Anthropometrical nutrition study of six to eleven year-old school children in Aruba.

Authors:

Dr. Richard Visser*, DC, PhD

Dr. Gregory Laclé**, MD

Dr. Troadio González***, Ph D

Dr. Angel Caballero***, Ph D

*Visser Wellness and Research Center

** General Hospital of Aruba

***Institute of Nutrition and Food Hygiene

Keywords: childhood obesity, anthropometry, morbid obesity.

About The Main Author:

Director Visser Wellness and Research Center
Havenstraat #30, Oranjestad, ARUBA.
Tel.(297) 583-0036 Fax.(297) 583-0031
e-mail: drvisser@simplyh.com

Abstract:

An anthropometrical nutrition study was performed in order to identify poor nutrition due to excess calorie intake among six to eleven year-old school children in Aruba, and to identify the features of these dietary issues within the population studied. It was found that 26.5% of the population was obese and 10.6% was overweight. 124 children were found to be morbidly obese with a predominant central distribution of body fat. The obese children were generally tall for their age, which indicates that this characteristic in the population studied is related to exogenous or secondary obesity resulting from low levels of moderate and intense physical activity and poor dietary habits.

Introduction

Obesity is a pandemic that affects various age groups, regardless of race, sex or social status[1,2]. Obesity has adverse consequences on body functions, which causes alterations in various body subsystems[3,4,5] and affects the morbidity and mortality rates of a population by significantly increasing the incidence of type II diabetes[6], arterial hypertension[7], cardiovascular and cerebrovascular disease[8], some types of cancer[9], and obstructive sleep apnea[10], among others. It should receive special attention and care when found in children.

In recent years, the number of children suffering from this illness has increased at an alarming rate, which means that diagnosis and treatment should be performed as early as possible due to health conditions that may arise during childhood. Obesity is one of the principal causes of high blood pressure in children and adolescents, and vascular complications in young adults; it is also a significant factor in the increased prevalence of adult obesity due to an increased number of adipocytes, which lead to increased deposits of neutral fats in later stages of life[11,12].

The purpose of this study was to identify obesity in six to eleven year-old Aruban school children, and determine the most important features of this illness in the affected population.

Methodology

In order to determine the prevalence of poor nutrition due to excess calorie intake among the six to eleven year-old population in Aruba, an anthropometrical nutrition study of 3952 school children was performed.

Measurements were made using the technique described in Weiner and Lourie's International Biological Program[13]. Weight; height; tricipital, subscapular, and suprailiac skin fold thicknesses; and arm, waist, and hip circumferences were measured. Height/Weight, Weight/Age, Height/Age, Waist/Hip Ratios, Body Mass Index, Areas of Fat and Muscle in the Arm, and Tricipital/Subscapular Skinfold Ratios were calculated. The results of these measurements, except for waist/hip and tricipital/subscapular skinfold ratios, were classified by comparison to reference percentiles published by the WHO[14, 15].

The results of all measurements and ratios were evaluated as a whole in order to determine the nutritional state of each individual studied. These individuals were then classified as obese, overweight, normal or healthy, or malnourished.

Results

Of the 3,952 Aruban school children studied, 179 (4.5%) were malnourished, 2309 (58.4%) were healthy, 418 (10.5%) were overweight, and 1046 (26.5%) were

simply H LLC
www.simplyh.com

Corporate HQ
5670 Wilshire Blvd
Suite No. 1777
Los Angeles, CA 90036

t 800-889-6697
t 323.937-9990
f 323.937-9992

Executive Officers:
CEO Dr. Richard Visser
Exec VP Lin Young

obese. A total of 1464 (37.0%) of these school children were overweight for their age and sex. Of the 1046 children found to be obese, 468 (44.7%) were girls and 578 (55.2%) were boys. Table 1.

The proportion of obesity found among the research population, grouped by age and sex, can be found in tables 2, 3, 4, 5, 6, and 7. 124 children were found to be morbidly obese.

Discussion

In recent years, scientific literature has suggested that childhood obesity is one of the most significant health problems found in practically all populations studied. This was confirmed in a review of data provided by studies performed on 137,593 individuals from 34 countries, which underscores the need to understand the behavior of this scourge in order to work on protecting the health of the population[16].

