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RESEARCH ARTICLE

Factors Associated with the Nutritional Status of Schoolchildren in the Main City of Benin Republic, Sub-Saharan Africa

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Abstract

Background: Malnutrition has become a real concern today. It is a pathological condition resulting from the relative or absolute deficiency or excess of one or more essential nutrients and can occur through either clinical or anthropometric signs or physiological or biochemical analyses.

General objective: The purpose of this study was to determine the factors associated with and the extent of malnutrition in schoolchildren in Cotonou, the main city of Benin Republic.

Method: This was a cross-sectional study conducted in July 2016. It involved data collection regarding food and nutritional knowledge, nutritional habits and practices, physical activity level and health status which were obtained using survey research. The study took place in four schools from the Friendly School of Nutrition Initiative (FNSI) in Cotonou and focused on schoolchildren aged from eight to eleven (n = 182). Anthropometric data including weight and height were collected, BMI indices weight-for age and height-for-age were calculated, making it thereby possible to assess the nutritional status of the schoolchildren. Factors associated with malnutrition were determined by logistic regression (p < 0.05).

Results: From the outcome of this study, 13% of the children were wasted; 5% were overweight or obese. The proportion of stunting was 5% of which 1% were severely stunted. Thirty-four percent (34%) of schoolchildren were anemic. Factors associated with wasting in schoolchildren were age (OR = 4.99; p = 0.007), gender (OR = 0.36; p = 0.049) and maternal employment status (OR = 5.58; p = 0.021). Maternal employment status had a high influence on stunting (OR = 7.77; p = 0.033).

Conclusion: It appears that the double burden of malnutrition is a reality in Cotonou's schools and is characterized by coexistence of wasting, stunting, overweight and obesity in these schoolchildren. Efficient strategies are needed to improve the nutritional status of Cotonou's schoolchildren.

Keywords

Double burden, Malnutrition, Schoolchildren, Associated factors, Cotonou, Benin

Abbreviations

WHO: World Health Organization; BMI: Body Mass Index

Introduction

Malnutrition has become a real concern nowadays. As a pathological condition resulting from the relative or absolute deficiency or excess of one or more essential nutrients, malnutrition could be manifested by clinical or anthropometric signs, physiological or biochemical analysis [1]. Among the vulnerable group, children in developing countries who suffer mainly from malnutrition due to deficiency are mostly affected.

Preschool age is a critical period in the development of every human being. During this period, malnutrition can be prevented, promptly identified and managed or corrected before it results into negative outcomes in schoolchildren.

However, it has been observed in several studies

that malnutrition is a challenge in schoolchildren. In a study conducted in Iran involving 695 male students aged 12 to 17 years, 25% showed growth retardation, signs and symptoms of delayed sexual maturation, significant reduction in hemoglobin, blood protein and blood albumin, especially in boys of small height [2]. In Santal, Puruliya district (West Bengal), India, among 442 schoolchildren aged 5 to 12 years, 17.9% were stunted, 33.7% underweight and 29.4% showed symptoms of wasting [3]. In Mali, a nutritional survey was conducted in 2005 by Sanokho, et al. involving four school groups in the urban commune of Ké-Macina. Based on this study, they reported that 12.8% of boys and 10.1% of girls showed signs of vitamin A deficiency; 22.1% of girls and 3.8% of boys had goiter; 33.3% of boys and 27.1% of girls showed signs of anemia; 0.8% of children were underweight; 1.98% were thin and 2.6% were stunted [4]. A study on the nutritional status of primary school-age children in 2013 found that 36%, 20% and 7% of schoolchildren in Ouagadougou were underweight, thin and stunted respectively. In Cotonou, Benin Republic, the same study reported lower rate, respectively 7%, 11% and 6% [5]. Malnutrition can take an irreversible toll on children's physical, psychomotor and cognitive development, as well as on school performance and productivity in adulthood, making it a dreadful condition if it not quickly detected and adequately attended to.

Thus, in the long run, school performance is dependent on the individual's nutritional status and feeding habit since their childhood, associated with good practices as far as hygiene, water and sanitation concerned. A study conducted in Switzerland revealed an even higher prevalence of obesity varying from 5-8%. About 20% of the children and teenagers were overweight according to the study [6]. In 2006, the Regional Health Observatory of Languedoc-Roussillon, France observed that 14.3% of the children aged 3 to 17-years-old were overweight while 3.5% were obese [7].

