

Original

## The “healthy lifestyle guide pyramid” for children and adolescents

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### Abstract

**Introduction:** Increasing evidence demonstrates that risk factors for chronic diseases are established during childhood and adolescence. Consensus about the need to increase prevention efforts makes the adoption of a healthy lifestyle seem desirable from early childhood onwards. After reviewing educational tools for children and adolescents aimed at promoting a healthy lifestyle, it was recognized that there was a need to develop a simple educational tool specifically designed for these age groups.

**Methods:** Development of the healthy lifestyle pyramid for children and adolescents.

**Results:** We propose a three-dimensional, truncated and staggered pyramid with 4 faces and a base, which introduces a completely new concept that goes beyond other published pyramids. Each of the faces is oriented towards achieving a different goal. Two faces (faces 1 and 2) are formulated around achieving a goal on a daily basis (daily food intake, face 1, and daily activities, face 2). Face 3 is an adaptation of the traditional food guide pyramid, adapted to children’s energy, nutritional and hydration needs. Face 4 deals with both daily and life-long habits. On the base of the pyramid, there is advice about adequate nutrition alternating with advice about physical activity and sports.

**Conclusion:** The Healthy Lifestyle Pyramid® is specifically developed for children and adolescents according to current scientific knowledge and evidence-based data and includes easy-to-follow advice and full colour pictures. Following these guidelines should improve health and reduce risk factors, promoting enjoyable and appropriate development towards adulthood.

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Key words: *Nutrition. Physical activity. Physical fitness. Hydration. Hygiene. Health.*

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### LA PIRAMIDE DEL ESTILO DE VIDA SALUDABLE PARA NIÑOS Y ADOLESCENTES

#### Resumen

**Introducción:** En la actualidad, existe evidencia científica de que los factores de riesgo de enfermedades crónicas se establecen durante la infancia y la adolescencia. La adopción de un estilo de vida saludable parece deseable desde edades tempranas existiendo un consenso cada vez mayor hacia la prevención. Al revisar las herramientas educativas existentes para niños y adolescentes dirigidas a la mejora de la adquisición de un estilo de vida saludable, se advirtió de la necesidad de desarrollar un instrumento educativo desarrollado específicamente para estos grupos de edad.

**Métodos:** Desarrollo de la pirámide de estilo de vida saludable para los niños y adolescentes.

**Resultados:** Nuestra propuesta trata de una pirámide tridimensional con 4 caras y una base, truncada y escalonada, introduciendo un nuevo concepto que va más allá de lo publicado en otras pirámides. Cada una de las caras se orienta hacia la consecución de un objetivo. Las dos primeras caras (caras 1 y 2) se han formulado con el fin de lograr un objetivo sobre una base diaria (alimentación diaria, la cara 1, frente a las actividades diarias la cara 2). La Cara 3 es una adaptación de la tradicional pirámide de alimentos, adecuada a las necesidades de energía, nutrientes e hidratación de los niños. La Cara 4 muestra los hábitos de higiene y salud que se deben mantener durante toda la vida. En la base de la pirámide, se alternan mensajes sobre la nutrición adecuada con mensajes relacionados con la actividad física y el deporte.

**Conclusión:** La Pirámide del Estilo de Vida Saludable® se ha desarrollado específicamente para niños y adolescentes, teniendo en cuenta los actuales conocimientos científicos. Incluye mensajes fáciles de entender e imágenes a todo color. El seguimiento de estas directrices debería contribuir a mejorar la salud y a la reducción de los factores de riesgo en la edad adulta, al tiempo que se divierten y crecen de una manera aconsejable.

(Nutr Hosp. 2008;23:159-168)

Palabras clave: *Nutrición. Actividad física. Condición física. Hidratación. Higiene. Salud.*

## Introduction

Since the first publishing of the *Food Guide Pyramid* in 1992,<sup>1</sup> hundreds of pyramids have been published world-wide, with the aim of adapting the message to a specific country or population group (vegetarians, athletes, children, etc.). During the last 15 years, the message has been updated according to new scientific evidence, both by scientists<sup>2</sup> and by governmental institutions<sup>3</sup>, mostly in relation to the positioning of foodstuffs in the pyramid and the number of portions. These last proposals include some advice about regular physical activity. At the same time, physical activity pyramids have been proposed for children, adolescents, adults and elderly,<sup>4,7</sup> which include no message about healthy nutrition and hydration at all. In most of these pyramids, proposals are given on the lower part about increasing daily incidental activity; on the second step about performing planned aerobic activities 3-5 days per week; on the third step about sports and active leisure 2-3 times per week and on the peak only to do sedentary activities occasionally. Reinhardt and Brevard<sup>8</sup> recognized the importance of both messages and proposed integrating both the Food Guide and the Physical Activity Pyramid to achieve positive dietary and physical activity behaviour in adolescents. The Spanish Ministry of Health has followed this suggestion (in the NAOS pyramid).<sup>9</sup> But Food Guide and Physical Activity Pyramids adapted for children and adolescents are extrapolated from those formulated for adults.<sup>10</sup> The position of foods and activities on the pyramids are the same, but both energy and nutrient requirements and daily activities in children and adolescents differ from those established for adults. The excellent review by Strong et al.<sup>11</sup> about the current situation, states that even if they are active, school-age

youth should participate daily in 60 minutes or more of sports (moderate to vigorous physical activity, 5-8 METs) in order to achieve desired health and behavioural outcomes. During development and sexual maturation, with the exception of the first year of life, the requirements are the highest of the whole lifespan.<sup>12</sup> In order to enhance bone development, there must be adequate intake of bone-related nutrients (calcium, magnesium, vitamin D, phosphorus) and mechanical loading of sufficient intensity.<sup>13,14</sup>

It has only been quite recently that research has focused on the early onset of risk factors during childhood and adolescence.<sup>15</sup> There is a consensus that the main health problems related to Nutrition and Physical activity that adolescents face are<sup>15,16</sup> (a) being overweight or obese, (b) anorexia and bulimia nervosa, (c) bone mineralization, and (d) the initiation of cardiovascular risk factors; but health-related problems go beyond nutrition and physical activity, as tobacco and alcohol consumption are high among adolescents and contribute to non-communicable diseases.<sup>17-22</sup> Several studies have found a relationship between hygiene and health.<sup>23</sup> Therefore, there is probably a need to go one step further not only integrating nutrition and physical activity<sup>8</sup> but making young people understand the importance of a healthy lifestyle.