The results of this study are in agreement with the results given by other authors, which point to an alarming increase in childhood obesity in both rich, industrialized countries and poor or underdeveloped countries, even though the physiopathogenic mechanisms of such increases differ[17, 18, 19, 20, 21, 22].

It has been reported that the proportion of overweight and obesity among children is between 25% and 42% in countries such as the United Kingdom, Portugal, Greece, and America, among others[19, 20, 21, 22, 23, 24].

Within the population used for this study, the proportion of obese children increased with age, from 21.5% in six-year-olds to 33.7% in 11-year-old children. This tendency has also been observed by other researchers, who express their concern for the impact this problem can have on children's health both during childhood and later on in their lives as adolescents and adults; they also express concern for these individuals' ability to eventually contribute to societal development, due to the difficulty manifested by a significant number of obese children in developing skills and abilities, especially during the more severe stages of the illness[25, 26, 27].

In the population of school-age children studied, the height index for the obese and overweight subgroup (39.7% and 21.0%, respectively) was generally higher than for the healthy and malnourished children (15.5% and 12.8%, respectively). Table 8.

One of the most frequently studied aspects of childhood obesity is its influence on growth and development. It has been suggested that an obese child will seem to grow at a faster rate than a normal child and there has been much debate whether sexual or bone maturation in obese children is accelerated[28].

A positive correlation has been found between adiposity (percentage of weight in

fat) and the height of an obese child, while others point to early onset (before one year) as the most significant factor, and it has been reported that individuals with early onset obesity show increased lean mass, in addition to increased total body mass, which means they will grow more[28,29].

Obese children show more advanced skeletal and sexual maturation compared with children of the same age group. Likewise, obese children have been observed to be tall for their age, especially children whose obesity began in infancy.

The fact that an obese or overweight child is tall for his or her age confirms the exogenous nature of the illness, which is also known as secondary obesity. Secondary hyperinsulinism arising from exogenous obesity would result in an increased hepatic somatomedin level, which leads to increased height due to its action on growth cartilage. On the other hand, primary obesity, which is caused by genetic or neuroendocrine factors, would be characterized by short stature[30].

Of the 1,046 obese school-age children, 509 (49.6%) were found to have central obesity, based on the definition of central obesity using the tricipital and subscapular skinfold ratio. By the same definition, of the 418 overweight children, 86 (20.5%) also suffered from central obesity. The high proportion of school-age children with a greater central distribution of body fat was also confirmed using the waist-hip ratio. Based on this measurement, 272 (65%) of the overweight children and 734 (70.1%) of the obese children had central obesity. This should stand as a reminder of the high risk of cardiovascular disease faced by these children, since factors known as atherogenic factors are thought to be closely related to a concentration of body fat in the central regions of the body[29].

Scientific literature suggests that central obesity (visceral or android) tends to cause metabolic complications, determined by the characteristics of the central or visceral adipocytes, which can also become a risk factor for lipid disorders, disorders of carbohydrate metabolism, and high blood pressure. Central obesity is characterized by reduced lipolysis and reduced oxidation of free fatty acids, both of which are processes involving insulin. It has been suggested that the activity of hormone-sensitive tissue lipase is decreased, or its active form does not reach the bioavailability required to increase the hydrolysis of neutral fats previously stored in adipocytes. At the same time, capture and oxidation of plasma free fatty acids at the hepatic level would be reduced, all of which seems to be due to an increased Km (ap) in some of the enzymes involved in initiating the process of energy derivation from such fats, or due to changes in the insulin receptors on the cytoplasmic membrane of liver cells[31, 32].

Approximately 50% of these fatty acids do not undergo direct oxidation, but are re-esterified in the liver cells. By increasing their bioavailability in the liver cells, VLDL-cholesterol synthesis is also increased, which, when its catabolism is also decreased, will lead to hypertriglyceridemia—one of the most common lipid disorders in obese individuals. The high level of free fatty acids can be a factor in tissue

simply H LLC
www.simplyh.com

Corporate HQ
5670 Wilshire Blvd
Suite No. 1777
Los Angeles, CA 90036

t 800-889-6697
t 323.937-9990
f 323.937-9992

Executive Officers:
CEO Dr. Richard Visser
Exec VP Lin Young

insulin resistance, because these fatty acids inhibit glucose metabolism in muscle cells. They are also a contributing factor in the onset of hyperinsulinemia, as they reduce the liver's capacity to remove insulin[33].