In Benin Republic, the prevalence of obesity is increasing, and undernutrition is still a major burden, especially among disadvantaged groups in the population [5]. While data on the nutritional status of children under five are available from the Demographic and Health Surveys (DHS), few studies have been conducted on the nutritional status of school-age children and adolescents. In 2013, a study reported that 15% of schoolchildren were overweight in Cotonou [5]. This shows that the two main aspects of malnutrition (undernutrition and overnutrition) are found among school children, sustaining the existence of double burden of malnutrition in this school environment. Since 2013, no study in our opinion has been conducted on the nutritional status of schoolchildren. This lack of recent data has led us to investigate the current extent of malnutrition and the factors associated with it.

Methods

Study setting and sampling

This was a cross-sectional study conducted in July 2016 based on data collected in June 2013. The study took place in Cotonou city, which is the largest city in Benin Republic. We have 170 state-owned primary schools in this city [8]. These schools are organized into four school districts. One school was chosen per school district in respect of urban and peri-urban settlements in the context of the "Friends of Nutrition Schools Initiative" (FNSI) of the Double Burden of Nutrition (DBN) project in Benin (2009-2014). Two state-owned primary schools were selected from urban settlements, namely, Gbegamey-Sud school and Gbeto-Sud school. Likewise, the two state-owned primary schools selected from peri-urban settlements were Vedoko school and Akpakpa-centre school.

These schools are big complexes composed of several arms within the six classes. The Akpakpa-centre school is subdivided into six arms of six classes accommodating 1800 schoolchildren. The Vedoko School structure accommodates three arms per class with a total of 1085 schoolchildren. In Gbeto-sud school each class is divided into four arms with 1209 schoolchildren. The Gbegamey sud school has five arms per class and a total of 1415 schoolchildren.

From each of the four selected schools, schoolchildren were identified by a systematic random sampling method. The children were selected from 3rd grade pupils to 5th grade pupils (CE1 to CM1) from the list of schoolchildren aged 8 to 11 years. The sample size of 182 schoolchildren, was obtained using the Schwartz formula [9], applying a prevalence rate of 11% wasting among school-age children obtained from a previous study [10] and assuming a non-response rate of 20%. The number of schoolchildren allocated per school was proportional to the population size of the target school-age group (8-11 years) available in each school, Akpakpa-Centre (65/630), Gbégamey-Sud (48/425), Vêdoko (41/394), Gbéto-Sud (28/366).

Variables

The dependent variable was nutritional status, with the following modalities - normal state, wasting, overweight and obesity using WHO criteria for BMI-for-age; Stunting was identified based on WHO criteria using Height-for-Age; micronutrient deficiencies such as anemia was also considered.

Weight and height were measured following WHO recommended procedures by employing the SECA electronic scale (Seca Lena 354/364) for the weight measurements (precision of 100 grams) and SHORR tape measure for height measurements [11].

Hemoglobin levels were determined by blood sample analysis. Following sample collection and homoge-

Azandjeme et al. Int Arch Public Health Community Med 2020, 4:036

• Page 2 of 8 •

nization, the assay was performed using a Genius counter-counter equipped with a screen, keyboard and printer. Results were read off from the display screen. Anemia has been diagnosed in schoolchildren with hemoglobin levels below 11.5 g/dl.

The independent variables in the study were socio-demographic variables, socioeconomic variables, food and nutrition knowledge, nutritional habits and practices, physical activity level, and health status. The socio-economic well-being score computed form socioeconomic variables was recoded to tertiles: High (3rd tertile), medium (2nd tertile) and low (1st tertile). Food and nutritional knowledge was explored using a questionnaire. Pictures of several food groups were showed to schoolchildren after which they were requested to make choices regarding which foods "to eat most often", "to avoid most often", "which provides a high energy intake", "which the body uses to build muscles", "which better protects the body from disease". A food and nutritional knowledge score was computed and recoded into tertiles. Eating habits and lifestyle practices were collected and treated in the same manner. Malaria was diagnosed by observing thick blood smears, sickle cell disease by hemoglobin electrophoresis, and parasites in stool samples. Physical activity and sedentary practices were assessed using a validated questionnaire of the International Atomic Energy Agency (IAEA) [12]. They were measured in terms of type of activity and frequency and categorized into tertiles "not very active", "moderately active" and "very active".

