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Obesity prevention: from conception to adolescence

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Prof. Dra. Carla Rego

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Profissionalizante"**

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Faculdade de Medicina da Universidade do Porto, 15/04/2011

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5 **Obesity prevention: from conception to adolescence**

6 **Abstract**

7 Obesity is nowadays one of the most important public health care problems worldwide,
8 particularly in western countries, being highly prevalent in adults and increasing
9 drastically in children. Prevention, when started very early, presents as a key factor in
10 addressing this problem. Therefore, the objective of this work consists on the review of
11 the existing strategies for childhood obesity prevention, from conception to
12 adolescence, with emphasis on the role of the family doctor and the pediatrician, parents
13 (family), schools and the community in general. A search in PubMed was conducted
14 using the query “childhood obesity” [MesH] AND “prevention” [MesH] AND
15 “management” [MesH] in order to identify articles related to the theme published in the
16 last five years. Family doctors or pediatricians, contacting the child from an early age,
17 are important partners in helping parents to understand what to do about prevention of
18 childhood obesity and in diagnosing children with risk factors as well as implementing
19 prevention measures and treatment whenever necessary. Another key issue is the
20 importance of involving the whole family in the process of acquiring and maintaining
21 healthy eating habits and physical activity by the child, because it has a strong and
22 undeniable influence in prevention of obesity. Even at schools, where children spend
23 most of their time, one should incorporate teaching sessions on the negative impact of
24 obesity in health in general, providing strategies to prevent and treat it. Finally, the
25 community as a whole should be involved in the development of strategies to help fight
26 against obesity.

27	Index	
28	List of abbreviations and acronyms	4
29	Introduction.....	5
30	Materials and methods.....	8
31	Discussion.....	9
32	The role of the family physician and the pediatrician in childhood obesity	
33	prevention.....	9
34	Pregnancy/The perinatal period.....	12
35	Role of parents and family in interventions.....	16
36	Nutrition.....	17
37	Exercise.....	19
38	Role of schools.....	21
39	Role of the community in general.....	22
40	Conclusion.....	23
41	References.....	24

42 **List of abbreviations and acronyms**

43 WHO - World Health Organization

44 NHANES - National Health and Nutrition Examination Survey

45 COSI - Childhood Obesity Surveillance Initiative

46 SPEO - Sociedade Portuguesa para Estudo da Obesidade

47 BMI - Body mass index

48 CDC - Centers for Disease Control and Prevention

49 IOTF - International Obesity Task Force

50 SGA - small for gestational age

51 ESPGHAN - European Society of Pediatric Gastroenterology, Hepatology and Nutrition

52 **Introduction**

53 Obesity is nowadays one of the most important public health care problems
54 worldwide, particularly in western countries, being highly prevalent in adults and
55 increasing drastically in children. (1, 2)

56 Over the past three decades, the prevalence of obesity has increased among
57 children of all ages. The World Health Organization (WHO) estimated that 43 million
58 children are overweight and obese even in their preschool years, and 35 million of these
59 children are in developing countries. (3)

60 A study conducted by the National Health and Nutrition Examination Survey
61 (NHANES) in the United States between 2007 and 2008, estimated that 9.5% of infants
62 and toddlers (95% confidence interval (CI), 7.3%-11.7%) were at or above the 95th
63 percentile of the weight-for-recumbent length growth charts, defined as obesity. Taking
64 into account children and adolescents between the age of 2 and 19 years old, 16.9%
65 (95% CI, 14.1%-19.6%) were at or above the 95th percentile and 31.7% (95% CI,
66 29.2%-34.1%) were at or above the 85th percentile of body mass index (BMI) for age,
67 this last one defined as overweight. (4)

68 In Portugal, the situation is equally serious. WHO, following the approval of the
69 European Chart for the fight against Obesity, has launched an initiative within member
70 states with the intention of installing a surveillance system on childhood obesity. The
71 WHO - European Childhood Obesity Surveillance Initiative (COSI), constitutes the first
72 Childhood Nutritional Surveillance System in Europe. Portugal has assumed its
73 European coordination. On the first year of its implementation (2008/2009) and taking
74 into account a representative sample of children aged between 6 and 10, a prevalence of
75 pre-obesity of 18.1% and obesity of 13.9% has been registered. On the same study,
76 although not presenting regional representative samples, Azores was the region with the

