

Childhood Obesity: Reason behind this health crisis

Abhinav Sawhney*, Nidha Amir, Mohd Mazhar, Sumeet Gullaiya, Satyendra K Rajput
 Department of Pharmacology,
 Amity institute of Pharmacy, Amity University,
 Noida, Uttar Pradesh
 *abhinavsawhney@live.com



ABSTRACT

Obesity has emerged as a major health issues for pediatric population as well as in adults in the present global scenario. In children, numerous studies have revealed a relationship between the breast feeding and obesity in children. Apart from these, Family economic and education level, child meal pattern, duration of sleep and birth weight are also responsible for obesity. Some genetic problems including environmental and socio-economic factors are also responsible for the child obesity. Several studies have shown an evidence of protective effect of breast feeding against obesity while some shows a time dependent effect of breast feeding on childhood obesity. As per WHO recommendations, a child should be exclusively breast fed upto 6 months and breast fed along with the complementary food of good quality. Introduction of the complementary food has a relationship bound with adipose rebound, which goes upto the age of 14. The intake of complementary food reduces the intake of breast milk and also induces the allergic reactions in the child. Apart from these leptin level and energy regulation in the body also plays and important role in pediatric obesity.

Keywords: Obesity, Childhood, Breast Feeding, Complementary Food

INTRODUCTION

Obesity is becoming a major issue in the present scenario. From adults to children everyone is suffering from the problems. This is one of the major concerns in adolescents. Obesity in the small age is a major concern as it is referred as the growing age and it causes the various health problems in them. Today when we go to various societies in our living area most of the children we see are obese or fat. Various children are suffering from the weight problem at the time of birth. Some are underweight or some overweight, or after birth they got over weight. What should be the reasons behind this? Is it the breastfeeding, or the food and medicines taken by the mother during the pregnancy? Various studies have shown a relationship between the

breastfeeding and the obesity in children^[1]. Some reasons like less physical exercise label of the children is seen to very less among the children is very less these days, Level of physical activity is decreasing day by day in the children. As we see in our homes these days when there is a child in our house we don't allow him to play on the floor else we take him in our laps and play with him, means child is playing but he is not doing any physical work, similarly when children grew up the parents provide them with the numerous electronics gadgets like mobile, videogames, etc. instead of sending them to playgrounds for playing physical games, this reduces their physical work and make them lazy. Most of the time they are found sitting in the front of the television or computers which affects their health. This is one the serious

How to cite this article: A Sawhney, N Amir, M Mazhar, S Gullaiya, SK Rajput; Childhood Obesity: Reason behind this health crisis; PharmaTutor; 2015; 3(3); 11-17

health problems or we can say social health problem as society is suffering from this. The various other factors which include are like first degree family history of obesity, family economic and education level, child meal pattern (having fast food), duration of sleep, and birth weight, while some factors are like biological factors, genetics, environmental, and socio-economic factors affect the child obesity. Studies have shown that children who are obese suffer from various ailments like chronic heart disease, non alcoholic fatty liver disease, obstructive sleep aponea, infertility, asthma, and cancer ^[2]. Body weight of the child also effects the child obesity, study by hales and barker shows that child with low birth weight impairs problems in organ development like pancreas, which lead to obesity, they have proposed that children with low body weight will gain weight more quickly, known as catch up growth, in order to gain the lack of growth which leads to increase in abdominal obesity. According to their studies environmental factors play more important role in childhood obesity as compare to genetic factors, this is known as “thrifty phenotype” hypothesis^[3]. American Academy of Pediatrics and WHO says that complementary food should be introduced after the age of 4 months or around 6 months, when the child is physiologically ready for the intake of food, but as seen these days, mothers

are introducing the food before or in the age of 4 months. The present review is aimed is to discuss the innumerable reasons which are responsible for the obesity among the children, which is leading to various health problems in their age.