Anthropometric data were exported to WHO An-throplus software in order to calculate z-scores of body mass indices (BMI) for age and height-for-age. STATA 13.0 software was used for data analysis. After employing univariate and bivariate tests to search for significant associations, logistic regression through a step-by-step top-down procedure was used to determine the predictive factors for the nutritional status of schoolchildren.

Results

General characteristics of schoolchildren

Out of 182 schoolchildren recruited into the study, 52% were boys and 48% girls. The mean age was 9.62 years with a standard deviation of 1.04 years. Almost half (46.7%) of the schoolchildren were fourth grade pupils (CE2) while only about 15.9% were in fifth grade pupils (CM1). A higher proportion of schoolchildren (35.7%) came from Apkapka centre school situated in an urban area and 22.5% came from the Vêdoko's school in the peri-urban area. The majority of schoolchildren lived in households of six to ten people (54.0%); Seven children came from a household of more than 10 individuals (3.9%). The household range was 2 to 40 while the average size was 6.44 with a standard deviation of 3.33. The socio-economic well-being score level was moderate for 38.5% of the schoolchildren. (Table 1).

Food and nutritional knowledge of schoolchildren

Regarding food and nutritional knowledge, only

Table 1: Characteristics of schoolchildren and their nutritional status.

Variables	Frequency	Percentage
Age		
8-years-old	31	17.0
9-years-old	53	29.1
10-years-old	52	28.6
11-years-old	46	25.3
Gender		
Female	88	48.4
Male	94	51.6
Household size		
1 to 5	73	40.1
6 to 10	102	56.0
> 10	7	3.9
Level of socio-economic well-being bbbbbbeingbeing		
Low	62	34.1
Medium	70	38.4
High	50	27.5

Level of food and nutrition Knowledge		
Low	90	49.4
Medium	40	22.0
High	52	28.6
Level of nutritional habits and practices		
Low	82	45.1
Medium	59	32.4
High	41	22.5
Type of activity during break time the last seven days		
Remained seated	48	26.5
Wandered around the area	23	12.6
Run or play a little bit	47	25.8
Run or and play a little bit	31	17.0
Run and play most of the time	33	18.1
Frequency of activity just after school by being very active during the last seven days		
None	33	18.1

Once in a while	56	30.8
2-3 times	78	42.9
4 times	7	3.8
5 times or more	8	4.4
Mode of transport for the school		
Car/motorcycle	7	3.8
Foot	135	74.2
All of the above	40	22
Frequency TV of watches		
Every day	50	27.5
Most days of the week	62	34.1
Only on weekends	70	38.4

Table 2: Health and nutritional status of schoolchildren.

Variables	Frequency	Percentage
Malaria parasitemia		
Negative	67	36.8
Positive	115	63.2
Hemoglobin level		
No anemia	120	65.9
Anemia	62	34.1
Electrophoresis of hemoglobin		
Hb AA	134	73.6
Hb AS/AC	44	24.2
Hb SS/SC	04	2.2
Intestinal parasitosis		
Parasitosis (Ascaris)	01	0.6
No parasitosis	181	99.4
BMI for age		
Normal	149	81.9
Emaciation	24	13.2
Overweight/Obesity	9	04.9
Height for age		
Normal	171	93.9
Moderate growth retardation	9	4.9
Severe growth retardation	2	1.2

two schoolchildren replied that the consumption of sweets, food and sweetened drinks was unhealthy (1.1%); 94.5% indicated that practicing sport every day was beneficial to their health. The knowledge score divided into tertiles showed that half of the schoolchildren had a low level of food and nutritional knowledge.

Schoolchildren's eating habits and lifestyle practices

An assessment of the eating and nutritional habits and practices of schoolchildren revealed that 65.4% to 67.6% of children consumed fruit and vegetables during the week preceding the survey. No child surveyed slept without an evening meal. Half of the children ate with their families and 33% ate in front of the television. The Food and Nutrition Habits and Practices score showed that 45% of schoolchildren have poor food and nutrition habits and practices. In terms of physical activity, most of the schoolchildren surveyed walked to their schools (74.2%); 38.5% watch TV only during weekends as shown in Table 1.