Furthermore, data published in the literature indicate that children and adolescents are not following the recommendations for healthy eating<sup>24,25</sup> or physical activity patterns.<sup>11</sup> Therefore, there is still a need for public health initiatives to promote healthier lifestyles.

Our aim is to integrate all the above-mentioned aspects in an educational tool specifically developed for children and adolescents. To the best of our knowledge, no "healthy lifestyle pyramid", specifically developed for children and adolescents, has appeared to date.



Fig. 1.—The three-dimensional Healthy lifestyle pyramid for children and adolescents aged 6 to 18 years.

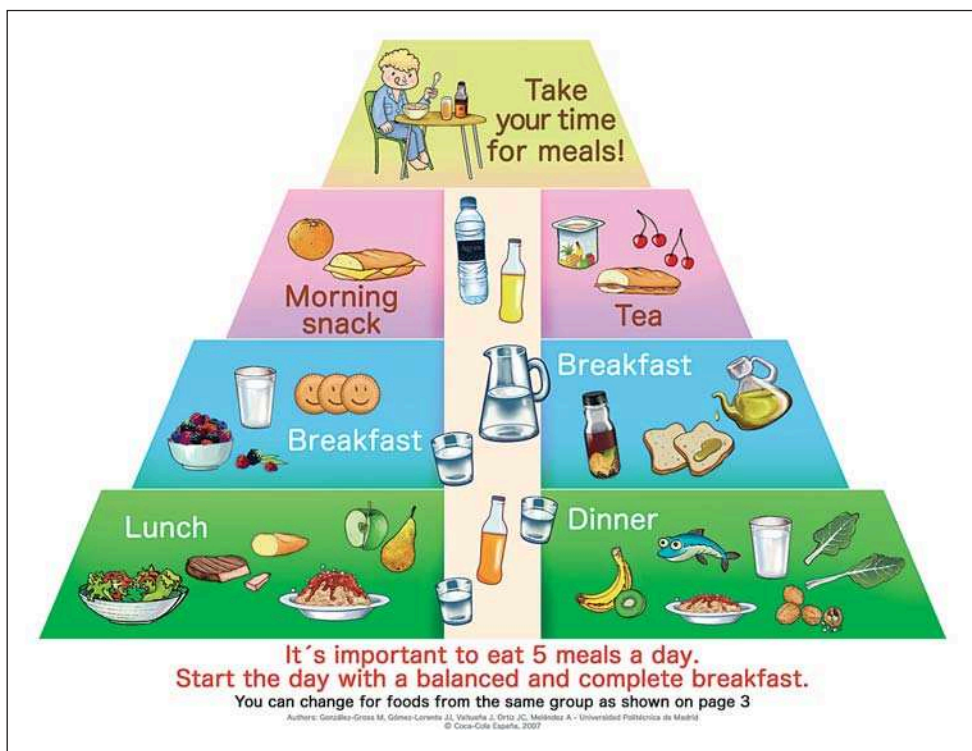


Fig. 2.—Face 1 of the pyramid. Daily intake.

## Material and methods

A multidisciplinary research team which included experts in nutrition, exercise physiology, physical activity and public health, most of them with more than 20 years of professional experience, carefully reviewed all available pyramids published in scientific journals, leaflets or in the internet.<sup>1-7,26-35</sup> It was decided to develop a completely innovative tool which should include all topics that lead to a healthy lifestyle: nutrition, hydration, physical activity, hygiene, avoiding accidents, no tobacco, and no alcohol. This should be communicated to the young people in the form of easy-to-follow advice and illustrated with pictures. The tool should be intuitive, logical and simple to understand, without the need of a manual. It was also decided that as a healthy lifestyle is a continuous learning process, the tool should be aimed at children aged 6 (when entering school) to 18 years. The number of portions is based on menus calculated by taking into account the Dietary Reference Intakes for energy, nutrients and liquids for these age groups developed by the Institute of Medicine.<sup>36-41</sup>

## Results

Our proposal is a three-dimensional truncated and staggered pyramid with 4 faces and a base, inspired by the pyramids of the Mayas (fig. 1) and introducing a completely new concept that goes beyond other published pyramids. As there is no peak, there is no goal in reaching the top of the pyramid. Instead, each of the faces is

oriented towards achieving a different goal. Two faces (faces 1 and 2) are formulated to achieve a goal on a daily basis. Face 1 (fig. 2) deals with daily food intake and emphasises the importance of having 5 regular meals per day while sitting in a relaxed atmosphere. Face 2 (fig. 3) presents daily activities in a 24 hour example, introducing the concept that all activities are beneficial and necessary but the time spent on them should differ. Face 3 (fig. 4) is an adaptation of the traditional food guide pyramid, adjusted to children's energy, nutrient and hydration needs. Olive oil is treated separately from other fat sources, and there is a clearly stated recommendation about consumption of legumes, and food with higher fat and sugar content. The foods proposed in the daily example given on face 1 can be changed for foodstuffs included in each of the food groups on face 3, so that children learn to introduce variety into their diet. Face 4 (fig. 5) deals with the acquisition of both daily and life-long habits. The first step is devoted to daily hygiene habits; and the second step to regular visits to the paediatrician, dentist and ophthalmologist. In the case of sports-oriented children and adolescents, a more thorough medical check-up is recommended. The advice included in the third step aims to avoid accidents, not only on the road, but also the domestic accidents that frequently affect children. The last step includes the only advice formulated in a negative way in the whole pyramid, the one related to non-smoking and no alcohol consumption. Advice about adequate nutrition alternates with advice about physical activity and sports on the base of the pyramid (fig. 6). They are grouped in three different columns, each column aimed at a specific age



range, that is, 6 to 9 years, 10 to 13 and 14 to 18 so that children and adolescents understand that a healthy lifestyle is a life-long process, that should start early in life and progressively introduce new concepts as a function of age. This is the reason why the term “sports” is defined for each age group, as it is an evolving concept throughout youth. Due to limited space and simplification of the education tool, gender-specific advice has not been included.