EFFECT OF BREAST FEEDING AND BODY WEIGHT ON CHILD OBESITY

Numerous studies were performed in recent times, showed that nutritional experiences have a major effect on childhood obesity. Some studies have depicted an evidence of protective effect of breastfeeding against obesity, while some proved a time dependent effect of breast feeding. Studies of Zarrati *et al* have researched a relation between breast feeding and child obesity. Their studies also show a link between abdominal obesity and breast feeding but there was no relation between low body weight and breast feeding. There studies show that children having breast feeding upto 1-2 yr have less impact of childhood obesity and abdominal obesity ^[1]. Another study shows that breastfeeding does not have such an impact on child obesity as the other factors like birth weight and complementary food effect them, according to their study introduction of complementary food has effects the BMI which is one of the scale to identify the obesity ^[4].



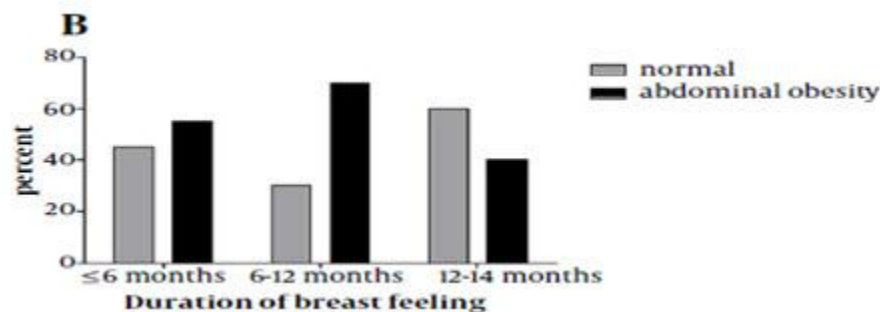


Figure 1: Distribution of BMI (A) and abdominal Obesity (B) by Breast Feeding in Children with Low Birth Weight. * $P < 0.05$; ** $P > 0.05$; BMI: Body Mass Index^[1]

These graphs are taken from the study of Zarrati *et al* showing the effect of breast feeding on pediatric obesity in their particular region of study.

EFFECT OF COMPLEMENTARY FOOD ON CHILD OBESITY

As per WHO recommendations, a child should be exclusive breast fed upto 6 months and then breastfed along with the complementary food of good quality for about 2 years or till the child and mother is able to do that but 6 months is compulsory, exclusive breast fed means breast milk along with vitamins, minerals, and medicines^[5-7]. As seen these days' mothers breast fed their child mostly upto 4 months and then they introduce the complementary foods^[8]. Introduction of complementary food has a relationship bound with the adipose rebound, which goes upto the age of fourteen, Introduction of complementary food early will result in high adipose rebound leading to abdominal obesity. Study shows that introduction of complementary food in 9-16 wk have slower weight and length velocity as compare to those child in whom the food is introduced in 17-24 week and 25-32 week^[9]. A study has shown that introduction of these complementary foods in the 4 month of age does not have any advantages, but they show many disadvantages^[10]. The increase in the consumption of energy containing complementary food reduces the intake of breast milk. Complementary food also induces the allergic reactions in the child; studies have shown that early introduction of food in child

causes eczema in them. There are various evidences which show that early introduction of food in the child result in various other diseases like cancer, hypertension, allergic reactions, diabetes mellitus, and many more^[8]. Study by Mehta *et al* proved that introduction of complementary food is linked with pregravid BMI of the mother^[11].

EFFECT OF OTHER MISCELLANIOUS FACTORS

Other factors includes like environmental factors, economic problems, child physical activity level, meal pattern and many other. Study has shown that there is a relationship between the obesity and type of food children having, fast food amount, physical exercise level, time spent in watching television and total stationary time. Children having fast food more than 2 times a day, having a low physical exercise level, and view television more than 2-3 hr/day are more susceptible to being obese. Way of cooking food also affects the child obesity, addition of pure ghee in the food or cooking food in pure ghee which is a saturated fat causes obesity, but it is not an independent risk factor. Parents economic factor also affects the child health, study shows that children studying in schools having annual fees more than Rs 10000 pa are more obese as compare to children studying in schools having fees less than 10000 pa.^[12] Some evidence says that

