

# The Eating Habits of School Children from the Longevity Blue Zone of Sardinia: a Positive Model

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## Abstract

A healthy diet should balance caloric intake (quality calories) with a variety of foods poor in simple sugars, such as cereals and legumes, fruits and vegetables, nuts, low-fat dairy products, fish, meat, and eggs prepared with culinary skills and minimally processed. This paper investigates the eating habits of school children of Villagrande, Italy, a rural village characterized by the remarkable longevity of its inhabitants, and makes a comparison with a sample of school children of the same age from an urban setting in the island. A specific questionnaire was used to collect demographic data, meals structure and composition, frequency of food consumption, and characteristic of the usual diet.

The frequency of healthy eating habits, according to the current standards, was superior in the rural compared to the urban setting. The consumption of vegetables was higher in rural than in urban students ( $\geq$  once a week, 94% vs 54%,  $p < 0.01$ ) whereas for fruit and legumes the percentages were comparable ( $\geq$  once a week, 97% vs 94% and 79% vs 71%, respectively). Cheese, which is a typical product of Sardinia and mostly homemade, was consumed more than once a week in 86% of rural compared to 73% of urban school children. Fish consumption was consistently higher in the rural compared to the urban area (more than once a week 81% vs 65% ( $p < 0.001$ )). Alcoholic beverages were consumed in small quantities in both cohorts surveyed, while soft drinks to a greater extent among urban school children. The overall nutrition pattern observed in the rural village could be considered the result of persistent traditional household influence and may prove useful to prevent early onset of obesity if extended to a broader school children population, although the implementation of such observations may be the biggest challenge.

**Keywords:** Sardinia; Eating behaviour; School children

## Introduction

Promoting healthy lifestyles, including nutritional habits, is a strategy essential for preventing the onset of chronic diseases during adult life [1]. To achieve this goal it is necessary to stimulate the adoption of a healthy diet early in life [2]. Several studies in Western countries suggest that incorrect nutrition in childhood is associated with overweight and obesity in adult life, thus increasing the prevalence of chronic non-transmissible diseases which are the leading cause of morbidity and mortality [3-5]. According to current estimates, between 5% and 30% of the school children population in most European countries overweight/obese [1] and this phenomenon is rapidly growing. In the last fifty years there has been a progressive modification of eating habits in the industrialized world, which entailed moving away from traditional diets in favour of a “Western” diet pattern, often referred as Standard American Diet (SAD) [6] which is undoubtedly expanding in many areas of the world [7]. This tendency, that nowadays is particularly evident in teenagers, is characterized by increased consumption of high-calorie, low-nutrient foods, rich in saturated fats, salt and simple carbohydrates, and low-quality, highly processed, animal-derived foods with the consequence of a decreased consumption of fruit and vegetables, whole grains, legumes, nutritious dairy products, often accompanied by a decline in daily physical activity from outdoor leisure activities.

Along with this “nutrition transition” there is a similar transition in cooking and food preparation, which involves increased use of pre-prepared and pre-packaged food. These changes in cooking and food

preparation skills have been determined by general socioeconomic mechanisms such as the participation of women in the labor market which is not compatible with the time required for traditional cooking. This has resulted in an epidemic of excess weight in children, and consequent increase in their risk of metabolic and cardiovascular diseases in adulthood [7-8]. Literature data indicates that children are particularly prone to developing unhealthy eating habits during school years, a period crucial for the individual’s development, as the rising rate of cardiovascular morbidity and mortality in adulthood, beyond the genetic background, depends largely on the lifestyle habits acquired during pre-adolescence [8]. In addition, overall school performance also depends on healthy eating habits, which should thus be regarded as a primary concern in education programmes [3,7]. Unhealthy dietary habits in adulthood, such as skipping breakfast, indulging in saturated fats-containing foods or sweet beverages, and the frequent habit of eating in fast foods restaurants, almost always date back to

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the school period [9]. As the quality of eating behaviour in childhood is strongly influenced by the home environment, as well as by family education and background, there is a growing interest in investigating these aspects.