Health and Nutritional status of schoolchildren

Table 2 shows that the thick blood smears collected were positive in 62.6% of cases, meaning that these schoolchildren were carriers of malaria parasite. Thirty four percent (34%) of schoolchildren had anemia; 24% of the children had S or C sickle cell trait and 2% of children had SS or SC sickle cell disease. Intestinal parasitosis (ascaris) was found in only one female schoolchild, aged nine years.

Most of the children had a normal BMI for normal age (82%). Wasting was the most common disorder encountered (13%), followed by overweight and obesity in 5% of children. Moderate stunting was observed in 5% of children and severe stunting in 1%.

Factors associated with the nutritional status of schoolchildren (Logistic regression model)

Factors associated with wasting: Factors associated with leanness in univariate analysis at 20% threshold were: Gender, school class, age, mother's occupation, home powered to electricity, level of food and nutritional knowledge, fruit consumption, cooking with charcoal, radio ownership and malaria infestation. Wasting was observed twice as much in boys than in girls (8% in girls and 17% in boys).

Based on the multivariate model, (Table 3), girls were at a lower risk of developing wasting than boys (OR = 0.36 CI 95%: 0.13, 0.99). The probability of having wasting increased with the age of the schoolchild (OR = 4.99, CI 95%: 1.56, 15.93). Schoolchildren whose mothers were unemployed were 5.58 times more likely to be thin (p = 0.021).

Factors associated with stunting: Boys are more likely to be stunted than girls (6.4% versus 5.7%). The variables associated with stunting at the 20% threshold were: choice of protective food group, response to the question "daily consumption of fruits and vegetables protects the body", mother with a profession, father with a profession. Adjusted for the other variables in the model, Table 4 shows that children from mothers without a profession had a higher probability of stunting compared to children from mothers with a profession (OR = 7.77, CI 95%: 1.18-51.19).

Table 3: Factors influencing wasting in the logistic regression model.

	Adjusted Odds Ratio (OR)	95% CI	p-value
Gender			
Male	1		
Female	0.36	[0.13;0.99]	**0.049***
Age			
[8-9 years old]	1		
[10-11 years old]	4.99	[1.56;15.93]	**0.007***
Mother with a profession			
Yes	1		
No	5.58	[1.29;24.11]	**0.021***

*p-value < 0.05.

Table 4: Factors influencing stunting in the logistic regression model.

	Adjusted Odds Ratio (OR)	95% CI	p-value
Mother with a profession			
Yes	1		
No	7.77	[1.18;51.19]	**0.033***
Eat daily fruits and vegetables Yes	1		
No	4.43	[0.99;19.73]	0.051
Don't know	5.64	[0.83;38.20]	0.076

*p < 0.05.

Factors associated with overweight: The variables associated with being overweight at the 20% threshold were gender, age, sweetened beverage consumption and knowledge on the health-promoting effect of fruit and vegetables. The prevalence of overweight was higher among girls than boys (8% versus 2.1%). After a descending step-by-step introduction procedure was applied, none of the variables selected in the univariate analysis were associated with overweight.

Discussion

Prevalence of malnutrition in its different forms

Wasting: The prevalence of wasting among the schoolchildren in this study (13%) is not far from the rate reported by Latour, et al. (11%) who conducted an earlier study in the same town of Cotonou in 2013 [5]. The rate from this present study is also similar to that from a study conducted in an urban area in Burkina-Faso (13.7%) in 2013 [13]. Higher rates were observed in Ivory Coast (39%) in 2012 [14]. In contrast, lower values were reported in 2005 in the urban township of Ke-macina (1.98%) in Mali [4] and in Cameroon (9.5%) [15]. Difference in study methods might explain the observed differences.