parents whom are not able to give proper time to their child, makes their child lazy and busy with the various electronics gadgets, these electronic gadgets like computers, video games make them lazy and reduces their physical activity level. Environment among the children in the schools also affect them. It is seen these days that smoking among the school children has been increased; as we know smoking is one of the causative factors of causing obesity. Smoking by a pregnant woman causes the low baby weight during the birth, which results in obesity in child and also causes various problems in them like cleft palate and cleft lip^[13]. These evidences somehow reveals that parents are also responsible for the obesity in the children. Studies have investigated various risk factors which are done by parents especially mother during pregnancy and they affect the children health. The various risk factors includes smoking during pregnancy,

gestational weight gain, gestational diabetes, birth weight, caesarian section, and the main previous important factor breast feeding and introduction of solid food was also included which already has been discuss. According to their results these factors not only result in obesity but also cause tetragenocytosis and result in various other life threatening diseases. Now if we check on the economic factors affect on the child health there are various studies have been done to check the impact like study by demment et al, have shown that how the socio-economic factors affects the child health. Family income is independently associated with the child health, according their findings we can't negotiate this factor, and there should be holistic approach for the formation of policies regarding economic health of family, low family income has a relation with the childhood obesity and premature birth^[14].

Table 1: Distribution of body mass index by gender, age, socioeconomic status (SES), school type, and diet^[15]

	Underweigh t (n=110)	Normal (n=473)	Overweight (n=184)	Obesity (n=43)	Total	p-value
Gender						<0.001
Male	74 (16.1)	251 (54.7)	95 (20.7)	39 (8.5)	459 (56.7)	
Female	36 (10.3)	222 (63.2)	89 (25.4)	4 (1.1)	351 (43.3)	
Age (yr)						0.04
12	30 (27.3)	168 (35.5)	70 (38.0)	15 (34.9)	283 (34.9)	
13	33 (30.0)	107 (22.6)	45 (24.5)	8 (18.6)	103 (23.8)	
14	21 (19.1)	112 (23.7)	33 (17.9)	4 (9.3)	170 (21.0)	
15	26 (23.6)	86 (18.2)	36 (19.6)	16 (37.2)	164 (20.2)	
SES1						<0.001
Upper high	16 (14.5)	37 (7.8)	30 (16.3)	5 (11.6)	88 (10.9)	
High	8 (7.3)	123 (26.0)	64 (34.8)	16 (37.2)	211 (26.0)	
Upper middle	42 (38.2)	161 (34.0)	47 (25.5)	16 (37.2)	266 (32.8)	
Lower middle	41 (37.3)	132 (27.9)	40 (21.7)	5 (11.6)	218 (26.9)	
Poor	3 (2.7)	20 (4.2)	3 (1.6)	1 (2.3)	27 (3.3)	
School type						<0.001
Private	33 (10.4)	165 (52.2)	99 (31.4)	19 (6.0)	316 (39.0)	
Government	77 (15.6)	308 (62.3)	85 (17.2)	24 (4.9)	494 (61.0)	
Diet						0.09
Vegetarian	94 (13.5)	405 (57.6)	160 (22.9)	42 (6.0)	698 (86.2)	

Mixed	16 (14.3)	71 (63.4)	24 (21.4)	1 (0.9)	112 (13.8)	
Total	110 (13.6)	473 (58.4)	184 (22.7)	43 (5.3)	810 (100)	

This table shows data of a particular area where the above mention factors are considered and the studies were done. It shows that how much these parameters are responsible in pediatric obesity.

ROLE OF LEPTIN AND GEHLIN IN CHILD OBESITY

Leptin and gehrlin are the two hormones which regulate the energy homeostasis in the body, and they are also found in the fetal growth^[16]. Both of these hormones secretion is regulated from the centre of hunger and satiety regulation i.e. Hypothalamus Arcuate nucleus, paraventricular nucleus, lateral hypothalamic area, perifornical area are the structures involved in the energy regulation in body. Gehrlin is the hormone which modulates the growth hormone secretion, gehrlin secretion in stomach and hypothalamus plays an important role in regulating the body energy status. Studies have shown that after vagotomy there is a decreased in hunger induced gehrlin levels. Patients done with vagotomy do not show the increase food intake. Leptin is produced by the white adipose tissues, and shows its affect on both central and peripheral system due to presence of receptor at various places like hypothalamus, pancreas, intestines, lymphocytes, adiposities^[17]. Leptin suppresses the expression of AgRP/NpY/GABA which is generated during the period of energy deficiency, due to this the signal of anorexigenic arises which causes satiety. These appetite regulating hormones shows different role in the development of fetal growth, various studies have shown the level of these hormones in the fetal is much higher as compare to adults, this shows how much these hormones are important in fetal growth. Difference in concentration of these hormones shows how they regulate the appetite in fetals and adults. Affect in regulation of these hormones in fetal stage will lead to obesity in children^[18].