In the Mediterranean island of Sardinia nutrition transition occurred later than in mainland Italy [10,11], resulting in a prolonged exposure of the population to the traditional diet. In this island a hot spot of exceptional longevity (called Blue Zone) has been recently identified among the rural population [12]; its presence has been mainly attributed to the persistence of good nutritional standards inherited from the local tradition [13]. This finding seems to be related to the positive effect of an inter-generational transmission of the traditional lifestyle which combined the old knowledge with the positive aspects of transition [13]. A multi-center study carried out in 2341 Sardinian school children, aged 6-12, estimated between 6.6% and 18.7% the prevalence of obesity and overweight in this age group [14]. This proportion is lower than national average and far below the percentage of 30% recorded in the pre-adolescent population of Southern Italy [15]. However, up to now no data is available regarding school children living in the Blue Zone.

The object of this study was to investigate the prevalence of nutritional preferences among school children of both genders aged between 10 and 15, living in the Blue Zone, rural village of Villagrande Strisaili (hereafter referred as Villagrande), compared to an urban setting in the North of Sardinia island.

## Research Methods

The analysis presented in this study is part of a larger study currently underway in the province of Ogliastra, in the central-eastern area of Sardinia, aimed at investigating the dietary habits and the intergenerational transmission of nutritional features in a long-lived population [16]. The interest towards this community relies in the fact that the population of Ogliastra displays the lowest prevalence of overweight/obesity in the island [17], as well as a higher life expectancy compared to other areas of Sardinia [12]. This led us to hypothesize the role of lifestyle and nutritional factors in the remarkable good health and survival recorded in this community [11,13]. We performed a cross-sectional study which consisted in the investigation of 236 school children divided into two groups. The first one included all students present in 2012 in the *Comprensorio Villagrande Strisaili*, in the rural province of Ogliastra, Sardinia. The second group of school children was recruited in the town of Sassari, a 129,000-inhabitant urban center in the North-West of the island. All students were born in 1997 and at recruitment time they were aged between 10 and 15 years. In particular, these students attended the 4th and 5th year of elementary school or the first two years of middle school. The survey was organized through a series of meetings between teachers, students and nutritionists during which a food frequency questionnaire was administered. The questionnaire was completed by the investigators with the cooperation of children's parents in order to obtain demographic information, including age and gender of the child, place of residence and eating habits. The experimental protocol, the questionnaires on food and physical activity and the informed consent were submitted to the local Ethics Committee for approval before the start of the study. All students enrolled in the study were given an informed consent form that was returned with the signature of the parents [Prot. ORG 13 of 09/02/2012].

## Structure of daily dietary habits in Italy

To facilitate the interpretation of the results of this study, it may be

useful to clarify that in Sardinia-as in Italy-daily meal structure follows a fairly constant pattern. Breakfast is usually very light and consists mostly in a cup of coffee (*espresso*) or capuccino with milk and bread or cookies, and more recently, industrially processed sweet pastry filled with jam, cream or chocolate. Lunch is the biggest meal of the day and it is usually consumed at home with the family between 13:00 and 14:00 p.m. The first course (*primo piatto*) consists usually in pasta, or rice (especially in the North of Italy though less frequently in Sardinia). The main course (*secondo piatto*) typically includes meat or fish with vegetables or salad sometimes with cheese. This is often followed by fresh fruit or perhaps a sweet dessert. A full meal includes a first course, a main course and fruit or dessert and it is quite heavy. As in many Mediterranean countries, the preferred alcoholic beverage in Sardinia is wine which is consumed in moderate amounts (1 glass on average) and only during the meal. The evening meal is typically light (pulse soup, salad, cheese, vegetables and fruit). Appetizers are not frequent in daily meals.

