reference	54
11:	Median W/H of governmental and private School boys children compared to WHO reference	55
12:	Median W/H of governmental and private school girls children compared to WHO reference	55
13:	Median BMI of rural and urban School boys children compared to WHO reference	59
Figure		Page No.
14:	Median BMI of rural and urban school girls children compared to WHO reference	59
15:	Median BMI of governmental and private School boys children compared to WHO reference	60

16:	Median BMI of governmental and private school girls children compared to WHO reference	60
17:	Median triceps of rural and urban School boys children compared to WHO reference	65
18:	Median triceps of rural and urban School boys girls compared to WHO reference	65
19:	Median triceps of governmental and private School boys children compared to WHO reference	66
20:	Median triceps of governmental and private school girls children compared to WHO reference	66
21:	Median weight of School boys compared to WHO reference	71
22:	Median weight of school girls compared to WHO reference	71
23:	Median height of School boys compared to WHO reference	72
24:	Median height of school girls compared to WHO reference	72

ABSTARCT

The main objective of the study is to provide information on the nutritional status (N.S) [weight, height, skin fold thickness triceps (SKFT), body mass index (BMI) and food intake] and 15-to 15-yaers-old basic School Children in Khartoum State, Sudan, and to compare it with standards of the WHO-NCHS references. The determinant and their nutritional status including: socioeconomic, physical activities and heath status, in addition to some demographic factors. A total of 725 children were examined.

The results showed that the nutritional status of rural School Children is significantly different ($P \leq 0.05$) of underweight ($< -1SD$ W/A), stunting ($< -1SD$ H/A) and thickness ($SKFTC < 5^{th}$ percentile) from that of urban School Children. The prevalence of obesity ($BMW > 85^{th}$ percentile) among boys was higher in private schools than in governmental schools (50% for private schools and 6.5% for governmental schools), whereas, among girls there was no significant difference ($P \leq 0.05$) 16.7% for private schools and 6.5% for governmental schools. In general, the nutritional status of school girls was better than that of School boys. The prevalence of underweight and stunting between both sexes were more obvious in Khartoum North, Omdurman and Khartoum respectively, only significant differences ($P \leq 0.05$) were observed between School boys. The study demonstrates that the median weight and heights at age 5-to 10-years of both sexes of School Children were equal to or greater than the WHO-NCHS references, but they were far below the WHO-NCHS references at age 11-to 15 years of both sexes.

The study revealed that the most important determinants of the children nutritional status were the children parents' education, father profession, income, living condition, family size and physical activities. The distribution of the diseases specially respiratory infections and malaria were presents in significantly higher percentage in rural School Children (63% and 36.1%, respectively) compared to urban (29.7% and 18.2%, respectively) and private (25% and 10.3%, respectively) schools children.

Skipping of breakfast meal was common among rural School Children (18.5%) than urban (16.5%) and private (5.2%). The higher percentages of School Children who take three meals daily were present at private (82.3%) compared to urban (78.5%) and rural (74.1%) schools children. The study also showed that there was significant difference

($P \leq 0.05$) between governmental and private School Children in dietary intake of all of food groups (carbohydrates, legumes, vegetables, milk and milk products and eggs, fruits and fruit juices and beverages), meanwhile only significant differences ($P \leq 0.05$) between urban and rural School Children in dietary intake of carbohydrates and legumes were observed.

بسم الله الرحمن الرحيم

ملخص الأطروحة

هذه الدراسة تصف الحالة التغذوية (الوزن/الطول/سمك الجلد للعضلة ذات الثلاث رؤوس، كتلة الجسم و الغذاء المتناول) للتلاميذ السودانيين (5-15 سنة) فى مدارس الأساس بولاية الخرطوم وإختبار العوامل المحددة لحالتهم التغذوية وهذه تشمل الحالة الإجتماعية والإقتصادية والنشاطات البدنية والحالة الصحية. شملت الدراسة 725 تلميذاً (من الجنسين) وتم جمع المعلومات عن طريق الإستبيان، وأخذت القياسات الجسمية وتمت المقارنة مع WHO-NCHS م قارنتها مع مرجع التغذية

أظهرت نتائج هذه الدراسة أن حالات سوء التغذية أظهرت إختلافاً وسمك الجلد ($<ISD H/A$) والطول ($<ISD W/A$) معونياً بالنسبة للوزن بين طلاب الريف م مقارنةً بطلاب الحضر، كما وجد (**Skin fold thickness**) أن ظاهرة السمنة منتشرة بنسبة عالية بين طلاب المدارس الخاصة عنها بين طلاب المدارس الحكومية (50% لطلاب المدارس الخاصة، 6.5% لطلاب بين الطالبات ($P \leq 0.05$) المدارس الحكومية)، بينما لا يوجد إختلاف معنوى 16.7% لطالبات المدارس الخاصة، 6.5% لطالبات المدارس الحكومية)؛ وخلصت الدراسة إلى أن الحالة التغذوية للطالبات أفضل منها لدى الطلاب. كما أوضحت الدراسة أن حالات سوء التغذية بالنسبة للطول والوزن منتشرة بوضوح بين طلاب مدارس بحرى، أمدرمان، والخرطوم فقط بين الطلاب. وقد تمت ($P \leq 0.05$) بالتوالى، ويوجد إختلاف معنوى ووجد WHO-NCHS م مقارنة الحالة التغذوية للطلاب مع المراجع القياسية أن حالة الطلاب فى المراحل الدراسية الأولى (5-10 سنة) أفضل منها فى (المراحل الدراسية المتأخرة (11-15 سنة).

أظهرت الدراسة أن هنالك مؤثرات واضحة وقوية على الحالة التغذوية للطلاب تمثل؛ مستوى تعليم الوالدين، الوظيفة، الدخل، الحالة المعيشية والنشاطات الجسدية. و قد بينت الدراسة أن نسبة تفشى الإصابة بأمراض الجهاز التنفسى والملاريا وسط الطلاب كانت عالية بين طلاب الريف (36%، 36.1%، على التوالى) مقارنةً مع طلاب الحضر (29.7%، 18.2%، على التوالى) وطلاب المدارس الخاصة (25%، 10.3%، على

التوالى)، ولقد ظهر جلياً من هذه الدراسة أن عادة عدم تناول وجبة الإفطار اظهرت بنسبة عالية بين طلاب الريف (15.8%)، الخضر (16.5%) وطلاب المدارس الخاصة (5.2%)؛ كما بينت الدراسة أن هنالك إختلافاً فى تناول المجموعات الغذائية (اللحوم، الكربوهيدرات، (P≤0.05) معنوياً البقوليات، الخضروات، الألبان ومنتجاتها والبيض، الفواكه، العصائر والمنبهات) بين طلاب المدارس الخاصة والحكومية، بينما الإختلاف المعنوى بين طلاب مدارس الريف والحضر فى تناول الكربوهيدرات (والبقوليات فقط).