GENETIC FACTORS

Genetic reasons are the one of the most considered factors for the obesity. It is normally said that if parents are obese than child is going to be obese, transfer of genes takes place from the parents. Sometimes mutations and other factors results in genetic variations resulting in various diseases. Studies based on genome wide association have identified variation in fat mass and obese associated gene(FTO), which having a strong genetic effect on obesity. The calcium levels in the body are inversely affecting the metabolism in the body resulting in obesity, decreased level of 25-hydroxy vitamin D levels in the body are prevalent among the obese adolescents. The FTO is directly associated with the level of vitamin D, according to a study deficiency of Vitamin D results in the variation in the FTO^[19]. Now when we say about the genetic mutations and transfer of genes, there must be some heredity, paraoxanase 1(PON 1) is the molecule which is causing the obesity heritability. PON 1 is high density lipo protein associated enzyme involved in lipid preoxidation and has been associated with diseases which are due to oxidative stress and obesity is also considered to be due to chronic oxidative stress. A study has shown that the PON 1 genotype has a relationship among the obesity in children. PON 1 is also a main genotype for the genetic ancestry of the obesity. Genome wide associated study (GWAS) has found out various other genomes which are linked with the obesity, similarly there is a gene *SH2B1* which has also genetic variation resulting in obesity. This gene is involved in the regulation of energy haemostatis in the body. Mutation in this gene results in child obesity, by regulating the leptin signaling^[20]. There are

various other genes which are also responsible for the genetic variation.

CONCLUSION

After studying the various research paper, statistical data, and various surveys the major reason behind child obesity is the role of parents in the child development. Mother and father both have similar responsibilities in the development of child. Starting from his birth till the age of adolescent, mother should take care in the child's food, like in infant age proper breast feeding upto 6 months should be there, after 6 months there should be addition of complementary food along with breast milk for a proper time period. Cooking of food should be in healthy way, fast food should be avoided as much as it can be. Child should be motivated to

play physical games; both parents should give him proper time and should play with him. During the school time they should regularly have a check on their child, his surrounding environment and his friend circle to save him from the various bad habits like smoking and drinking. Parents should avoid smoking and drinking in front of their child as it affects them to and it is always said that children always learn from their parents. Apart from these social factors some scientific factors like level of leptin and gehrlin, regulation of energy homeostasis in the body, role of various genetic factors, various other genes which are responsible for heredity of obesity should be identified. Drugs for the treatment of defect in the energy regulation system should be discovered and developed.

Acknowledgement: I would like to thank Dr. Sumeet Gullaiya, Dr. Satyendra K Rajput, and all my friends for their immense support, execution of idea Was not possible without the motivation and emotional encouragement during literature survey and writing manuscript.