## Recruitment of participants and questionnaire

A structured qualitative questionnaire, obtained from a slight modification of a previous questionnaire adopted in nutrition studies in Sardinia [14], was administered to each school child included in the study for the collection of personal data, eating habits, and lifestyle including physical activity. A copy of the questionnaire is shown in as supplemental material. Briefly, the questionnaire consisted three parts: Part I included the students' personal data and parents' names; Part II included a group of questions regarding the number and type of meals; Part III included general insight regarding the frequency of consumption of various food categories.

## Statistical analysis

Mean values  $\pm$  standard deviation or frequencies of the main parameters derived from the analysis of the questionnaire were calculated and represented in the form of tables. For comparing groups the Mann-Whitney U test for continuous variables and the Pearson  $\chi^2$  for frequencies were used with SPSS 10.1 (SPSS Inc., Chicago, IL, USA). The significance of differences was set at  $p=0.05$ .

## Results

As shown in Table 1, among 236 school children 116 (59 boys and 57 girls) were from Villagrande (rural area), and 120 (60 boys and 60 girls) were from Sassari (urban area).

## Breakfast

To the question: "Do you have breakfast in the morning?" 89% of rural students responded yes, with predominance of boys (95%) compared to girls (82%) ( $p=0.033$ ). All students except one girl (99%) eat breakfast at home. In the urban group only 89 (74%) did eat breakfast at home. Table 2 shows the frequency of breakfast consumption for different food categories in the sample of students by gender. In the rural setting 76% percent of boys and 96% of girls consumed milk products daily, followed by cookies (M 54.2%, F 49.1%), cereals (30.5%) and bread and Nutella\* (sweet cream chocolate-based) (20.3%). In the

Location	Variable	Boys	Girls	Total
Villagrande S.	No.	59 (50.9%)	57 (49.1%)	116
	Age (years)	11.8 $\pm$ 1.3	11.9 $\pm$ 1.1	11.8 $\pm$ 1.2
Sassari	No.	60 (50%)	60 (50%)	120
	Age (years)	10.7 $\pm$ 2.4	10.2 $\pm$ 1.0	11.1 $\pm$ 1.3

Table 1: Values of Villagrande S. And Sassari.

Food	Villagrande (rural)		Sassari (urban)	
	Boys	Girls	Boys	Girls
Milk	45 (76.3%)	55 (96.5%)	36 (60.7%)	31 (52.4%)
Cereals	18 (30.5%)	23 (40.4%)	17 (28.6%)	17 (28.6%)
Chocolate	8 (13.6%)	6 (10.3%)	2 (3.6%)	6 (9.5%)
Cookies	32 (54.2%)	28 (49.1%)	13 (21.4%)	26 (42.9%)
Coffee	3 (5.1%)	8 (14.0%)	13 (21.4%)	6 (9.5%)
Cappuccino	3 (5.1%)	7 (12.3%)	13 (21.4%)	0 (0.0%)
Thé	9 (15.3%)	4 (7.0%)	15 (25.0%)	9 (14.3%)
Pizza/paste	1 (1.7%)	0 (0.0%)	4 (7.1%)	6 (9.5%)
Juice/sqwashed fruit	15 (25.4%)	9 (15.8%)	9 (14.3%)	29 (47.6%)
Hot dog	3 (5.1%)	5 (8.8%)	0 (0.0%)	3 (4.8%)
Sweets	2 (3.4%)	4 (7.0%)	26 (42.9%)	0 (0.0%)
Jam/rusks/butter	5 (8.5%)	2 (3.5%)	6 (10.7%)	3 (4.8%)
Bread and Nutella	12 (20.3%)	17 (29.8%)	0 (0.0%)	0 (0.0%)
Other	6 (10.2%)	2 (3.5%)	2 (3.6%)	0 (0.0%)

Table 2: Food frequency at breakfast.

urban setting the two most consumed food were milk (M 60.7%, F 52.4%) and sweets (M 42.9%).