77 highest prevalence of pre-obesity and obesity (respectively 21.7% and 20.7%) and
78 Algarve showed the lowest numbers with 10.7% pre-obesity and 6.8% obesity. (5)
79 Under the guidance of the Portuguese Society for the Study of Obesity (SPEO) and
80 running at the same time of COSI, a study was undertaken which estimated a prevalence
81 of overweight or pre-obesity of 29.0% and obesity of 12.5% in children aged between 2
82 and 5 and a prevalence of 28.2% of overweight and 11.3% of obesity in 11 to 15 years
83 old adolescents. (6) It should be noted that these results seem to be close to the ones
84 estimated in United States of America.

85 Obesity has a negative impact on health and quality of life. (7) Overweight or
86 obese children present an increased risk for multiple comorbidities as well as behavioral
87 and psychomotor changes (including social isolation, poor school performance, and
88 poor self-image). (2) Some pathologies which are more prone to develop when there is
89 excess weight are asthma, liver steatosis, obstructive sleep apnoea and diabetes mellitus
90 type 2. (8, 9) The clustering of cardiovascular risk factors related to obesity in children
91 includes hyperglycemia, dyslipidemia, inflammation, and hypertension, which are
92 predictive of adult-onset cardiovascular disease. (9) Obesity also increases the risk for
93 development of long term comorbidities in debilitating chronic conditions such as
94 stroke, breast, colon and kidney cancer, muscle skeletal disorders and gall bladder
95 disease. (8)

96 Childhood obesity also predicts premature death from endogenous causes. A
97 study showed that children in the highest quartile of age-standardized and sex-
98 standardized BMI had significantly higher rates of death (more than double) than did
99 children in the lowest quartile. (10)

100 Once established, obesity is difficult to treat, making it essential to work on
101 strategies for its prevention. (7) To be able to cut off this vicious cycle of obese children

102 turning into obese adults and subsequently delivering obese children one has to invest in
103 prevention and early intervention. (11)

104 In opposition to many pediatric pathologies, childhood obesity presents multiple
105 causes and needs for its treatment and prevention a multidisciplinary approach, with
106 emphasis on the patient, family and all its surroundings. (12-15) It is believed that an
107 approach on a population basis may present more benefits than an individual or small
108 group basis when looking at primary prevention of obesity and associated comorbid
109 conditions. (1, 14)

110 Taking all this into account, it is imperative to make early decisions on the fight
111 against this healthcare condition which is becoming more and more prevalent.
112 Prevention, when started very early, presents as the key factor in the fight against this
113 problem and for this reason, the objective of this work consists on the review of existing
114 strategies for childhood obesity prevention, from conception to adolescence, with
115 emphasis on the role of the family doctor/pediatrician, parents (family), schools and the
116 community in general.

117 **Materials and Methods**

118 A search in PubMed was performed, using the query “childhood obesity”
119 [MesH] AND “prevention” [MesH] AND “management” [MesH] in order to identify
120 articles related to the theme published in the last five years. Limits of “humans and
121 English, Portuguese and Spanish” were also included. The literature search yielded 237
122 articles. Of these, titles were assessed for relevance and 172 articles were excluded,
123 remaining 65. The abstracts of these 65 articles were reviewed, 48 were excluded and
124 17 were included. A search of reference lists of relevant articles published in the last
125 five years yielded an additional 47 articles, which were also included in the review
126 process, making up a total of 64 final articles.

127 **Discussion**

128 **The role of the family doctor, the obstetrician and the pediatrician in childhood**
129 **obesity prevention**

130 Although for adequate medical practice it is essential that clinicians use four key
131 words: “how to ask”, “how to inform”, “how to advise” and “how to listen”, the main
132 obstacle in this area remains to be on the definition and diagnosis of childhood obesity.
133 (16)

134 Even though most discussions revolve around the effects of excess fat, the most
135 common metric in use today is BMI, weight in kilograms divided by the square of
136 height in meters. (17, 18) Therefore, an evaluation of obesity starts with the work out of
137 BMI which is related to total body fat although a perfect cut point for BMI which may
138 identify all children with excess body fat is not available yet. (8) While it is appealing to
139 use a single cut point to identify children who have excess body fatness at all ages, a
140 single cut point is unlikely to be optimal. So, a cut point which does not vary with age
141 and gender will necessarily not take into account the changes in body fatness which
142 occur over a period of time neither the relationship of body fatness and certain risk
143 factors in different age groups. (19)