## Discussion

Health education for children and adolescents must have a different approach from that for adults. In fact, there is a consensus that health education during childhood and adolescence should not force models of behaviour onto individuals or groups. Adolescents need a food culture based on foods to eat rather than foods to avoid, and an understanding of suitable weight-control measures.<sup>42</sup> Following this recommendation, all advice included in the Healthy Lifestyle Pyramid for children and adolescents<sup>®</sup> is formulated in a positive way, except for alcohol and tobacco, where we could not find a positive way to effectively transmit the danger that smoking and alcohol consumption causes at these ages (fig. 4).

Current nutrition education for young people should be focused on food-based dietary guidelines<sup>43,44</sup> and food patterns.<sup>14,45,46</sup> Irregular meal patterns correlate with less healthy food choices, poor nutrient intake,

negative lifestyle factors, smoking included<sup>47,48</sup> and a higher risk of eating disorders.<sup>46</sup> Therefore, the daily dietary intake on face 1 gives an example of healthy food choices during a day, consumed on 5 “programmed” eating occasions (fig. 2) while sitting and taking time for meals. Recently, some doubts have been expressed in the literature about consuming 5 meals a day. In both adults and children there is little data dealing with this aspect,<sup>49</sup> but the current consensus still recommends three or more meals every day as the most adequate dietary pattern to promote adequate growth and sexual maturation.<sup>50</sup> Even in adults, more favourable lipid profiles have been observed with an increasing number of meals.<sup>51,52</sup> There is emphasis on having breakfast, as 2-35% of children and adolescents or even more skip or have a very deficient breakfast depending on age and country.<sup>53</sup> Regular breakfast habits correlate with healthier food choices<sup>54-56</sup> and better cognitive and physical performance.<sup>57</sup> Following our proposal, children and adolescents can change for food from the same food group shown on face 3 (fig. 4) to introduce variety. This means that for example for lunch, instead of pasta they can consume a similar amount of potatoes or rice, or instead of the orange as a morning snack they can choose no an apple or even a tomato. Fruits and vegetables are presented as one food group in order to simplify the message and following current food-based dietary guidelines.<sup>58</sup> The diets that satisfy the Food Guide Pyramid generally tend to satisfy the DRI.<sup>59</sup> Even taking into account country-specific situations, nutrients at risk in children and ado-

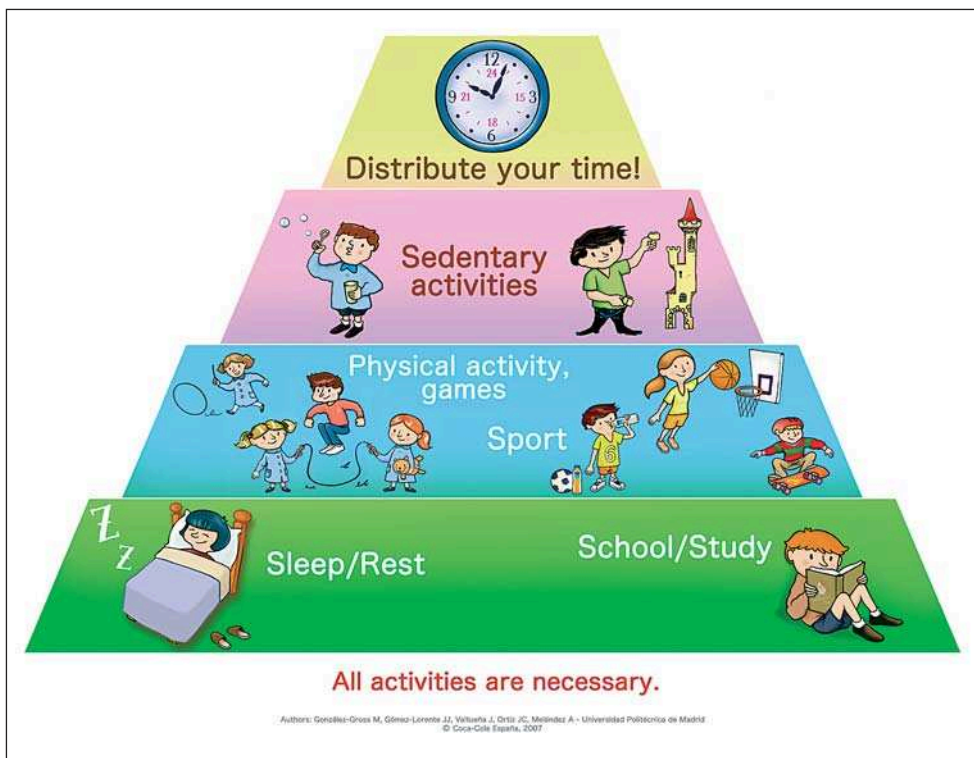


Fig. 3.—Face 2 of the pyramid. Daily activities.



Fig. 4.—Face 3 of the pyramid. Food guide pyramid for children and adolescents.

lescents living in developed countries are vitamin D, calcium, folate, iron, zinc, phosphorus and magnesium.<sup>12, 15, 48, 60-62</sup> Whole milk dairy products are recommended, in order to assure fatty acids, vitamin D and calcium intake. In order to meet current calcium recommendations (an adequate intake of 1,300 mg), and to keep the likelihood of inadequate intake to a minimum, an average of 4 servings of dairy products should be consumed by children aged 9-18 years.<sup>63</sup> Several studies have shown hypovitaminosis D in adolescents, particularly in girls,<sup>48</sup> who may avoid dairy products due to concerns that these foods are “fattening”. In a recent Swedish study, low intake of milk in both boys and girls correlated with a higher body fat percentage.<sup>56</sup> Adequate fat intake is always an issue. There is a consensus that schoolchildren should obtain 30% of total calories from fat, in order to guarantee fatty acid, mineral and vitamin intake<sup>41, 64</sup> and adequate growth. Data on fat metabolism during childhood is limited, but results indicate that there is a much higher fat oxidation than in adults and that preference is given to oxidation of dietary fat.<sup>64</sup> Following current guidelines and the traditional Mediterranean diets, olive oil and other vegetable oils (daily intake) should be differentiated from other fat sources, like fat meat, sausages, etc (upper step of the proposed food guide pyramid) (fig. 4), that can be consumed twice a week. Likewise, red meat, a good dietary source for iron and zinc, should be consumed more often by children and adolescents than recommended for adults.