### Snacks

Up to 95% of students in the rural setting had mid-morning snacks (boys 97% vs. girls 93%). The preferred foods were in order of frequency: sandwich and fruit (Table 3). The totality of girls and 98.3% of boys had lunch at home and only a minority of studied children (12/120) attended the canteen, albeit intermittently. Up to 80% of students had also mid-afternoon snacks, with a slightly lower frequency in comparison to mid-morning snacks. There was no gender difference (Table 4). The two most frequently consumed foods were sandwiches and fruit. Preferred foods were sweets among boys (35%) and fruit among girls (37%); followed by sweet snacks in girls (30%) and fruit in boys (30%).

### Main meals

None of the students interviewed in Villagrande had lunch or dinner outside their home, whereas 100% of urban students attended the canteen. The structure of lunch and dinner is given in Tables 4,5 and 6, respectively. In general the school children of the urban location preferred a full meal (at lunch 60% of boys and 76% of girls respectively; at dinner 54% of boys and 29% of girls, respectively). In contrast, boys from the rural municipality preferred a less complete meal (at lunch only the first course in 37% of boys and 45% of girls; at dinner a first plus second course in 32% of boys, only fruits and vegetables in 30% of girls). Consumption of fruits and vegetables in both lunch and dinner was considerably higher in rural than in urban school children. Most importantly, especially in the rural setting, the food is homemade while in the urban setting a not negligible percentage consumed prepared foods.

### Food preferences in rural and urban cohorts

Table 7 displays the food preferences, regardless of gender, estimated as a weekly frequency of consumption. The overall consumption of meat was higher among children residing in the rural areas than among those living in the urban area (100% vs 94%) a point worth considering due to the importance of high quality proteins for child's successful development. In detail, students reported that the consumption of homemade "sausages", "salami" and "ham" and other typical homemade food products was considerable. It must be clarified that in Sardinia homemade processed meat does not contain

preservatives or other chemical products, using only salt and spices such as pepper, onion, anisette etc. 31% of the sample consumed it daily, and only 9% abstained completely, similarly to the urban area. This difference extended also to cheese which is a typical product of Sardinia and mostly homemade (more than once a week, 86% versus 73%,  $p < 0.05$ ). The frequency of fish consumption was consistently higher in the rural compared to the urban area (more than once a week

Food	Villagrande (rural)		Sassari (urban)	
	Boys	Girls	Boys	Girls
Hot dog	44/59 (74.5%)	37/57 (64.9%)	43/60 (71.4%)	51/60 (85.7%)
Snack	7/59 (11.8%)	10/57 (17.5%)	15/60 (25.0%)	11/60 (19.0%)
Pizza	3/59 (5%)	0/57 (0%)	0 (0.0%)	9/60 (14.3%)
Cappuccino/coffee	4/59 (6.7%)	1/57 (1.7%)	0 (0.0%)	0 (0.0%)
Sweets (pastries & similar)	4/59 (6.7%)	2/57 (3.5%)	4/60 (7.1%)	0 (0.0%)
Fruit	12/59 (20.3%)	16.57 (28.0%)	2/60 (3.6%)	0 (0.0%)
Other	9/59 (15.2%)	11/57 (19.2%)	6/60 (10.7%)	0 (0.0%)

Table 3: Food frequency at 1st snack.

Food	Villagrande (rural)		Sassari (urban)	
	Boys	Girls	Boys	Girls
First course ("Primo")	22/59 (37.2%)	26/57 (45.0%)	13/60 (21.4%)	0 (0.0%)
Second course ("Secondo")	9/59 (15.2%)	10/57 (17.5%)	0 (0.0%)	0 (0.0%)
First & second course	9/59 (15.2%)	13/57 (22.8%)	13/60 (21.4%)	11/60 (19.0%)
Fruit/vegetables	17/59 (28.8%)	22/57 (38.6%)	9/60 (14.3%)	0 (0.0%)
Hot dog	4/59 (6.8%)	0/0 (0%)	0 (0.0%)	0 (0.0%)
Full meal (First, second course & fruit)	21/59 (35.6)	15/57 (26.3%)	36/60 (60.7%)	46/60 (76.2%)
Pizza	2/59 (3.4%)	4/57 (7.0%)	2/60 (3.6%)	0 (0.0%)
Other	1/69 (3.4%)	1/57 (1.7%)	0 (0.0%)	0 (0.0%)

Table 4: Frequency of meals at lunch.