144 Taking into account BMI changes with age, it is known that under normal
145 physiological conditions, during the first year of life, BMI increases rapidly but then
146 decreases afterwards reaching a minimum at around 5-6 years old. This period of
147 minimum BMI is called “the adiposity rebound” or more correctly “BMI rebound”.
148 After this time, BMI begins to increase again. (1) BMI is particularly useful for
149 screening purposes during the time of adiposity rebound. Problematic adiposity
150 rebound is the one which occurs as early as 3 years of life and is associated with an
151 increase in metabolic diseases such as diabetes. (20) Pediatricians who observe the

152 child's BMI starting to move upward during the early preschool period should be
153 particularly concerned. (1, 21, 22)

154 At the moment there are 3 cutoff systems in widespread use: the 2000 Centers
155 for Disease Control and Prevention (CDC) reference curves at the 85th and 95th
156 percentiles; the International Obesity Task Force (IOTF) BMI 25 and BMI 30
157 percentile-equivalent cutoffs; and the 2007 WHO growth curves with first and second
158 standard deviation limits. (23)

159 Another question which must be raised has to do with the fact that the accuracy
160 of BMI as an indicator of adiposity vary considerably according to the degree of body
161 fatness. Among relatively fat children, BMI is a good indicator of excess adiposity, but
162 differences in the BMIs of relatively thin children due to differences in fat-free mass
163 may be a confounding factor in this analysis. (19)

164 However and besides the limitations pointed above, BMI is still considered a
165 valid tool with a reasonable efficacy in the evaluation of excess weight and obesity. One
166 should therefore point out that BMI is considered a screening and not a diagnostic tool
167 and more in-depth assessment of individual children should be required in ascertain
168 specific health status. (18)

169 There are several reasons to consider the role of physicians in the prevention of
170 obesity as an essential one: the fact that excess weight starts very early in life and
171 persists all lifelong emphasizes the need of precocious intervention; another reason is
172 related to the fact that younger children visit their physicians more frequently than the
173 older ones. (21, 24)

174 Family doctors and pediatricians have an important role in timely identification
175 of overweight and obese children during periodic health examinations. They also have a

176 role in promoting preventive measures and encouraging positive changes in behavior, as
177 well as identifying and treating obesity-related comorbidity. (17)

178 However, there is frequently the perception that tackling childhood obesity
179 within primary healthcare is extremely challenging. Fears about the level of adequate
180 preparation, especially within family physicians, as well as the time needed to perform a
181 complete evaluation seem to be drawbacks on this issue. (25-27)

182 It is therefore essential that pediatric primary care providers obtain adequate
183 knowledge, in brief, validated methods of diet and physical activity assessment. (8, 26)
184 All of them should also have appropriate skills to identify pediatric obesity and its risk
185 factors as well as knowledge of preventive and treatment options. (17)

186 Effective solutions must be implemented for prevention related to diet, physical
187 exercise, sedentary behavior and family context as well as strategies for treatment of
188 established cases and possible complications. (8, 28)

189 There are three behavioral situations which are believed to have a major
190 influence and family practitioners and pediatricians should be able to discuss with the
191 parents: time spent by children watching television, sugar-sweetened beverages and
192 level of physical activity. (21)

193 Informing children and parents that the child is at risk for overweight or is
194 already overweight is critically important, but often not welcomed by either parent or
195 child. (21) So, in addition to focusing on BMI, pediatricians also need to evaluate
196 parental readiness to implement changes. If, after assessing readiness to change, the
197 clinician feels the family is not able to introduce changes in their daily habits, then he
198 must try to demonstrate the importance of maintaining an healthy weight focusing on
199 motivational strategies to obtain it and inserting the practice of regular physical

200 activities and adequate dietary habits within each family dynamic environmental status.
201 (21, 29) Parents and children should not be put on the defensive about these issues. (21)