One of the main criticisms and weak points of food guide pyramids is the difficulty consumers, especially

adolescents and people from low socio-economic environments have to interpret the portion size correctly.<sup>59</sup> The most frequent errors are overestimating the portion size of meat, underestimating the portion size of fruits and vegetables, and misclassification of some food like cookies, pastries and appetizers. Our proposal presents the same limitations but as portion size should increase with age, specifically during the growth spurt accompanying sexual maturation, we have included some advice on the base of the pyramid related to this topic (fig. 6).

In relationship to physical activity, our aim was to transmit the message based on a 24-hour daily routine. Daily activities of children and adolescents include around 8 to 10 hours of sleep and rest, 5 or 8 hours at school, depending on the country and the school system, homework and sedentary activities that are positive for their intellectual development, like for example reading, chess, puzzles, constructions or other games. Learning to play an instrument or listening to music or attending a concert are also positive sedentary activities. Thus as stated before, instead of prohibiting sedentary activities, the idea of this face of the pyramid is to show how young people can organize their day in order to have time for multiple occupations, including leisure time activities. Most experts agree on reducing sedentary behaviours (TV, computer) to less than 2 hours per day.<sup>11</sup> During recess at school and in the afternoon, children should have time to play traditional games, like skipping and elastic rope, hide and seek etc. and responsible teachers at schools should facilitate this. The review by Strong et al.<sup>11</sup> states that the

results of cross-sectional and longitudinal studies suggest that youth of both sexes who participate in relatively high levels of physical activity have less adiposity than less active youth.<sup>65-68</sup> This is the reason why physical activity is presented separately from sports. Young people must achieve a certain degree of physical fitness in order to reduce risk factors which can contribute to chronic diseases in adulthood.<sup>69,70</sup> A minimum of 40 minutes of activity per day, 5 days per week for 4 months appears to be required to achieve improvement in lipid and lipoprotein levels, primarily increased HDL-C and decreased triglyceride levels.<sup>11</sup> There is also some evidence that both physical fitness and physical activity may be associated with better academic outcomes, specifically related to memory, problem-solving, reading, and matching<sup>71-73</sup> and fewer incidences of disruptive behaviour.<sup>74</sup> Even if there are not too many studies published in this context, it is important to note that physical activity has not been associated with a decrease in academic performance, even when allocating more curricular time to programs of physical activity and reducing other subjects.<sup>11</sup> But types and contexts of activities are variable and change with age during childhood and adolescence. Emphasis changes from general physical activity, highlighting motor skills in early childhood to prescriptive physical activity, highlighting health, fitness and behavioural outcomes.<sup>75</sup> At younger ages, this physical activity is more related to games (6 to 9 years), than to basic sports (10 to 13 years) and at older ages, adolescents should follow a more structured training programme. This is the reason for the advice that is given in the three

columns on the base of the pyramid (fig. 6), so that children and their parents know about this evolution, which normally is not very clear to the general public outside the scientific or sport-related professions. Also some positive habits related to sports, like warming-up, stretching and adequate hydration are included. At all ages, activities should be supervised by a sport professional. The authors share with the scientific community the concern about the decline of physical activity during adolescence observed in several studies.<sup>8,76-78</sup> On the base of the pyramid the advice (“Don’t lose the acquired habits”) for the 14-18 year-old group is meant in this sense. Several studies support the idea that the real differences in eating habits between lean and overweight adolescents are very small.<sup>46,56,79</sup> Therefore, in regard to obesity prevention, emphasis should be placed on physical activity and sport. Other health-related variables, like cardiovascular, musculoskeletal and mental health, adiposity in overweight youth and blood pressure in mildly hypertensive adolescents will also benefit.<sup>11</sup> As Durstine and Lysterly<sup>80</sup> have stated recently, no physical activity or exercise is not an option.

Another important issue is hydration. Currently, there is little data published in the literature about water and beverage intake in young people.<sup>81</sup> Recommendations about water and liquid intake are included in faces 1 and 3 (figs. 2 and 4), transmitting the idea that fluids should be drunk throughout the day. On face 2 (fig. 3), second step a recommendation is included about fluid intake during sports. Several studies have reported a high incidence of involuntary dehydration in young athletes. This aspect is very frequent among children



Fig. 5.—Face 4 of the pyramid. Hygiene and health.