Stunting: Rate of stunting was 6% in this study, with 5% moderate stunting and 1% severe stunting. Similar findings were reported in Cotonou (6%) and 7% in Ouagadougou [5]. These rates are slightly lower than the one reported by Dabone, et al. (8.8%) in Ouagadou-

gou in 2013 [13]. Higher rates were observed in Nigeria (14.2%) [16] and India (54.11%) [17]. In contrast, Sanokho, et al. found only 2.6% of schoolchildren were affected by stunting in the same country [4]. In Bangladesh 11.8% of schoolchildren were stunted in a study involving 8 to 12 year old children from 110 schools [18]. The differences observed may be due to the different methods used.

Overweight and obesity: The rate of overweight and obesity detected was 5%. This rate is only valid for children who attended public schools. This rate could be higher if private schools had been included in the study because it is expected that most children in these schools come from families who are better placed financially compared to those in public schools. A similar rate (4.58%) was reported in 2010 from a study involving urban schools in Togo [19]. Lower rates (1.7%) were reported in 2009 by the pilot study in FNSI schools in Cotonou [20] and Burkina-Faso (2.3%) [13]. Higher values were reported respectively 15% in Cotonou by Latour, et al. [5], 9% in Marrakech [10], 8.7% in Rabat [21], 12.4% in Cameroon [15] and 10.8% in Libreville [22]. The differences noted between the rates found could be related to the sample size as ours was relatively smaller.

Factors associated with nutritional status

Factors associated with malnutrition due to deficiency (Wasting and Stunting): Emaciation affected twice as many boys (17%) as girls (8%). The female sex was significantly more protected against thinness than

Azandjeme et al. Int Arch Public Health Community Med 2020, 4:036

• Page 5 of 8 •

the male sex (OR = 0.36). The same observation was made by a study in Egypt which also found that more boys (3%) were thin compared to girls (2.2%) [23]. The increase in body fat in girls at the onset of puberty might explain this observation, as reported by Eto, et al. who stated that correlations between BMI and body fat depend on age, sex and pubertal stage [24]. In addition, boys are often more active than girls, who become less active as they make the transition from childhood to teenage years. Indeed, according to a Canadian study, only 4% of girls versus 9% of boys had achieved recommended levels of daily physical activity [25]. Between the ages of 5 and 12, 56% of girls were not sufficiently active and 70% were not active during adolescence [26].

It was also observed in this study that schoolchildren aged 10-11 years were five times more likely to be underweight than younger children aged 8-9 years. In contrast, Dabone, et al. found that schoolchildren aged 5-9 years were thinner than their elders [27].

Age was not detected as a risk factor for stunting in the current study. However, growth retardation was observed in 4.8% of 8-9-year-old compared to 7.1% of 10-11-year-old. This confirms the fact that stunting tends to increase with age [28], although this trend is most prevalent in preschool children, i.e. those under six.

Gender was not identified as a risk factor for stunting in this study, although, 6.4% of boys were stunted compared to 5.7% of girls. The predominance of the male sex has been confirmed by several African studies in Nigeria and Turkey [28,29]. In contrast, female predominance has been reported elsewhere [3].

Although household size has not been identified as a risk factor for malnutrition, it should be noted that big household size exposes children to malnutrition [24]. Indeed, when the number of individuals in a household increases, food needs will increase and the food supply for schoolchildren, especially the older ones, is compromised [30]. The situation is worse in households with low socio-economic status.

In this study, 54.0% of children came from households of six to ten people and 3.9% from households with more than 10 children. Most of these schoolchildren also came from households with a low (34.1%) or middle (38.4%) socio-economic status. It should also be noted that half of the schoolchildren had a low level of food and nutritional knowledge and 45% had poor food and nutritional habits and practices. These inadequate practices mainly concerned skipping of breakfast by majority of schoolchildren and the low consumption of fruit and vegetables. Only 28% of schoolchildren ate breakfast before going to school, 14.8% brought lunch boxes to school. These figures corroborate the study by Koo, et al. who found that only 22% of Kuala Lumpur schoolchildren consumed breakfast on a regular basis [31].

The health condition of schoolchildren was characterized by a high prevalence of malaria parasitaemia (62.6%), the presence of AS or AC haemoglobinopathy features (24%) and anemia (34%). These factors should not be overlooked bearing in mind the vicious cycle of malnutrition and infections. The observed malaria infection rate is close to that observed in Nigeria (58.9%) [30], but significantly higher than those found by other authors in Tanzania (5.4%) [32] and Rwanda (3.2%) in 2008 [33].