202 It is believed that sensitive communication of BMI to parents who are often
203 unaware of their child's weight status, may be a motivator factor in changing dietary
204 and physical activity behaviors. And so, physicians should have a careful and positive
205 approach when explaining child's weight status. The focus on the discussion should be
206 on healthy activity habits and not weight itself. When talking with families it is also
207 advisable to start by identifying just one to two goals per visit so as not to overwhelm
208 the patient and parents. (21)

209

210 **Pregnancy and the perinatal period**

211 In the last two decades, there has been new evidence that life growth patterns
212 and behaviors play an important role in the aetiology of obesity. (11, 30, 31) The
213 association between certain risk factors and childhood obesity manifests itself in
214 different ways, according to the developmental stage in which the child is. (16)

215 Interventions for preventing obesity in childhood should begin before pregnancy
216 and subsequently maintained during gestation and postpartum period for both mother
217 and child. (8)

218 Investigators have identified several potentially modifiable factors in the
219 prenatal and early postnatal periods that increase the risk of overweight in childhood.
220 (30) These include maternal smoking during pregnancy (30, 32), excessive gestational
221 weight gain (9, 30, 33), low birth weight (9, 34), reduced breastfeeding duration (11, 30,
222 35-37), short sleep duration (30, 38) and early introduction of solid foods (11, 36).

223 In relation to a possible effect of smoking during pregnancy on newborns'
224 weight, a systematic review and meta-analysis in 2008 evaluated data from 14

225 observational studies on a total of 84 563 children whose mothers smoked during
226 pregnancy and concluded that these children had an increased risk of overweight
227 (pooled adjusted odds ratio (OR) 1.50, 95% CI: 1.36-1.65) between 3 and 33 years of
228 age when comparing with those children whose mothers did not smoke during
229 pregnancy. (32) The association was not affected by adjustments related to
230 sociodemographic characteristics of parents and body size, weight increase in
231 pregnancy, infant feeding, and childhood behaviors which points out that social and
232 behavioral differences between smokers and non smokers are not probably related to the
233 results obtained on the risks of overweight. (32) It is so believed that pre-natal
234 exposition to smoking may increase the risk of excess weight in childhood and adult
235 life. (32, 34) In parts of the world undergoing the epidemiologic transition, the
236 continuing increase in smoking among young women can contribute to progressive
237 increases in indexes of obesity-related health outcomes on the twenty first century. (32)
238 It is therefore recommended to stop smoking for mothers during pregnancy, not only
239 for the well established effect of underweight risk on child birth but as well by the
240 evidence of an increased future risk of obesity on the newborn child. (34)

241 In relation to weight gain during pregnancy, this must be accompanied and
242 controlled as it is believed this may be a risk factor to the development of gestational
243 diabetes and, as a consequence, infants' excessive weight on birth. Obese women
244 generally do not lose weight in between pregnancies and a gain of excessive weight
245 during subsequent pregnancies increases the risk for gestational diabetes mellitus. This
246 pathology is associated to a high birth weight and higher percent body fat of the
247 neonate, both of which are risk factors for obesity during childhood and adolescence.
248 Hence, efforts should be made to prevent gestational diabetes mellitus and excess
249 maternal weight gain during pregnancy to avoid a vicious cycle. (9) Therefore the effect

250 of the nutritional maternal status previous to pregnancy on birth outcomes is of great
251 importance in terms of public healthcare. Epidemiological studies have shown a clear
252 association between maternal pregravid weight and birth outcomes. (33)

253 Low birth weight, together with infant catch-up growth, is also a risk factor for
254 obesity and obesity-related diseases in childhood. Individuals born small for gestational
255 age (SGA), birth weight <10th percentile, are at increased risk of rapid postnatal weight
256 gain, later obesity and diseases in adulthood such as type 2 diabetes, hypertension and
257 cardiovascular diseases. (39-41) Prevention of future obesity is another reason to assure
258 that pregnant women have access to prenatal care, optimal nutrition, efforts to reduce
259 prenatal stress, and counseling to avoid alcohol, drugs, and cigarettes. (9)