These indications are supported by the fact that intraabdominal adipose tissue is metabolically more active than peripheral fat due to its greater blood flow and the high surface density of beta-adrenoreceptors that mediate lipolysis, in contrast with the lack of receptors that inhibit lipolysis, characteristic of subcutaneous adipose tissue. The high rate of triglyceride and free fatty acid turnover and the increased production of tumor necrosis factor (TNF alpha) by adipocytes would both play a role in insulin resistance[28].

Many of the aspects stated here are in agreement with the differences pointed out by some researchers, which overweight and obese individuals show in relation to specific enzyme activity, bioavailability, or response to certain internal, neurogenic, or chemical stimuli involved in the storage, mobilization, and utilization of neutral fats and the free fatty acids derived from them[34,35].

High proportions of morbid obesity have also been reported among children. In the Aruban study, morbid obesity was defined as 2 standard deviations above the 95th percentile for body mass index for a particular age, which further serves to demonstrate the extreme level of obesity found. These school children face the greatest risk and the poorest prognosis--they are very likely to suffer metabolic syndromes, together with all the complications arising from such health problems. They exhibit a significant accumulation of fat in the two large compartments reserved for adipose tissue by the body: the subcutaneous compartment and the visceral compartment[36].

Of the 3,952 school-age children who participated in this study, 124 (3.1%) were found to have morbid obesity; however, the rate of morbid obesity tended to increase with age, from 13 (2.2%) of a total of 571 six-year-old school children, to 37 (5.1%) among the 11-year-olds. In relation to sex, it was found that 87 (4.2%) of the 2,038 boys and 37 (1.9%) of the 1,914 girls were morbidly obese.

Of the 124 morbidly obese school-children, 21 (16.9%) were found to have high blood pressure, based on a single measurement, which reinforces the fact that this health problem is related to childhood obesity. In this particular case, follow-up high blood pressure studies become mandatory, due to the fact that morbid obesity responds very little, if at all, to current therapeutic procedures.

Risk factors for morbid obesity were studied in 53 (42.7%) of the 124 morbidly obese individuals found, which revealed that those individuals exhibited an excessive and unbalanced intake of food energy (over 120% of that required), and in addition, 48 (38.7%) showed a significantly sedentary lifestyle; in other words, a significant reduction in energy expenditure. This may explain the results, at least in part, of an energy imbalance significantly deviated to the right, possibly as the result of hormonal failures of the adipose tissue itself: excessive synthesis and

secretion of leptin and a decrease in adiponectin, as well as an abnormal response to melanocortin, which is related to the regulation of food energy intake. It is known that the latter works by promoting the mobilization of neutral fats from adipose tissue, and increases the utilization of glucose and free fatty acids as energy sources[31, 37, 38, 39, 40, 41].

The failure of the adipose tissue to secrete hormones, and/or in the response of the effectors or target sites to those hormones suggests that morbid obesity may have molecular origins or may be due to a fault in the individual's genotype. This shows the importance of detecting such issues as early as possible, while simultaneously applying appropriate therapeutic procedures. Unfortunately, the result of the above is that, as has been mentioned previously, the mandatory treatment for morbid obesity is surgery, and the chances for success are low[42, 43, 44].

The existence of morbid obesity in the 124 school-age children diagnosed as such was confirmed by observing the statistics of their fat areas[13]--all were above the 95th percentile for their ages, which indicates that all had very high energy reserves.

Of the 124 morbidly obese children, 112 (90.3%) were found to have muscle areas and heights above the 90th percentile for their ages. These statistics are in agreement with the definition of individuals with exogenous or secondary obesity; such individuals are characterized by excess intake of food energy in relation to the physical activity they perform, which raises their blood glucose levels, stimulating the hypothalamic secretion of the growth hormone release factor by the adenohypophysis during childhood, which causes compensatory hyperinsulinism, increases development of adipose tissue, promotes accelerated growth and precocious puberty. In other words, the excess food energy that causes exogenous obesity also creates the conditions, not only for increased adipose tissue development, but also for the development of muscle and bone systems, among others, unlike endogenous or primary obesity, in which genetic factors and neuroendocrine disorders promote the growth of adipose tissue, but not bone and muscle development, which means that individuals with this disorder are short and may even exhibit hypogonadism[5, 25, 45, 46, 47, 48].