The prevalence of anemia is the same as stated by Osei, et al. (36%) [34]. Higher rates had been reported in Burkina Faso 40.4% [27]. The observed differences could be attributed to the assay method used. Hemocue was used in Tanzania whereas blood count was used in this study. Lower rate was reported in Morocco (12.2%) by Hioui, et al. [35]. This low rate can be explained by the Moroccan government's efforts to combat anemia in schools and also by the threshold considered in defining anemia (12.5 g/dl), whereas in this study the threshold value considered was lower (11.5 g/L), the former could underestimate the proportion of anemic children. The prevalence of intestinal parasitosis (0.55%) in this study was quite low compared to some other studies reporting 27.9% and 22.7% of intestinal parasitosis in schoolchildren respectively [35].

In addition, maternal employment status in this study predicted stunting 7.77 times and thinness 5.58 times. A similar observation was reported that stunting and thinness were higher in mothers with no or non-formal jobs than in mothers with formal jobs. Arage, et al. reported a positive association for stunting (5.27 times) but a negative association for thinness [36].

Factors associated with overweight: No factors were associated with overweight in this study. However, the study found that 8% of girls compared to 2.1% of boys were overweight, a trend observed in several African countries. Manyanga, et al. found that girls had a higher prevalence of overweight among school-going adolescents in five African countries, including Benin, than boys [37]. The same observation was made by Muthuri, et al. among children and youths within school-age in sub-Saharan Africa [38].

On the other hand, a higher prevalence of overweight among boys 3.7% and 1.4% among girls has been reported among children attending public schools in the city of Rabat, Morocco [10]. This difference can be attributed to the heterogeneity of the criteria used to classify overweight and obesity. Nevertheless, overweight and obesity were much more prevalent among younger schoolchildren, as 5.9% compared to 4.1% in this study. The study by Manyanga, et al. showed that overweight was more common among young adolescents under 12 years of age and decreased with age [37].

The majority of overweight and obese schoolchildren came from households with average socio-economic levels (8.6%). This finding that the prevalence of overweight/obesity was higher among children of higher socio-economic status or high-income earning parents has been confirmed by other study [10]. The same study stated that poverty was a risk factor for stunting. In contrast, studies conducted in the United Kingdom and Sweden by Lauzon, et al. showed that overweight and obesity are increasing more rapidly in the lower classes than in the upper classes [39].

Moreover, the consumption of sweetened drinks was found to be associated with the nutritional status of schoolchildren, as confirmed by Trichesa and Giuglianib [40] which contradicts what was reported in Libreville. Sweets were regularly purchased at school by 27.5% of the children. Ategbo, et al. reported a higher prevalence of sugar consumption, up to 88.4% [22]. This difference may be due to the availability and affordability of sweetened drinks within the vicinity of the schools.

A significant proportion of the schoolchildren recruited into this study were not very active (37.4%), however, most of them trekked to school (74.2%). Most schoolchildren watched TV only during weekends (38.5%). Although sedentary lifestyles or low levels of physical activity may be implicated in the occurrence of overweight and obesity and BMI is related to activity levels during and outside school hours, physical activity level was not found as a risk factor for overweight in this study. This difference observed in this work can be attributed to the small sample size and also to the fact that sport is regularly practiced in most schools in Cotonou.

Some limitations of this study include the small sample size (though the sampling technique was ideal) as well as the fact that only four public schools were involved and private schools were excluded. Perhaps if participants from the later had been enrolled into this study, a higher proportion of cases affected by malnutrition due to overweight or deficiency might have been observed owing to the higher socio-economic status of families from which most children in private schools come from. Finally, this work did not target the genetic and psychological factors associated with nutritional status. Thus, it would be desirable for further in-depth studies to be carried out to investigate all the micronutrient deficiencies frequently encountered in Africa. Despite these limitations, this study highlighted factors that need to be addressed in schoolchildren to reduce malnutrition in its different forms. The study is one of the few on the nutritional status of schoolchildren and associated factors in the Republic of Benin.