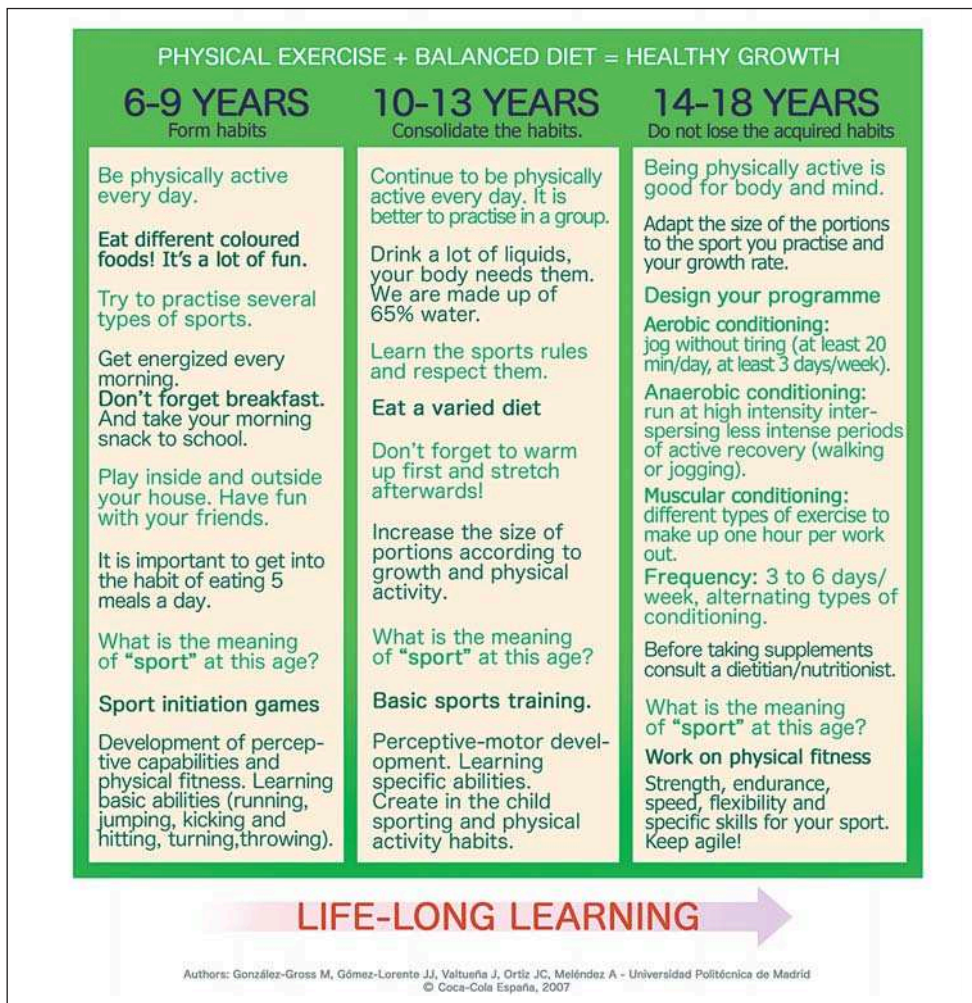


Fig. 6.—Base of the pyramid. Healthy growth.

and adolescents who exercise in the heat without being told to drink, especially when the replacement beverage is unflavoured water.<sup>82-84</sup> However, when the replacement drink contains carbohydrates (CHO) and electrolytes, sodium (Na<sup>+</sup>) fundamentally, these populations increase their fluid intake during and after exercise, although sometimes it is not sufficient to cover liquid needs. Children and young adolescents are at a much higher risk of heat-related disorders, including heat stroke, than adults;<sup>85</sup> therefore, adequate hydration is even more important in warm-climate countries.

Face 4 (fig. 5) deals with the acquisition of hygiene and health habits at young ages. Proper hygiene includes washing, dental care, medical visits, non-smoking and no alcohol consumption among others. It seems that good oral hygiene habits, established in early childhood, provide a foundation for a low experience of proximal caries in adolescents.<sup>86,87</sup> The Spanish Association of Sports Medicine together with the Spanish Association of Adolescent Medicine recommends a medical check-up before increasing training intensity for the child or adolescent athlete,<sup>88,89</sup> in order to detect diseases, disorders or defects that might be life-threatening or that could reduce sport performance.

Children and adolescents must avoid dangerous situations: in developing and industrialized countries 10-30% of all hospital admissions are due to accidental injuries, with children and adolescents particularly at risk. The European Community (EC) is working to improve the safety of the environment and products at home.<sup>90</sup> Another important issue is alcohol and tobacco consumption.<sup>91,92</sup> Children and adolescents must avoid all kind of alcoholic beverages. This includes both fermented (beer and wine) and distilled (gin, vodka, whiskey, etc.) alcoholic beverages, and all the different mixtures, some of them quite popular among the young people (i.e. alcopops). After reviewing the literature, Metzner and Kraus<sup>93</sup> conclude that a successful alcohol policy should aim to implement evidence-based measures for the reduction of total alcohol consumption in place of beverage-specific interventions. The prevalence of teenage smoking is around 15% in developing countries (with wide variations from country to country), and around 26% in the UK and USA. Prevention is essential, as there is some evidence that those who do not smoke before the age of 20 are significantly less likely to start as adults.<sup>94</sup>

## Conclusions

Children and adolescents have specific nutritional needs and a different daily activity plan from adults. In addition, health-related education is perceived in a different way. The Healthy Lifestyle Pyramid® is specifically developed for children and adolescents taking into account current scientific knowledge and evidence-based data and includes easy-to-follow advice and pictures. It is assumed that if they follow these guidelines they will improve health and reduce risk factors while having fun and developing appropriately towards adulthood.