It is important to point out that obese individuals, especially morbidly obese individuals, also show substantial cardiorespiratory problems that may significantly affect the individual's biological health, even from the early stages of life. The prevalence of asthma and other respiratory tract illnesses is extremely common among obese individuals, including obstructive upper airway problems and concomitant left ventricular hypertrophy, as well as reduced lung development. Such disorders jeopardize the lungs' functional ventilation capacity and the capacity to reach the cardiac output necessary to meet the oxygen needs of the tissues and organs throughout the body. Along these lines, it has been suggested that these functional cardiorespiratory limitations prevent the increases in height, bone mass, and total adipose tissue mass from going as high as they could. It is a sort of braking effect caused by the reduced oxygen supply to the body's tissues and or-

gans, even though the final result is a greater development of height, bone, and muscle in obese individuals, compared with healthy individuals, despite the above limitations[49, 50].

These data show that the obesity found in the school-age children studied seems to be fundamentally caused by consumption of food energy greater than that expended in physical activity.

Conclusions

High proportions of childhood obesity have been found in the school-age children studied, which reveals that they are facing a significant health problem.

The characteristics of the obesity found are similar to the characteristics of obesity caused by external factors, such as poor dietary habits and a sedentary lifestyle.

Works Cited

1. Organización Mundial de la Salud. Estrategia mundial sobre régimen alimentario, actividad física y salud. 57 Asamblea Mundial de la Salud. Ginebra:OMS;2004: (WHA57.17)

2. Stubbs CO, Lee AJ. The obesity epidemic: both energy intake and physical activity contribute. Med J Aust. 2004;181(9):489-91.

3. Erbas T. Metabolic syndrome. Acta Diabetol. 2003;40 Suppl 2:S401-4.

4. Marks V The metabolic syndrome. Nurs Stand. 2003;17(49):37-44.

5. Preeyasombat C, Bacchetti P, Lazar AA, Lustig RH. Racial and etiopathologic dichotomies in insulin hypersecretion and resistance in obese children. J Pediatr. 2005;146(4):474-81.

6. Bener A, Zirie M, Al-Rikabi A. Genetics, obesity, and environmental risk factors associated with type 2 diabetes. Croat Med J. 2005;46(2):302-7.

7. Ribeiro MM, Silva AG, Santos NS, Guazzelle I, Matos LN, Trombetta IC, Halpern A, Negrao CE, Villares SM. Diet and exercise training restore blood pressure and vasodilatory responses during physiological maneuvers in obese children. Circulation. 2005;111(15):1915-23.

simply H LLC
www.simplyh.com

Corporate HQ
5670 Wilshire Blvd
Suite No. 1777
Los Angeles, CA 90036

t 800-889-6697
t 323.937-9990
f 323.937-9992

Executive Officers:
CEO Dr. Richard Visser
Exec VP Lin Young

8. Zhou JF, Wang JY, Luo YE, Chen HH. Influence of hypertension, lipometabolism disorders, obesity and other lifestyles on spontaneous intracerebral hemorrhage. Biomed Environ Sci. 2003;16(3):295-303.

9. Rodler I, Zajkas G. Healthy nutrition and the prevention of cancer. Orv Hetil. 2003;144(9):413-8.

10: Gami AS, Caples SM, Somers VK. Obesity and obstructive sleep apnea.Endocrinol Metab Clin North Am. 2003;32(4):869-94.

11. Ishihara T, Takeda Y, Mizutani T, Okamoto M, Koga M, Tamura U, Yamada N, Cheng S, Nakamura K, Iijima S, Yamagata Z. Relationships between infant lifestyle and adolescent obesity. The Enzan maternal-and-child health longitudinal study. Nippon Koshu Eisei Zasshi. 2003;50(2):106-17.

12. Kvaavik E, Tell GS, Klepp KI. Predictors and tracking of body mass index from adolescence into adulthood: follow-up of 18 to 20 years in the Oslo Youth Study. Arch Pediatr Adolesc Med. 2003;157(12):1212-8.

13. Weiner JS, Lourie JA. Human biology. A guide to field method. International Biological Program. Handbook No. 9. Oxford Blackwell Scientific Publications. LTD. 1969:3-16

14. Amador M, Hermelo M. Métodos para la evaluación de la composición corporal en humanos, editado por Universidad Central de Caracas, 1996.