Conclusion

This study determined the extent of malnutrition and the associated factors among schoolchildren in Cotonou. Both forms of malnutrition were identified, namely deficiency malnutrition (acute malnutrition, chronic malnutrition, micronutrient deficiency, i.e anemia) and overload malnutrition (i.e. overweight and obesity). This situation of double burden of malnutrition coexisted with a high prevalence of malaria parasitemia, contributing therefore to the vicious circle of malnutrition.

The factors associated with the debilitating nutritional status of schoolchildren were age, gender, and maternal employment status. However, nutritional knowledge, nutritional practices and physical activity also need to be enhanced in order to improve the nutritional status of schoolchildren.

Acknowledgement

References

1. Levinson FJ, Basset L (2007) Malnutrition is still a major contributor to child deaths, but cost-effective interventions can reduce global impacts. Population Reference Bureau.

2. Ronaghy HA, Kohout E, Hadidi N (1970) Body height and chronic malnutrition in school children in Iran. AJCN 23: 1080-1084.

3. Sutanu DS, Tarun C, Tushar KG (2008) Prevalence of undernutrition in santal children of Puruliya district, West Bengal. Indian Paediatrics 17: 43-46.

4. Sanokho M (2005) Nutritional survey in the four school groups of the urban commune of Kemacina. Faculty of Medicine, Pharmacy and Odontostomatology, Mali.

5. Latour C (2013) Nutritional status of primary school-age children in Cotonou and Ouagadougou. Mini memories and seminars, NUT 3035.

6. Farpour-Lambert N, l'Allemand D, Sempach R, Laimbacher J (2OO6) Surcharge pondérale et obésité chez les enfants et adolescents. Paediatrica Journal, 17.

7. Baguet F, Ruiz I, Ledesert B (2008) Overweight-obese. Regional Health Observatory of Languedoc-Roussillon, 6.

8. Akomagni A (2006) Monograph of the commune of Cotonou.

9. Schwartz D (1960) The statistical method in medicine: ethiological surveys. Review of Applied Statistics 8: 5-27.

10. Sebbani M, Elbouchti I, Adarmouch L, Amine M (2013) Prevalence of obesity and overweight among primary school children in Marrakech, Morocco. Journal of Epidemiology and Public Health 61: 545-549.

11. Lohman TG, Roche AF, Martorell R (1988) Anthropometric standardization reference manual. Human Kinetics, Champaign, IL.

12. Stuart JH Biddle, Trish Gorely, Natalie Pearson, Fiona C Bull (2011) An assessment of self-reported physical activity instruments in young people for population surveillance:

Project ALPHA. Int J Behav Nutr Phys Act 8: 1.

13. Dabone C (2011) The double burden of malnutrition in school age in urban areas: A study in Burkina Faso. University of Montreal.

14. Kramoh KE, N'goran YNK, Ake-Traboulsi E, Boka BC, Harding DE, et al. (2012) Prevalence of obesity in schools in Ivory Coast. Ann Cardiol Angeiol (Paris) 61: 145-149.

15. Wamba PCF, Enyong Oben J, Cianflone K (2013) Prevalence of Overweight, Obesity, and Thinness in Cameroon Urban Children and Adolescents. J Obes 2013: 1-9.

16. Fetuga MB, Ogunlesi TA, Adekanmbi AF, Alabi AD (2011) Nutritional status of semi-urban Nigerian school children using the 2007 WHO reference population. West Afr J Med 30: 331-336.

17. Sati V, Dahiya S (2012) Nutritional Assessment of Rural School-Going Children (7-9 Years) of Hisar District, Haryana. Open Access Scientific Reports 1: 363.

18. Haque M, Arafat Y, Roy SK, Md Zahid Hasan Khan, AKM Majbah Uddin, et al. (2014) Nutritional Status and Hygiene Practices of Primary School Children. J Nutr Health Food Eng 1: 36-40.

19. Djadou KE, Sadzo-Hetsu K, Koffi KS, et al. (2010) Prevalence of obesity in urban school settings (Togo). Journal of Paediatrics and Childcare 23: 335-339.

20. Tchouape G (2009) Facteurs associés à l'état nutritionnel des élèves des écoles pilotes de l'IEAN de Cotonou. IRSP.

21. Cherkaoui DI (2014) Assessment of the nutritional status of children attending public schools in the city of Rabat: the role of socio-economic factors. Faculty of Medicine and Pharmacy of Rabat, Morocco.