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## References

1. USDA 1992. Food Guide Pyramid: A Guide to Daily Food Choices. Washington, DC: US Dept of Agriculture, Human Nutrition Information Services; 1992; *Home and Garden Bulletin* 252.
2. Willett WC, Stampfer MJ. Rebuilding the food pyramid. *Sci Am*. 2003; 288(1):64-71.
3. USDA 2005. My pyramid. <http://www.mypyramid.gov/sp-index.html>. Visited: 15/05/07.
4. University of Colorado (EE.UU.). La pirámide del ejercicio. <http://www.coopext.colostate.edu/Adams/nep/pdf/ExercisePyramid-sp.pdf>. Visited: 15/05/07
5. Rauramaa R, Leon AS. Physical Activity Pyramid. In Physical Activity and risk of cardiovascular disease in middle aged individuals. *Sports Medicine*; 1996; 22(2):65-69.
6. Charles B. Corbin. Fitness for Life Physical Activity Pyramid for Teens <http://www.humankinetics.com/products/showproduct.cfm?isbn=0736050981>. Visited: 11/05/07.
7. Park Nicollet HealthSource (1996). The Activity Pyramid. <http://prevention.sph.sc.edu/material/pyramid.htm>. Visited: 15/05/07.
8. Reinhardt WC, Brevard PB. Integrating the food guide pyramid and physical activity pyramid for positive dietary and physical activity behaviours in adolescents. *Am J Diet Assoc* 2002; 102:S97-S99.
9. Moreno Esteban B, Charro Salgado A. Nutrición, Actividad Física y Prevención de la Obesidad. Madrid: Ed. Panamericana, 2007.
10. González-Gross M. [Inclusion of physical activity messages to the Food Guide Pyramid]. Conference given at the Symposium: La sociedad y la escuela frente al reto de la obesidad infantil y juvenil. Departamento de Educación Física y Artística. Universidad Autónoma de Madrid. March 2006.
11. Strong WB, Malina RM, Blimkie CJR, et al. Evidence based physical activity for school-age youth. *J Pediatrics* 2005; 146:732-737.
12. Casas J, González-Gross M, Marcos A. Nutrición del adolescente. En: R Tojo, editor. *Tratado de Nutrición en Pediatría*. Barcelona: Ediciones Doyma, pp. 437-453, 2001.
13. Anderson JJB. Calcium requirements during adolescence to maximize bone health. *J Am Coll Nutr* 2001; 20:186S-191S.
14. Whiting SJ, Vatanparast H, Baxter-Jones A, Faulkner RA, Mirwald R, Bailey DA. Factors that affect bone mineral accrual in the adolescent growth spurt. *J Nutr* 2004; 134:696S-700S.
15. Moreno LA, González-Gross M, Kersting M, et al. on behalf of the HELENA Study Group. Assessing, understanding and modifying nutritional status, eating habits and physical activity in European adolescents. The HELENA Study. *Public Health Nutr* 2007; 6:1-12.
16. De Henauw S, Gottrand F, De Bourdeaudhuij I, et al. on behalf of the HELENA Study Group Nutritional status and lifestyle of adolescents in a public health perspective. The HELENA Project - Healthy Lifestyle in Europe by Nutrition in Adolescence. *J Public Health* 2007; 3:187-197.
17. Croft JB, Freedman DS, Cresanta JL, et al. Adverse influences of alcohol, tobacco, and oral contraceptive use on cardiovascular risk factors during transition to adulthood. *Am J Epidemiol* 1987; 126(2):202-13.
18. Freedman DS, Srinivasan SR, Shear CL, et al. Cigarette smoking initiation and longitudinal changes in serum lipids and lipoproteins in early adulthood: the Bogalusa Heart Study. *Am J Epidemiol* 1986; 124(2):207-19.
19. Bau PF, Bau CH, Rosito GA, Manfroí WC, Fuchs FD. Alcohol consumption, cardiovascular health, and endothelial function markers. *Alcohol* 2007; 41(7):479-88.
20. Eckardt MJ, File SE, Gessa GL, et al. Effects of moderate alcohol consumption on the central nervous system. *Alcohol Clin Exp Res* 1998; 22(5):998-1040.
21. Tang WK, Lum CM, Ungvari GS, Chiu HF. Alcohol consumption, lung function, and quality of life in pneumoconiosis. *Alcohol Clin Exp Res* 2005; 29(7):1230-6.
22. Ioannou GN, Dominitz JA, Weiss NS, Heagerty PJ, Kowdley KV. The effect of alcohol consumption on the prevalence of iron overload, iron deficiency, and iron deficiency anaemia. *Gastroenterology* 2004; 126(5):1293-301.
23. Marcer H, Finlay F, Jordan N. Body piercing in school children: a review of the issues. *Community Pract* 2006; 79(10):328-30.
24. Hurson-M, Corish-C. Evaluation of lifestyle, food consumption and nutrient intake patterns among Irish teenagers. *Ir J Med Sci* 1997; 166(4):225-30.
25. Savige GS, Ball K, Worsley A, Crawford D. Food intake patterns among Australian adolescents. *Asia Pac J Clin Nutr* 2007; 16(4):738-47.
26. Rovati, D. (2005). Pirámide de alimentos para niños. <http://www.bebesymas.com/2005/11/21-piramide-de-alimentos-para-ninos>. Visited: 15/05/07.
27. Willenberg, B. Children's Activity Pyramid. <http://www.madison.k12.al.us/Nutrition/gh1800.pdf>. Visited: 15/05/07.
28. Pirámide de la alimentación saludable. V Congreso de la Sociedad Española de Nutrición Comunitaria (SENC). Madrid, septiembre 2004. <http://obesidadinfantil.consumer.es/web/es/variedad/3.php>. Visited: 15/05/07.
29. Department of health and human services of EE.UU. <http://www.fitness.gov/images/pyramid2.jpg>. Visited: 11/05/07.
30. Department of Nutritional Sciences. University of Missouri. My Activity Pyramid. <http://extension.missouri.edu/explore/hesguide/foodnut/n00386.htm>. Visited: 11/05/07.
31. The kid's activity pyramid. [http://www.mediaworkshop.org/armory/health\\_nutrition/activity.gif](http://www.mediaworkshop.org/armory/health_nutrition/activity.gif). Visited: 11/05/07.
32. Charles B. Corbin. Fitness for Life Physical Activity Pyramid for Children. <http://www.humankinetics.com/products/showproduct.cfm?isbn=0736050981>. Visited: 11/05/07.