260 As far as breastfeeding, parents should be informed that it should be the
261 preferred source for nutrition of infants during early life. (11, 35-37) Concerning the
262 general recommendation of the European Society of Pediatric Gastroenterology,
263 Hepatology and Nutrition (ESPGHAN) and WHO, mothers should exclusively
264 breastfeed their children at least 6 months and mothers willing to do it up to one year of
265 age should be encouraged to do so. (35, 42) Difference in nutritional content between
266 breast milk (high fat, low protein) and formula milk (low fat, high protein) contributes
267 to early adiposity rebound and greater subsequent childhood obesity in formula-fed
268 infants. (20, 37) Besides, bottle-feeding, regardless of the type of milk, is distinct from
269 feeding at the breast in its effect on infants' self-regulation of milk intake. (43) Breastfed
270 infants may be better able to control the amount of milk they consume in response to
271 their internal satiety cues than bottle-fed infants. (44) Breast milk also contains satiety
272 regulatory substances. For example, leptin present in breast milk may regulate body
273 weight gain during infancy in humans and is one of the bioactive components present in
274 milk that could be responsible for the role of breast-feeding in lowering the risk of

275 childhood obesity. (45) Also other substances such as adiponectin, adipocyte fatty acid
276 binding protein and epidermal fatty acid binding protein are components of human
277 breast milk and may play a role in the protective effects of breastfeeding. (46)

278 For parents who choose/need to feed their children with formula milk, they
279 should be given specific counselling such as being encouraged to feed them only when
280 they feel hungry instead of a strictly scheduled scheme. Parents should also be taught
281 about the signs given by infants when they are filled, instead of just worrying about
282 their son finishing the bottle. Finally, it is important to teach parents to distinguish when
283 the child is hungry from other types of care in order to reduce over-feeding the child.
284 (11)

285 It is not only breastfeeding that is considered an important issue in the
286 prevention of obesity. It is also believed that avoidance of solid foods during the first
287 months of life may protect from obesity. (11, 36) For this reason, according to
288 ESPGHAN, it is recommended to avoid the introduction of solid foods and caloric
289 beverages during the first 6 months after birth, unless suggested by special needs. (35)

290 Finally, in relation to sleeping hours per night, a recent study conducted in
291 Portugal, suggests an inverse relationship between long sleep duration (>11 hours) and
292 overweight/obesity prevalence. Another important finding of the study was the
293 association between family characteristics (parental education), children's behavior
294 (television watching and physical activity) and sleep duration. Children where both
295 parents had a low educational level, spend more time watching television and are not
296 engaged in physical activity do sleep less hours per night. (38) These findings are
297 important as sleep duration is a potentially modifiable risk factor that can be relevant in
298 the prevention and treatment of childhood obesity. (11, 38)

299 For all this, prevention of obesity must be initiated very early in childhood, and
300 the clinicians should assume the role of integrating the information given by the child's
301 BMI, parent's nutritional status (specially the mother), general medical risk factors and
302 nutritional habits and physical activity. (8) Interventions to introduce positive changes
303 during pregnancy and infancy may have a substantial impact for the prevention of
304 childhood overweight and its consequences. (30)

305 The pediatric primary care office remains a potentially important setting for the
306 prevention or treatment of obesity in children and adolescents. (29) Family physicians
307 have a role in promoting preventive measures and identifying and treating obesity-
308 related comorbidity. (17)

309

310 **Role of parents and family in interventions**

311 The social context most likely to support healthy behavioral changes is the
312 family. (47) Lasting changes are more likely to happen when they involve the family
313 unit as it becomes an active part not only in introducing changes but also in maintaining
314 adopted behaviors. (14, 47, 48)

315 Each family has a unique willingness to accept changes in their lifestyle. The
316 assessment of readiness for change in each family is important in order to plan the
317 necessary intervention to be done. (8, 16, 49) As such, understanding parental decision-
318 making related to adopting recommendations is critical and could help in future efforts
319 to reduce childhood obesity. For example, information about parental barriers and
320 facilitators could lead to obesity interventions that are tailored to maximize parental
321 compliance. (49) There are innumerable barriers facing parents at the time of putting into
322 practice the necessary measures to prevent their children's obesity. Economic
323 considerations, especially time costs, may play a role in parent's decisions to implement

324 obesity-related recommendations and should be considered in the context of other
325 priorities for the child and the family. Barriers should be routinely assessed and
326 addressed when obesity-related recommendations are offered to enhance parental
327 compliance. It is important to find ways to overcome these barriers so that the family
328 will be able to fully comply with the strategies to adopt to prevent obesity. (49)