15. World Health Organization. Physical Status: the use and interpretation of antropometry. Geneva:WHO;1995 (Technical Report Series 854)

16. Janssen I, Katzmarzyk PT, Boyce WF, Vereecken C, Mulvihill C, Roberts C, Currie C, Pickett W; The Health Behaviour in School-Aged Children Obesity Working Group*. Comparison of overweight and obesity prevalence in school-aged youth from 34 countries and their relationships with physical activity and dietary patterns. Obes Rev. 2005;6(2):123-32.

17. Seidell JC. Epidemiology of obesity. Semin Vasc Med. 2005;5(1):3-14.

18. James PT. Obesity: the worldwide epidemic. Clin Dermatol. 2004;22(4):276-80.

19. Whiteley P, Dodou K, Todd L, Shattock P. Body mass index of children from the United Kingdom diagnosed with pervasive developmental disorders. Pediatr Int. 2004;46(5):531-3.

simply H

health

holistic

humanidad

healing

humanity

honestidad

heart

home

simply H LLC
www.simplyh.com

Corporate HQ
5670 Wilshire Blvd
Suite No. 1777
Los Angeles, CA 90036

t 800-889-6697
t 323.937-9990
f 323.937-9992

Executive Officers:
CEO Dr. Richard Visser
Exec VP Lin Young

20. Padez C, Fernandes T, Mourao I, Moreira P, Rosado V. Prevalence of overweight and obesity in 7-9-year-old Portuguese children: Trends in body mass index from 1970-2002. Am J Hum Biol. 2004;16(6):670-8.

21. Manios Y, Yiannakouris N, Papoutsakis C, Moschonis G, Magkos F. Behavioral and physiological indices related to BMI in a cohort of primary schoolchildren in Greece. Am J Hum Biol. 2004;16(6):639-47.

22. Muzzo S, Burrows R, Cordero J, Ramirez I. Trends in nutritional status and stature among school-age children in Chile. Nutrition. 2004;20(10):867-72.

23. Tanuseputro P, Manuel DG, Leung M, Nguyen K, Johansen H. Risk factors for cardiovascular disease in Canada. Can J Cardiol. 2003;19(11):1249-59.

24. Jacoby E, Goldstein J, Lopez A, Nunez E, Lopez T. Social class, family, and lifestyle factors associated with overweight and obesity among adults in Peruvian cities. Prev Med. 2003;37(5):396-405.

25. Monteiro PO, Victora CG. Rapid growth in infancy and childhood and obesity in later life - a systematic review. Obes Rev. 2005;6(2):143-54.

26. Flegal KM, Ogden CL, Carroll MD. Prevalence and trends in overweight in Mexican-american adults and children. Nutr Rev. 2004;62(7 Pt 2):S144-8.

27. Jirapinyo P, Densupsoontorn N, Kongtragoolpitak S, Wong-Arn R, Thamonsiri N. Increasing risks of becoming obese after 6 years in primary school: comparing the relative risks among some schools in Bangkok, Saraburi and Sakolnakorn. J Med Assoc Thai. 2005;88(6):829-32.

28. Clarke SD. El genoma humano y la nutrición. En: Conocimientos Actuales sobre Nutrición. Octava Edición. Publicación Ciencia y Técnica No. 592. 2003,pp 817-27.

29. Galuska DA, Kettel L. La Obesidad desde la perspectiva de la salud pública. En: Conocimientos Actuales sobre Nutrición. Octava Edición. Publicación Ciencia y Técnica No. 592. 2003,pp 579-90.

30. Flodmark CE, Bissau I, Moreno LA, Pietrobelli A, Widhalm K. New insights into the field of children and adolescents'obesity: the European perspective. Int J Obes Relat Metab Disord. 2004;10:1189-96.

31. Tounian P. Body-weight regulation in children: a key to obesity physiopathology understanding. Arch Pediatr. 2004;11(3):240-4.

32. Gil-Campos M, Canete RR, Gil A. Adiponectin, the missing link in insulin resis-

tance and obesity. Clin Nutr. 2004;23(5):963-74.