33. Deutsche Gesellschaft für Ernährung e.V. (2005). Die dreidimensionale Lebensmittelpyramide. <http://www.dge.de/modules.php?name=News&file=article&sid=481>. Visited: 15/05/07.
34. Sciences tobacco and you (2002). Pirámide alimenticia. <http://scienceu.fsu.edu/espanol/content/virtuallab/healthyfoodgroups/foodguide.html>. Visited: 11/05/07.
35. Guía pirámide de alimentos. [https://health.state.tn.us/wic/PDFs/Women/GU%C3%8DA\\_PIRAMIDE\\_DE\\_ALIMENTOS.pdf](https://health.state.tn.us/wic/PDFs/Women/GU%C3%8DA_PIRAMIDE_DE_ALIMENTOS.pdf). Visited: 15/05/07.
36. Dietary reference intakes for calcium, phosphorus, magnesium, vitamin D and fluoride/ Standing Committee on the Scientific Evaluation of Dietary Reference Intakes, Food and Nutrition Board, Institute of Medicine. Washington, DC: *National Academy Press*, 1997.
37. Dietary reference intakes for thiamin, riboflavin, niacin, vitamin B<sub>6</sub>, folate, vitamin B<sub>12</sub>, pantothenic acid, biotin, and choline/ a report of the Standing Committee on the Scientific Evaluation of Dietary Reference Intakes and its Panel on Folate, Other B Vitamins, and Choline and Subcommittee on Upper Levels on Nutrients, Food and Nutrition Board, Institute of Medicine. Washington, DC: *National Academy Press*, 1998.
38. Dietary Reference Intakes for vitamin C, vitamin E, selenium, and carotenoids: a report of the Panel on Dietary Antioxidants and Related Compounds, Subcommittees on Upper Reference Levels of Nutrients and of Interpretation and Use of Dietary Reference Intakes, and the Standing Committee on the Scientific Evaluation of Dietary Reference Intakes, Food and Nutrition Board, Institute of Medicine. Washington, DC: *National Academy Press*, 2000.
39. Dietary reference intakes for vitamin A, vitamin K, arsenic, boron, chromium, copper, iodine, iron, manganese, molybdenum, nickel, silicon, vanadium, and zinc. Institute of Medicine/ Food and Nutrition Board). Washington, DC: *National Academy Press*, 2001.
40. Dietary reference intakes for water, potassium, sodium, chloride, and sulphate. Institute of Medicine, Food and Nutrition Board. Washington, DC: *National Academy Press*, 2004.
41. Dietary reference intakes for energy, carbohydrate, fiber, fat, fatty acids, cholesterol, protein, and amino acids (macronutrients). Food and Nutrition Board, Institute of Medicine. Washington, DC: *National Academy Press*, 2005.
42. Nowak M. The weight-conscious adolescent: body image, food intake, and weight-related behaviour. *J Adol Health* 1998; 23:389-398.
43. Food and Agriculture Organization/World Health Organization of the United Nations. Preparation and use of Food-based-dietary guidelines. Report on a joint FAO/WHO consultation. Nicosia, Cyprus. WHO/NUT/96.6, 1996.
44. IEFS. *Brit J Nutr* 1999; 81:Supl. 2.
45. Perry-C; Lytle-LA; Feldman-H, et al. Effects of the child and adolescent trial for cardiovascular health (CATCH) on fruit and vegetable intake. *J Nutr Education* 1998; 30(6):354-360.
46. Neumark-Sztainer D, Eisenberg ME, Fulkerson JA, Story M, Larson NI. Family meals and disordered eating in adolescents: longitudinal findings from project EAT. *Arch Pediatr Adolesc Med* 2008; 162(1):17-22.
47. Sjöberg A, Hallberg L, Höglund D, Hulthen L. Meal pattern, food choice, nutrient intake and lifestyle factors in the Göteborg Adolescence Study. *Eur J Clin Nutr* 2003; 57:1569-1578.
48. Samuelson G, Bratteby LE, Enghardt H, Hedgren M. Food habits and energy and nutrient intake in Swedish adolescents approaching the year 2000. *Acta Pediatr Suppl* 1996; 415:1-19.
49. Rodríguez G, Moreno LA. Is dietary intake able to explain differences in body fatness in children and adolescents? *Nutrition, Metab & Cardiovascular Disease* 2006; 16:294-301.
50. Mattson MP. The need for controlled studies of the effects of meal frequency on health. *Lancet* 2005; 365:1978-1980.
51. Redondo MR, Ortega RM, Zamora MJ, et al. Influence of the number of meals taken per day on cardiovascular risk factors and the energy and nutrient intakes of a group of elderly people. *Int J Vit Nutr Res* 1997; 67:176-82.
52. Titan SM, Bingham S, Welch A, et al. Frequency of eating and concentrations of serum cholesterol in the Norfolk population of the European prospective investigation into cancer (EPIC-Norfolk): Cross-sectional study. *BMJ* 2001; 323:1286-1288.
53. Moreno LA, Kersting M, de Henauw S, et al. How to measure dietary intake and food habits in adolescence: the European perspective. *Int J Obes* 2005; 29(Supl. 2):S66-S77.
54. Nicklas TA, Bao W, Webber LS, Berenson GS. Breakfast consumption affects adequacy of total daily intake in children. *J Am Diet Assoc* 1993; 93(8):886-91.
55. Chitra U, Reddy RC. The role of breakfast in nutrient intake of urban schoolchildren. *Public Health Nutr* 2007; 10:55-58.
56. Vagstrand K, Barkeling B, Forslund HB, et al. Eating habits in relation to body fatness and gender in adolescents-results from the SWEDES study. *Eur J Clin Nutr* 2007; 61:517-25.
57. Horswill C, Cromer B, Stein A, Thornton D. Acute effect of consumption/omission of breakfast on exercise tolerance in adolescents. *J Sports Med Phys Fitness* 1992; 32:76-83.
58. Blanchette L, Brug J. Determinants of fruit and vegetable consumption among 6-12-year-old children and effective interventions to increase consumption. *J Hum Nutr Diet* 2005; 18(6):431-43.
59. Tavelli S, Beerman K, Shultz JE, Heiss C. Sources of error and nutritional adequacy of the food guide pyramid. *JACH* 1998; 47:77-82.
60. Al-Tahan J, González-Gross M, Pietrzik K. B-vitamin status and intake in European adolescents. A review of the literature. *Nutr Hosp* 2006; 21(4):452-65.
61. Valtueña J, González-Gross M, Sola R. Iron status of Spanish junior soccer and basketball players. *Int J Sport Sci* 2006; 4:57-68.
62. Schenkel TC, Stockman NK, Brown JN, Duncan AM. Evaluation of energy, nutrient and dietary fiber intakes of adolescent males. *J Am Coll Nutr* 2007; 26(3):264-71.
63. Fulgoni VL, Hunth PJ, DiRienzo DB, Miller GD. Determination of the optimal number of dairy servings to ensure a low prevalence of inadequate calcium intake in Americans. *J Am Coll Nutr* 2004; 23:651-659.
64. Butte NF. Fat intake of children in relation to energy requirements. *Am J Clin Nutr* 2000; 72(Supl. 1):1246S-52S.
65. Bennell K, Khan K, Matthew B et al. Activity-Associated differences in bone mineral are evident before puberty: a cross-sectional study of 130 female novice dancers and controls. *Pediatric Exercise Science* 2000; 12 371-381.
66. Kemper HCG, Niemeier C. The importance of a physically active lifestyle during youth for peak bone mass. In New Horizons in Pediatric Exercise Science. Ed CJR Blimkie and O Bar-Or. *Human Kinetics* 1995; 77-95.
67. Bailey DA. The role of mechanical loading in the regulation of skeletal development during growth. In New Horizons in Pediatric Exercise Science. Ed CJR Blimkie and O Bar-Or. *Human Kinetics* 1995; 97-108.
68. Kemper HCG. Skeletal development during childhood and adolescence and the effects of physical activity. *Pediatric Exercise Science* 2000; 12:198-216.
69. García-Artero E, Ortega FB, Ruiz JR, et al. [Lipid and metabolic profiles in adolescents are affected more by physical fitness than physical activity (AVENA study)]. *Rev Esp Cardiol* 2007; 60(6):581-8.
70. Ruiz JR, Sola R, González-Gross M, et al. Cardiovascular fitness is negatively associated with homocysteine levels in female Spanish adolescents. *Arch Pediatr Adolesc Med* 2007; 161(2):166-71.
71. Daley AJ, Ryan J. Academic performance and participation in physical activity by secondary school adolescents. *Percept Mot Skills* 2000; 91:531-534.
72. Keays JJ, Allison KR. The effects of regular moderate to vigorous physical activity on student outcomes: a review. *Can J Public Health* 1995; 86:62-65.
73. California Department of Education. State study proves physically fit kids perform better academically.