329 **Nutrition**

330 Excessive adiposity stems from an energy imbalance. There are many factors
331 which promote excess energy consumption such as appetite stimulation, consumption of
332 excessive amounts of food or food with high caloric density. (8)

333 In general, prevention and treatment of obesity may imply a reduction in energy
334 consumption and an increase in energy expenditure to improve energy balance. (8)

335 The Expert Committee on the Assessment, Prevention, and Treatment of Child
336 and Adolescent Overweight and Obesity identified the following as dietary habits that
337 contribute to obesity: frequently consuming fast food and large volumes of sweet
338 beverages (e.g., fruit juices, soft drinks), eating large portions, skipping breakfast,
339 choosing foods high in energy density (e.g., high-fat snacks), eating few fruits and
340 vegetables, and having irregular meal frequency and snacking patterns. (50)

341 Therefore, The American Heart Association dietary guidelines for children
342 recommend the introduction of fibre-rich foods, including fruit, vegetables and whole
343 grain. (8) Food with high added sugar or salt should be avoided. (11) It is suggested that
344 reducing the intake of such products is a key measure in the strategies for prevention of
345 childhood obesity. (51) As sugar drinks have no nutritional benefit and are associated
346 with obesity and other comorbidities, their consumption by children should be
347 discouraged. Alternatively, parents are advised to encourage the consumption of water
348 and more recently low-calorie flavoured water. (11, 16) Families are also advised to

349 follow a balanced diet high in calcium and to limit consumption of energy-dense foods
350 (e.g., high-calorie snacks such as pastries and ice-cream). (50)

351 Other dietary habits which must be encouraged are: eating breakfast daily;
352 limiting meals outside the home specially in fast food venues and other restaurants;
353 eating family meals at least 5 or 6 times per week and limit portions to appropriate
354 serving sizes. (16, 52)

355 During the first years of life, infants and toddlers learn a lot about different foods
356 and how to combine them as they are progressively introduced into adult's diet. They
357 learn when to eat, what food is and what is not, the amount to be ingested and, as a
358 result of their experiences with different types of food, they will develop their own food
359 preferences. (11) And it is parent's responsibility the type of food presented to their
360 children, the size of the portions and the entire emotional context related to food so that
361 they are seen as role models to be followed by the child. (12, 16, 53)

362 There is evidence that feeding style using coercion is unlikely to have a desirable
363 effect in short term and may result in unhealthy weight status in the long run because
364 data from recent studies suggest that monitoring made by the mother on the son's diet
365 during the first years of life moderates the increase in child's weight. (53) Besides
366 promoting the child's dislike for healthy foods and increase demand for banned
367 unhealthy options, the coercive practices can also promote deviant eating behaviors
368 such as over eating, eating in response to the presence of food on the table and eating in
369 order to seek comfort (this type of behavior is encouraged by the coercive practice of,
370 for example, forcing the child to eat all vegetables that are placed on the plate regardless
371 their food preferences and the fact that he might be already full). (54) These coercive
372 behaviors should be discouraged and parents should introduce new types of food to
373 children in a repeated and positive context. (11) So, food must be balanced and

374 undertaken by the family in an environment of support and harmony where the child
375 may be able to develop a taste for healthy food options. (11, 12, 55)

376 **Exercise**

377 Physical activity is associated to a diminished cardiovascular and metabolic risk
378 at any age. (12)

379 Although there are no uncertainties about the potential benefits of physical
380 exercise to prevent obesity, doubts still persist on the quantity and type of exercise
381 needed in infancy to prevent excess weight. (11) Professional medical organizations
382 often do not provide specific recommendations for intensity, duration, frequency, or
383 modality of exercise for the management of pediatric obesity. (8) But, it is believed that
384 physical activities which may be interactive, stimulating, pleasant and easy to perform
385 will be a good choice and should be incorporated in infants' daily routines. (11)

386 Parents need to be informed on the most appropriate type of activity for each age
387 group, state of development and emotional make up of the child. Parents also need skills
388 to teach their children how to play sports. Children with excess weight need to learn
389 pacing skills to exercise at an appropriate level without injury. (8)