33. Knip M, Akerblom HK. Early nutrition and later diabetes risk. Adv Exp Med Biol. 2005;569:142-50.

34. Pérez Martin A, Raynaud E, Mercier J. Insulin resistance and associated metabolic abnormalities in muscle, effects of exercise. Obesity 2001; 2: 47-59

35. Tafel J, Branscheid I, Skwarna B, Schlimme M, Morcos M, Algenstaedt P, Hinney A, Hebebrand J, Nawroth P, Hamann A. Variants in the human beta 1-, beta 2-, and beta 3-adrenergic receptor genes are not associated with morbid obesity in children and adolescents. Diabetes Obes Metab. 2004;6(6):452-5.

36. Al-Haddad F, Al-Nuaimi Y, Little BB, Thabit M. Prevalence of obesity among school children in the United Arab Emirates. Am J Hum Biol. 2000;12(4):498-502.

37. Ogawa Y, Kikuchi T, Nagasaki K, Hiura M, Tanaka Y, Uchiyama M. Usefulness of serum adiponectin level as a diagnostic marker of metabolic syndrome in obese Japanese children. Hypertens Res. 2005;28(1):51-7.

38. Souza MS, Cardoso AL, Yasbek P Jr, Faintuch J. Aerobic endurance, energy expenditure, and serum leptin response in obese, sedentary, prepubertal children and adolescents participating in a short-term treadmill protocol. Nutrition. 2004;20(10):900-4.

39. Valli-Jaakola K, Lipsanen-Nyman M, Oksanen L, Hollenberg AN, Kontula K, Bjorbaek C, Schalin-Jantti C. Identification and characterization of melanocortin-4 receptor gene mutations in morbidly obese finnish children and adults. J Clin Endocrinol Metab. 2004;89(2):940-5.

40. Hinney A, Hohmann S, Geller F, Vogel C, Hess C, Wermter AK, Brokamp B, Goldschmidt H, Siegfried W, Remschmidt H, Schafer H, Gudermann T, Hebebrand J. Melanocortin-4 receptor gene: case-control study and transmission disequilibrium test confirm that functionally relevant mutations are compatible with a major gene effect for extreme obesity. J Clin Endocrinol Metab. 2003;88(9):4258-67.

41. Kirk S, Scott BJ, Daniels SR. Pediatric obesity epidemic: treatment options. J Am Diet Assoc. 2005;105(5 Suppl 1):S44-51.

42. Widhalm K, Dietrich S, Prager G. Adjustable gastric banding surgery in morbidly obese adolescents: experiences with eight patients. Int J Obes Relat Metab Disord. 2004;28 Suppl 3:S42-5.

43. Maggard MA, Shugarman LR, Suttorp M, Maglione M, Sugerman HJ, Livingston EH, Nguyen NT, Li Z, Mojica WA, Hilton L, Rhodes S, Morton SC, Shekelle PG. Meta-analysis: surgical treatment of obesity. Ann Intern Med. 2005;142(7):547-59.

simply H LLC
www.simplyh.com

Corporate HQ
5670 Wilshire Blvd
Suite No. 1777
Los Angeles, CA 90036

t 800-889-6697
t 323.937-9990
f 323.937-9992

Executive Officers:
CEO Dr. Richard Visser
Exec VP Lin Young

44. Kless W, Reich A. Clinical aspects of obesity in childhood and adolescence. Diagnosis, treatment and prevention. Int J Obes Reat Metab Disord 2001 (25 suppl): S 75-9.

45. Szadkowska A, Pietrzak I, Markuszewski L, Bodalski J. The role of insulin secretion and insulin resistance in the clinical course of newly diagnosed diabetes mellitus in children. Med Wieku Rozwoj. 2005;9(2):223-34.

46. Oberkofler H, Krempler F, Patsch W. Pathophysiology and genetics of obesity. Wien Klin Wochenschr. 2002;114 Suppl 4:4-9.

47. Speakman JR. Obesity: the integrated roles of environment and genetics. J Nutr. 2004;134(8 Suppl):2090S-2105S.

48. Lee YS, Poh LK, Loke KY. A novel melanocortin 3 receptor gene (MC3R) mutation associated with severe obesity. J Clin Endocrinol Metab. 2002;87(3):1423-6.

49. Gidding SS, Nehgme R, Heise C, Muscar C, Linton A, Hassink S. Severe obesity associated with cardiovascular deconditioning, high prevalence of cardiovascular risk factors, diabetes mellitus/hyperinsulinemia, and respiratory compromise. J Pediatr. 2004;144(6):766-9.