Food	Villagrande (rural)		Sassari (urban)	
	Boys	Girls	Boys	Girls
Hot dog	12/59 (23%)	5/57 (8.7%)	30 (50.0%)	23 (38.1%)
Snack	11/59 (18.6%)	14/57 (24.5%)	19 (32.1%)	26 (42.9%)
Pizza	4/59 (6.7%)	2/57 (3.5%)	2 (3.6%)	3 (4.8%)
Cappuccino/coffee	4/59 (6.7%)	6/57 (10.5%)	9 (14.3%)	3 (4.8%)
Sweets (pastry & similar)	21/59 (35.6%)	17/57 (29.8%)	6 (10.7%)	11 (19.0%)
Fruit	18/59 (30.5%)	21/57 (36.8%)	9 (14.3%)	11 (19.0%)

Table 5: Food frequency at 2st snack.

Food	Villagrande (rural)		Sassari (urban)	
	Boys	Girls	Boys	Girls
First course	13/59 (22.0%)	18/57 (31.5%)	19/60 (32.1%)	17 (28.6%)
Second course	12/59 (20.3%)	9/57 (15.7%)	4/60 (7.1%)	11 (19.0%)
First and second course	19/59 (32.2%)	16/57 (28.0%)	4/60 (7.1%)	20 (33.3%)
Fruit/vegetables	14/59 (23.7%)	17/57 (29.8%)	6/60 (10.7%)	3 (4.8%)
Hot dog	3/59 (5.1%)	0%	4/60 (7.1%)	0%
Full meal (First, second course & fruit)	11/59 (18.6%)	13/57 (22.8%)	32/60 (53.6%)	17 (28.6%)
Pizza	18/59 (30.5%)	8/57 (14.0%)	6/60 (10.7%)	0%
Other	2/59 (3.4%)	3/57 (5.2%)	0%	0%

Table 6: Food frequency at dinner.

Food	Villagrande (rural)			Sassari (urban)		
	Never	1/week	2-6 / week	Never	1/week	2-6 / week
Meat	0%	22%	78%	6%	12%	82%
Fish	19%	63%	18%	35%	47%	18%
Cheese	14%	18%	68%	27%	8%	65%
Processed meat	9%	57%	34%	14%	10%	76%
Convenience food	46%	32%	22%	33%	22%	45%
Vegetables	6%	28%	66%	46%	27%	27%
Fruit	3%	24%	73%	6%	20%	74%
Legumes	21%	47%	32%	29%	29%	42%
Wine	89%	8%	3%	96%	2%	2%
Beer	91%	7%	2%	94%	2%	4%
Alcoholic beverages	96%	3%	1%	96%	4%	0%
Soft drinks	13%	43%	44%	2%	22%	76%
Ice creams/sweets	21%	34%	45%	0%	24%	76%
Salted snacks	25%	36%	39%	4%	20%	76%

**Table 7:** Food frequency in the current diet.

81% vs 65%,  $p < 0.001$ ) although fish consumption was traditionally not very frequent in Sardinia [13]. The consumption of vegetables was remarkably higher in rural than in urban students ( $\geq$ once a week, 94% vs 54%,  $p < 0.01$ ) whereas for fruit and legumes the percentages were comparable ( $\geq$ once a week, 97% vs 94% and 79% vs 71%, respectively). Alcoholic beverages were consumed in small quantities in both cohorts surveyed, while soft drinks to a greater extent among urban school children.