390 There is strong evidence suggesting that daily moderate to intensive physical
391 exercise helps to reduce adiposity in overweight or obese children. When taking into
392 consideration normo-weight children the evidence related to physical exercise and
393 prevention of obesity is therefore inconsistent. However, there is a consensus related to
394 the benefits of physical exercise of at least sixty minutes daily for normo-weight
395 children. (16)

396 Evidence supports the existence of a strong link between the restriction of
397 sedentary habits (such as watching television and playing computer related games) and
398 the prevention of obesity, although the strength of evidence varies in between different

399 studies. (16) A recent study conducted in Portugal about the relationship between
400 sedentary habits and the risk of obesity, presented results that show that the incidence of
401 obesity is greater in children who spend much time playing electronic games and the
402 time spent on these activities is strongly associated to the incidence of obesity and a
403 bigger BMI. (56) It is advisable that the time spent by children on these sedentary
404 practices must generally be limited to a maximum of 2 hours per day and placement of
405 television on children's rooms should be discouraged. (11, 12, 52) Children aged less
406 than 2 years old should not be allowed to watch television. (12, 52) It is crucial that
407 parents assume an active role in setting total screen time limits and monitoring their
408 children's viewing habits. (52)

409 Besides its recognized benefits in prevention of obesity, regular physical
410 exercise has other advantages such as a higher self-esteem by the child as well as a
411 better group interaction. (12)

412 In conclusion, parents have a fundamental role in the prevention of childhood
413 obesity, with its contribution changing as age progresses. Improving the understanding
414 of their role on changing dietary, physical activity and sedentary habits of their children
415 and by consequence their weight, parents may learn how to develop an healthful
416 nutrition environment in their home, creating opportunities for physical exercise,
417 discouraging sedentary behaviors like watching too much television and serving
418 themselves as row models to follow. (57)

419 And more, it is thought that there is an association between the behavior in
420 relation to physical activity and dietary habits, acting together as it is believed that
421 obesity results from disequilibrium between energy consumption and its spending.
422 Therefore, effective changes in more than one of these behaviors may lead to synergistic
423 effects on the prevention of obesity. (58) Incoming research must look at the type of

424 food and level of intensity of physical exercise adequate in the efficient prevention of
425 childhood obesity. (59)

426

427 **Role of schools**

428 Children spend approximately half of their waking hours in school. Schools
429 provide 1 to 2 meals daily and are a natural setting for education about healthy food
430 choices. (60)

431 A study evaluated the effects of a School Nutrition Policy Initiative in the
432 prevention of overweight and obesity among children in grades 4 through 6 over a 2-
433 year period, having concluded that the program resulted in the declining of 50% in the
434 incidence of excess weight, having also a positive result at the level of general
435 prevalence of excess weight. (60)

436 Prevention of obesity at school level presents three principal forms: encouraging
437 healthy food, restricting the sale of other foodstuff at the vendor machines/coffee areas
438 within the school area and introducing lessons, on school curriculum, about the
439 importance of adequate dietary and physical exercise habits and developing activities
440 promoting physical exercise. (16) Studies on the impact of the implementation of these
441 measures at school level have shown in general an increase in the participation of these
442 activities related to incentives in physical exercise and changing food habits in schools
443 but results on changing of body weight were less consistent. (61) Some studies
444 demonstrated that it is possible to have a positive influence on dietary habits in schools
445 through the reduction of selling non healthy foodstuff at schools, increasing at the same
446 time the availability of healthy food alternatives and reducing their selling price. (61)

447 **Role of the community in general**

448 As it is known, the genesis of obesity includes several factors in a biological and
449 environmental perspective. Therefore, health promotion and obesity prevention in the
450 community are responsibilities which must be shared by several entities and
451 organizations and interests, including public health agencies, health-delivery
452 organizations, other public and private entities, and the people of the community. (8, 62)

453 Knowing the child's place of residence can provide additional insight into the
454 complex relationship between social and economic resources and obesity prevalence.
455 Childhood obesity prevalence varies by geographic location. (9) Children with limited
456 access to activities promoting the practice of physical exercise in their neighborhood
457 have an increased risk of becoming obese. Children's health care providers can support
458 efforts looking at preserving and increasing the number of green spaces designed for the
459 practice of physical activities, increasing specific routes for cycling and walking in
460 urban areas and promoting the use of these facilities by families (9, 16)