- <http://www.cde.ca.gov/nr/ne/yr02/yr02rel137.asp>. Visited: 15/05/07.
74. NIHCM. Obesity in young children: impact and intervention. Management NIfHC, Editor. NICHM Foundation, 2004.
  75. Malina RM. Fitness and performance: adult health and the culture of youth, new paradigms? In: RJ Park & MH Eckert, eds. *New possibilities, new paradigms?* (American Academy of Physical Education Papers No. 24). Champaign, IL: Human Kinetics Publishers; 1991, pp. 30-38.
  76. Caspersen CJ, Pereira MA, Curran KM. Changes in physical activity patterns in the United States, by sex and cross-sectional age. *Med Sci Sports Exerc* 2000; 32(9):1601-9.
  77. Tercedor P, Martín-Matillas M, Chillón P, et al. [Increase in cigarette smoking and decrease in the level of physical activity among Spanish adolescents. AVENA study]. *Nutr Hosp* 2007; 22(1):89-94. Spanish.
  78. Suris JC, Michaud PA, Chossis I, Jeannin A. Towards a sedentary society: trends in adolescent sport practice in Switzerland (1993-2002). *J Adolesc Health* 2006; 39(1):132-4.
  79. Reinehr T, Kersting M, Chahda C, Andler W. Nutritional knowledge of obese compared to non obese children. *Nutr Res* 2003; 23:645-649.
  80. Durstine JL, Lysterly GW. No physical activity or exercise is not an option. *J Appl Physiol* 2007; (May 24). Doi:10.1152/jaapphysiol.00477.2007. Editorial.
  81. Manz F. Hydration in children. *J Am Coll Nutr* 2007; 26(5 Supl.):562S-569S.
  82. Bar-Or O, Inbar O, Rothshtein A, Zonder H. Voluntary hypohydration in 10 to 12 year-old boys. *Journal of Applied Physiology* 1980; 48:104-108.
  83. Minehan MR, Riley MD, Burke LM. Effect of flavour and awareness of kilojoule content of drinks on preference and fluid balance in team sports. *International Journal of Sport Nutrition and Exercise Metabolism* 2002; 12(1):81-92.
  84. Rivera-Brown, AM, Torres M, Ramírez-Marrero F, Bar-Or O. Drink composition, voluntary drinking and fluid balance in exercising trained heat-acclimatized girls. *Medicine & Science in Sports and Exercise* 1999b; 31:S92.
  85. Wilmore JH, Costill DL. *Fisiología del Esfuerzo y del Deporte*. Ed. Paidotribo. Barcelona. 2003.
  86. Alm A, Wendt LK, Koch G, Birkhed D. Oral Hygiene and Parent-Related Factors during Early Childhood in Relation to Approximal Caries at 15 Years of Age. *Caries Res* 2007; 27;42(1):28-36.
  87. Douglass JM, Douglass AB, Silk HJ. A practical guide to infant oral health. *Am Fam Physician* 2004; 70(11): 2113-20.
  88. Asociación española de medicina en la adolescencia de la AEP. [http://www.adolescenciasema.org/index.php?menu=noticias&opcion=ver\\_noticia&id=1062&id\\_categoria=46](http://www.adolescenciasema.org/index.php?menu=noticias&opcion=ver_noticia&id=1062&id_categoria=46). Visited: 04/09/07.
  89. Asociación Aragonesa de Medicina del deporte. <http://www.femede.es/popup.php?/Publicaciones/Reconocimientos>. Visited: 04/09/07.
  90. Rogmans WH. Preventing accidents in childhood: a European perspective. *Acta Paediatr Jpn* 1993; 35(3):215-22.
  91. Infante C, Rubio-Colavida JM. La prevalencia del consumo de tabaco en España. *Adicciones* 2004; Vol. 16, Supl. 2.
  92. Rodríguez Artalejo F. Health counseling about alcoholic beverage consumption. *An R Acad Nac Med (Madr)* 2001; 118(1):111-24; discussion 124-9.
  93. Metzner C, Kraus L. The Impact of Alcopops on Adolescent Drinking: a Literature Review. *Alcohol Alcohol* 2007 Oct 17[Epub ahead of print].
  94. Grimshaw GM, Stanton A. Tobacco cessation interventions for young people. *Cochrane Database Syst Rev* 2006; 18(4):CD003289.