↓ REFERENCES

1. Shidfar Farzad, Mitrra Zarrati, Relationship between Breast feeding and obesity in children with low birth weight, Iranian Red Crescent Medical Journal. 2013 August; 15(8): 676-82.
2. Childhood obesity has long-term effects on health: Research, Available at: indianexpress.com/article/lifestyle/health/childhood-obesity-has-long-term-effects-on-health-research (Accessed: 3rd June 2014).
3. Hales CN, Barker DJP. Type 2 (non-insulin-dependent) diabetes mellitus: the thrifty phenotype hypothesis. *Diabetologia*. 1992; 35(7):595-601.
4. Vafa M, Moslehi N, Afshari S, Hossini A, Eshraghian M "Relationship between Breastfeeding and Obesity in Childhood *J HEALTH POPUL NUTR* 2012 Sep;30(3):303-310
5. World Health Organization (2002). Complementary feeding: report of the global consultation, and summary of guiding principles for complementary feeding of the breastfed child. Geneva. who.int/maternal_child_adolescent/documents/924154614X/en/index.html [cited 6 June 2014].
6. Kramer MS, Kakuma R. Optimal duration of exclusive breastfeeding: a systematic review. *Cochrane Database Syst Rev* 2002: CD003517.
7. World Health Organization, UNICEF (2003). Global strategy for infant and young child feeding. Geneva. whqlibdoc.who.int/publications/2003/9241562218.pdf [cited 6 June 2014].
8. Hörnell A, Lagström H, Lande B, Thorsdottir I "Breastfeeding, introduction of other foods and effects on health: a systematic literature review for the 5th Nordic Nutrition Recommendations" *Food & Nutrition Research* 2013. 57: 20823
9. WHO Working Group on the Growth Reference Protocol, WHO Task Force on Methods for the Natural Regulation of Fertility. Growth of healthy infants and the timing, type, and frequency of complementary

- foods. *Am J Clin Nutr* 2002; 76: 620_7.
10. Cohen RJ, Brown KH, Canahuati J, Rivera LL, Dewey KG. Effects of age of introduction of complementary foods on infant breast milk intake, total energy intake, and growth: a randomised intervention study in Honduras. *Lancet* 1994; 344: 288–93.
 11. Ushma J. Mehta, Anna Maria Siega-Riz, Amy H. Herring, Linda S. Adair, Margaret E. Bentley, “Pregavid body mass index is associated with early introduction of complementary foods” *J Acad Nutr Diet*. 2012 September ; 112(9): 1374–1379. doi:10.1016/j.jand.2012.06.005.
 12. Nawab T, Khan Z, Khan M.I, Ansari A.M, “Influence of Behavioral Determinants on the Prevalence of Overweight and Obesity among School Going Adolescents of Aligarh” *Indian Journal of Public Health*, Volume 58, Issue 2, April-June, 2014
 13. Smoking effect on your body, Available at: betterhealth.vic.gov.au/bhcv2/bhcarticles.nsf/pages/Smoking_effects_on_your_body (Accessed: 6 June 2014).
 14. Margaret M Demment, Jere D Haas, Christine M Olson “Changes in family income status and the development of overweight and obesity from 2 to 15 years: a longitudinal study” *BMC Public Health* 2014, biomedcentral.com/1471-2458/14/417
 15. Amandeep Chopra, Nanak Chand Rao, Nidhi Gupta, Shelja Vashisth, Manav Lakhanpal, “Influence of behavioral determinants on deviation of body mass index among 12-15 years old school children of Panchkula” Volume: 36, Article ID: e2014021, 8 pages dx.doi.org/10.4178/epih/e2014021
 16. Mitrovic O, Micic M, Todorovic V, et al. Ghrelin endocrine cells in the human stomach during prenatal and early postnatal development. *Archives of Biological Sciences* 2011; 1: 21–28.
 17. Bjorbaek C, Kahn BB. Leptin signaling in the central nervous system and the periphery. *Recent Prog Horm Res*. 2004; 59: 305–331.
 18. Magdalena Warchol, Hanna Krauss, Malgorzata Wojciechowska, Tomasz Opala, Beata Pieta, Wioletta Zukiewicz-Sobczak, Justyna Kupsz, Alina Grochowalska “The role of ghrelin, leptin and insulin in foetal development” *Annals of Agricultural and Environmental Medicine* 2014, Vol 21, No 2, 349–352
 19. Barbara H. Lourenço, Lu Qi, Walter C. Willett, Marly A. Cardoso, “FTO Genotype, Vitamin D Status, and Weight Gain during Childhood”, *Diabetes* 2014;63:808–814
 20. Anna-Lena Volckmar, Florian Bolze, Ivonne Jarick, et al “Mutation screen in the GWAS derived obesity gene SH2B1 including functional analyses of detected variants” *BMC Medical Genomics* 2012, 5:65 biomedcentral.com/1755-8794/5/65.