461 Another related question has to do with parent's perception of safety in their
462 neighborhood and how this may influence the practice by their children of outdoor
463 healthy physical activities. Parental concern about neighborhood crime and, therefore,
464 their children's safety may lead to children remaining at home after school (particularly
465 if no adult caretakers are available) and engaging in sedentary rather than physical
466 activity and it is believed that there is an association between parents' perceptions of
467 neighborhood safety and childhood obesity. (9, 63)

468 Reversing childhood obesity epidemic requires action in communities that may
469 include regional, national and even international projects. Community action requires
470 multi-strategies and multi-setting approaches which focus on building a community's
471 capacity to promote and sustain healthy eating and physical activity. (28, 62, 64)

472 **Conclusion**

473 The prevalence of obesity is increasing alarmingly throughout the world causing
474 a very negative impact on health in general, thereby undermining existing healthcare
475 projects and systems. (1, 7, 9)

476 To break the vicious cycle of obese children becoming obese adults which in
477 turn generate obese children, the measures for prevention of obesity are crucial and
478 these must be implemented early in life, during the prenatal period and then during
479 childhood. (11)

480 The family doctor or pediatrician, contacting the child at an early age, is an
481 important partner in helping parents to understand what to do about prevention of
482 childhood obesity and in diagnosing children with risk factors and implementing
483 prevention measures and treatment whenever necessary.

484 Another key issue is the importance of involving the whole family in the process
485 of acquiring and maintaining healthy eating habits and physical activity by the child
486 because it has a strong and undeniable influence in prevention of obesity.

487 Even at schools, where children spend most of their time and where they are
488 given relevant content to their training as individuals, one should incorporate
489 knowledge about the negative impact of obesity on health in general, providing
490 strategies to prevent and treat it.

491 Finally, we also need to sensitize the communities to the importance of the
492 development of strategies to help fight the negative effects of obesity.

493 Thus, when we act together in different spheres of possible intervention in the
494 prevention of childhood obesity, we will certainly get a higher benefit than if focusing
495 on a single area. And, given the increasing incidence of this problem worldwide, it is
496 imperative to have a decisive approach, in order to get the maximum benefit possible.

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Anexos

Format of papers – International Journal of Obesity

Review Articles	Reviews are comprehensive analyses of specific topics that are solicited by the Editor. Prospective authors of reviews should send a copy of the abstract of their proposed review to Richard Atkinson via the International Journal of Obesity Editorial Office (vfschmidt@earthlink.net) before full submission to confirm that the topic is of interest and not already covered by a review in preparation. All review articles will undergo peer review prior to acceptance.	Word limit is 6,000 words. Abstract should be an unstructured paragraph of 300 words maximum. References: 120 references maximum.
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House Style

- Text should be double spaced with a wide margin;
- All pages and lines are to be numbered (To add page numbers in MS Word go to Insert then Page Numbers. To add line numbers go to File, Page Setup, then click the Layout tab. In the Apply to box, select Whole document, click Line Numbers then select the Add line numbering check box, followed by continuous);

- Abbreviations should be preceded by the words they stand for in the first instance of use;
- At first mention of a manufacturer, the town (and state if USA) and country should be provided;
- Spaces, not commas should be used to separate thousands;
- Use SI units throughout;
- Do not make rules thinner than 1pt (0.36mm);
- Use a coarse hatching pattern rather than shading for tints in graphs;
- Colour should be distinct when being used as an identifying tool.

References

Only papers directly related to the article should be cited. Exhaustive lists should be avoided. References should follow the Vancouver format. In the text they should appear as numbers starting at one and at the end of the paper they should be listed (double-spaced) in numerical order corresponding to the order of citation in the text. All authors should be quoted for papers with up to six authors; for papers with more than six authors, the first six only should be quoted, followed by *et al.* Abbreviations for titles of medical periodicals should conform to those used in the latest edition of *Index Medicus*. The first and last page numbers for each reference should be provided. Abstracts and letters must be identified as such. Papers in press and papers already submitted for publication may be included in the list of references but no citation is required for work that is not yet submitted for publication.