50. Benefice E, Ndiaye G. Relationships between anthropometry, cardiorespiratory fitness indices and physical activity levels in different age and sex groups in rural Senegal (West Africa). Ann Hum Biol. 2005;32(3):366-82.

Table1: Nutritional State Percentages by Sex for School-age Children from 6 to 11 Years.

Nutritional State	SEX								TOTAL			
	MALE				FEMALE							
	No.	%	LI	LS	No.	%	LI	LS	No.	%	LI	LS
Malnourished	89	4.4	3.4	5.3	90	4.7	3.7	5.7	179	4.5	3.8	5.2
Healthy	1138	55.8	53.7	58.0	1171	61.1	59.0	63.4	2309	58.4	56.9	60.0
Overweight	233	11.4	10.0	12.8	185	9.7	8.3	11.0	418	10.6	9.6	11.5
Obese	578	28.4	26.4	30.3	468	24.5	22.5	26.4	1046	26.5	25.1	27.9
Total	2038	100	-	-	1914	100	-	-	3952	100	-	-

simply H LLC
www.simplyh.com

Corporate HQ
5670 Wilshire Blvd
Suite No. 1777
Los Angeles, CA 90036

t 800-889-6697
t 323.937-9990
f 323.937-9992

Executive Officers:
CEO Dr. Richard Visser
Exec VP Lin Young

Table 2: Nutritional State Percentages by Sex for 6-year-old School Children.

AGE 6	SEX								TOTAL			
	MALE				FEMALE							
	No.	%	LI	LS	No.	%	LI	LS	No.	%	LI	LS
Malnour-ished	11	3.9	1.4	6.3	12	4.2	1.7	6.7	23	4.0	2.3	5.7
Healthy	149	52.3	43.3	58.3	189	66.1	60.4	71.7	338	59.3	55.1	63.3
Overweight	52	18.2	13.6	22.9	35	12.2	8.3	16.2	87	15.2	12.2	18.3
Obese	73	25.6	20.4	30.9	50	17.5	12.9	22.1	123	21.5	18.1	25.0
Total	285	100.0	-	-	286	100.0	-	-	571	100.0	-	-

Table 3: Nutritional State Percentages by Sex for 7-year-old School Children.

AGE 7	SEX								TOTAL			
	MALE				FEMALE							
	No.	%	LI	LS	No.	%	LI	LS	No.	%	LI	LS
Malnour-ished	20	5.8	3.2	8.4	15	4.6	2.2	7.0	35	5.2	3.4	7.0
Healthy	232	67.5	62.3	72.5	217	66.2	60.9	71.4	449	66.8	63.2	70.5
Overweight	31	9.0	5.8	12.2	28	8.5	5.4	11.7	59	8.8	6.6	11.0
Obese	61	17.7	13.6	21.9	68	20.7	16.2	25.3	129	19.2	16.1	22.2
Total	344	100.0	-	-	328	100.0	-	-	672	100.0	-	-

Table 4: Nutritional State Percentages by Sex for 8-year-old School Children.

AGE 8	SEX								TOTAL			
	MALE				FEMALE							
	No.	%	LI	LS	No.	%	LI	LS	No.	%	LI	LS
Malnour-ished	11	3.1	1.2	5.1	22	7.3	4.2	10.4	33	5.0	3.3	6.8
Healthy	195	55.2	49.9	60.6	214	70.9	65.6	76.2	409	62.5	58.7	66.2
Overweight	20	5.7	3.1	8.2	11	3.6	1.4	5.9	31	4.7	3.0	6.4
Obese	127	36.0	30.8	41.1	55	18.2	13.7	22.7	182	27.8	24.3	31.3
Total	353	100.0	-	-	302	100.0	-	-	655	100.0	-	-

simply H LLC
www.simplyh.com

Corporate HQ
5670 Wilshire Blvd
Suite No. 1777
Los Angeles, CA 90036

t 800-889-6697
t 323.937-9990
f 323.937-9992

Executive Officers:
CEO Dr. Richard Visser
Exec VP Lin Young

Table 5: Nutritional State Percentages by Sex for 9-year-old School Children.