## Discussion

The knowledge of eating habits in pre-adolescents has an important role in planning educational interventions aimed at promoting well-being and the prevention of chronic diseases in adulthood. More specifically, school-age children are exposed to particularly critical factors, and eating trends that are acquired early in life can persist in adulthood. Therefore it is important that during school years a good lifestyle, including eating habits, is learned to avoid long-term health risks. In recent years, numerous epidemiological studies have documented the dramatic changes in dietary habits of the European population [18-20] including Italy [21-24], and especially among adolescents and pre-adolescents [25]. There was a progressive abandonment of healthy eating patterns such as the regional variant of the Mediterranean diet. Several factors have contributed to the spread of new dietary habits and consumption patterns, which are considered among the factors responsible for the increased occurrence of non-transmissible diseases such as obesity, diabetes and cardiovascular disease.

In mainland Italy an ISTAT [15] survey in 2005 on a sample of 60,000 households estimated the prevalence of overweight and obesity in adults by 34% and 10%, respectively. Moreover, an increase of 9% compared to the percentage observed in 2000 was reported [15]. Similar data emerged in a recent review of studies conducted by regional or local health authorities in a cohort of children aged 6-11 years, which displayed a prevalence of overweight and obesity between 14.7% and 31.3%, with higher percentages in South and Central Italy [21].

The present survey was prompted by the fact that in the Villagrande region the prevalence of overweight and obesity is the lowest reported in the entire national territory [17]. In addition, demographic data disclosed the exceptional longevity of this population [12] that was mainly attributed to good dietary habits [13]. Our study has the advantage of comparing the eating habits between school children

from a rural area characterized by high population longevity, and school children from a population whose life expectancy is within the European range.

One important point is to verify if the healthy eating habits of previous generations still persist in the younger generation. A food survey conducted about ten years ago in a limited number of families in the same village of Villagrande revealed that dietary habits and food consumption were still largely influenced by the traditional way of life [10].

The results of our study show that, overall, school children in Villagrande have quite correct eating habits, especially when compared to those from urban areas in the same age range. More importantly, the majority of respondents reported they had meals mostly within the family. Only a minority of them missed breakfast with an appropriate choice of foods, as reported previously [26]. Although the consumption of vegetables in the rural area was superior, fruit appear to be consumed in the same range as in the urban area, which arguably could be compensated by the traditional cooking within the family household. Finally, all respondents from rural areas had a considerable intake of meat, homemade spiced and smoked processed meat, and cheese mostly from goat's milk. This suggests the persistence of the longstanding agro-pastoral tradition of the rural population of Sardinia. Most students in Villagrande never drank wine or alcoholics; however, as expected, the situation is different as for consumption of sweet beverages. In fact, only a small percentage reported to abstain completely, almost all consumed at least once a week and even every fourth day. Finally, the majority of students are using olive oil as the main seasoning, while butter is consumed by a fairly low proportion of boys and even lower proportion of girls. This reflects a recent adherence to one of the pillars of the Mediterranean diet, high intake of olive oil, in the younger generations [13]. Although our study is essentially descriptive, it shows interesting results suggesting that the diet of Villagrande's children could be proposed as a model to be extended to a broader population of schoolchildren. However, some limitations must be taken into account. First, the sample size did not reach a statistical dimension necessary to put in evidence the slightest difference between the two cohorts. The choice of the sample size was forced by that fact that the study was conducted in Villagrande, the core of the Blue Zone, whose population is only 3,500 and the population of elementary and middle school is estimated around 5-7% of the total population. In addition, data was not collect through a food frequency questionnaire which did not allow a comprehensive evaluation of energy intake nor accurate macronutrient's estimates [26]. Nevertheless, it provided a good picture of the main habits of the younger generations in a geographical region recognized to be long-living.

In conclusion, our investigation, although preliminary, shows an overall favorable nutritional status in elementary school children of Villagrande, demonstrating that their eating habits in general differ significantly from those of Sassari and in general from other Italian children. However, there are early signs of a changing food eating pattern, fortunately not very widespread, probably due to the growing influence of advertising to which these children are subjected, because of the significant number of hours spent watching television [27]. Further studies are necessary to increase our knowledge of eating habit during childhood and adolescence, in order to adopt effective educational measures able to affect these trends early in life and to promote the maintenance of a healthy lifestyle in adulthood.

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