22. Ategbo SJ, Kuissi E, Ngoungou EB (2015) Epidemiology of childhood obesity in schools in Libreville and Owendo. Pediatrics Archives 1: 358.

23. Shaimaa B, Meray R, Amal S. Sedrak, John Rene Labib (2015) Nutritional Status and Dietary Habits of School Children in Beni-Suef Governorate, Egypt. Scientific Research Publishing 6: 54-63.

24. Eto C, Komiya S, Nakao T, Kikkawa K (2004) Validity of the body mass index and fat mass index as an indicator of obesity in children aged 3-5 year. J Physiol Anthropol Appl Human Sci 23: 25-30.

25. Colley RC, Garriguet D, Janssen I, Cora L. Craig, Janine Clarke, et al. (2011) Physical activity of Canada's children and youth: Accelerometer results from the Canadian Health Measures Survey 2007-2009. Health Reports 22: 15-23.

26. Craig CL (2001) Increasing Physical Activity: Building a supportive recreation and sport system. Canadian Fitness and Lifestyle Research Institute, Physical Activity Monitor.

27. Dabone C, Delisle HF, Receveur O (2011) Poor nutritional status of schoolchildren in urban and peri-urban areas of Ouagadougou (Burkina Faso). Nutrition Journal 10: 34.

28. Senbanjo IO, Oshikoya KA, Odusanya OO, Njokanma OF (2011) Prevalence of and Risk factors for Stunting among School Children and Adolescents in Abeokuta, Southwest Nigeria. J Health Popul Nutr 29: 364-370.

29. Gür E, Can G, Akkus S, Gökmen Ercan, Ahmet Arvas, et al. (2006) Is undernutrition a problem among Turkish school children? What are the influencing factors? J Trop Pediatr 52: 421-426.

30. Rowland MGM (1999) Prevention of protein-energy malnutrition. In: Standfield P, Brueton M, Chan M, Parkin M, Waterson T, Childhood Illness in Subtropical and Tropical Regions. (4th edn), Edward Arnold, Kent, 358-366.

31. Koo HC, Abdul JS, Ruzita AT (2015) Breakfast eating pattern and ready-to-eat cereals consumption among Schoolchildren in Kuala Lumpur. Malays J Med Sci 22: 32-39.

32. Nzobo BJ, Ngasala BE, Kihamia CM (2015) Prevalence of asymptomatic malaria infection and use of different malaria control measures among primary school children in Morogoro Municipality, Tanzania. Malar J 14: 491.

33. Dushimimana A, Condo J, Munyanshongore C (2008) The nutritional situation and parasitic infections among primary school children in Rwanda. Final report.

34. Osei A, Houser R, Bulusu S, Joshi T, Hamer D (2010) Nutritional status of primary schoolchildren in Garhwali Himalayan villages of India. Food Nutr Bull 31: 221-233.

35. Hioui ME, Ahami AOT, Aboussaleh Y, et al. (2007) Nutritional anaemia among schoolchildren in a rural and coastal area of northwest Morocco. Antropo 15: 35-40.

36. Getachew Arage, Mekonnen Assefa, Teshager Worku (2019) Socio-demographic and economic factors are associated with nutritional status of adolescent school girls in Lay Guyint Woreda, Northwest Ethiopia. SAGE Open Med.

37. Manyanga T, El-Sayed H, Doku DT, Randall JR (2014) The prevalence of underweight, overweight, obesity and associated risk factors among school-going adolescents in seven African countries. BMC Public Health 14: 887.

38. Muthuri SK, Francis CE, Wachira LM, LeBlanc AG, Sampson M, et al. (2016) Evidence of an Overweight/Obesity Transition among School-Aged Children and Youth in Sub-Saharan Africa: A systematic review. PLoS One 9: e92846.

39. Lauzon B, Charles M (2004) Childhood obesity: The role of socio-economic factors. Nutrition objectives, 7.

40. Trichesa RM, Giuglianib ERJ (2005) Obesity, eating habits and nutritional knowledge in school-aged children. Rev Saude Publica 39: 4.

Azandjeme et al. Int Arch Public Health Community Med 2020, 4:036

• Page 8 of 8 •