AGE 9	SEX								TOTAL			
	MALE				FEMALE							
	No.	%	LI	LS	No.	%	LI	LS	No.	%	LI	LS
Malnour-ished	16	4.4	2.2	6.6	13	4.3	1.8	6.7	29	4.3	2.7	5.9
Healthy	201	55.2	50.0	60.5	178	58.4	52.7	64.1	379	56.7	52.8	60.5
Overweight	43	11.8	8.4	15.3	30	9.8	6.3	13.3	73	10.9	8.5	13.3
Obese	104	28.6	23.8	33.4	84	27.5	22.4	32.7	188	28.1	24.6	31.6
Total	364	100.0	-	-	305	100.0	-	-	669	100.0	-	-

Table 6: Nutritional State Percentages by Sex for 10-year-old School Children.

AGE 10	SEX								TOTAL			
	MALE				FEMALE							
	No.	%	LI	LS	No.	%	LI	LS	No.	%	LI	LS
Malnour-ished	11	3.3	1.2	5.4	18	5.4	2.8	7.9	29	4.4	2.7	6.0
Healthy	213	64.4	59.0	69.7	175	52.3	46.7	57.7	388	58.2	54.4	62.1
Overweight	26	7.8	4.8	10.9	41	12.2	8.6	15.9	67	10.1	7.7	12.4
Obese	81	24.5	19.7	29.3	101	30.1	25.1	35.2	182	27.3	23.9	30.8
Total	331	100.0	-	-	335	100.0	-	-	666	100.0	-	-

Table 7: Nutritional State Percentages by Sex for 11-year-old School Children.

AGE 11	SEX								TOTAL			
	MALE				FEMALE							
	No.	%	LI	LS	No.	%	LI	LS	No.	%	LI	LS
Malnour-ished	20	5.5	3.0	8.0	10	2.8	0.9	4.6	30	4.2	2.6	5.7
Healthy	148	41.0	35.8	46.2	198	55.3	50.0	60.6	346	48.1	44.4	51.8
Overweight	61	16.9	12.9	20.9	40	11.2	7.8	14.6	101	14.0	11.4	16.7
Obese	132	36.6	31.5	41.7	110	30.7	25.8	35.6	242	33.7	30.1	37.2
Total	361	100.0	-	-	358	100.0	-	-	719	100.0	-	-

simply H LLC
www.simplyh.com

Corporate HQ
5670 Wilshire Blvd
Suite No. 1777
Los Angeles, CA 90036

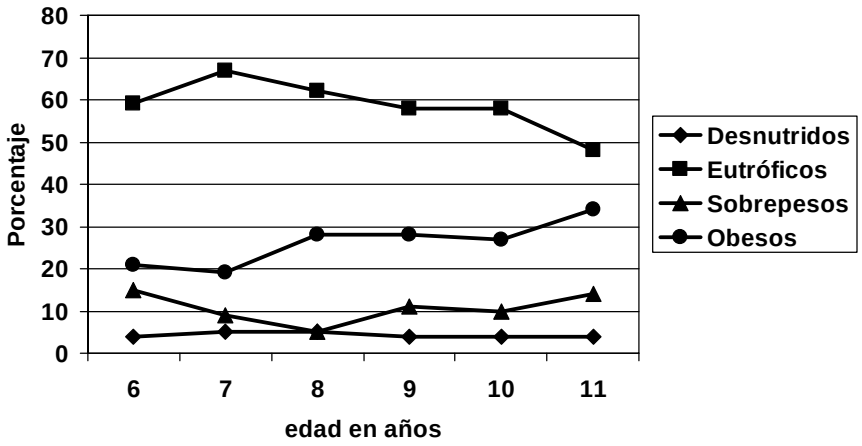
t 800-889-6697
t 323.937-9990
f 323.937-9992

Executive Officers:
CEO Dr. Richard Visser
Exec VP Lin Young

Table 8. Height/Age (H/A) Ratio Tendencies for School Children Studied

Nutritional Classification	No. of Children	High H/A Ratio
Malnourished	179	24 (12,8%)
Healthy	2309	336 (15,5%)
Overweight	418	88 (21%)
Obese	1046	416 (39,7%)
Total	3952	864 (22%)

Gráfico 1: Porcentaje de escolares según estado nutricional y edad



simply H

health

holistic

humanidad

healing

humanity

honestidad

heart

home

simply H LLC
www.simplyh.com

Corporate HQ
5670 Wilshire Blvd
Suite No. 1777
Los Angeles, CA 90036

t 800-889-6697
t 323.937-9990
f 323.937-9992

Executive Officers:
CEO Dr. Richard Visser
Exec VP Lin Young