Introduction

Does the consumption of dairy and animal protein containing large amounts of hormones, including estrogen, increase the risk of estrogen-dependent malignant diseases and early sexual precocity in prepubescent children? Dairy has been part of the human diet for many centuries. It has been considered a perfect food, but in recent years the scientific evidence has slowly but steadily come to a different conclusion. In modern times it has been marketed as an essential part of our diet through slogans such as "Milk Does the Body Good," "Got Milk" and the "Gateway to Health," The purpose of this paper is to research and investigate the health benefits and risks in the consumption of dairy and animal proteins. [1]

There is no denying that milk is highly nutritious, containing nutrients such as calcium, protein, riboflavin, iodine and many other nutrients that are beneficial to humans. It is important, however, that we consume these nutrients in their proper amounts and from the right sources. Cow's milk is nature's perfect food for a calf that weighs about 63lbs at birth, by week eight will weigh 163lbs and when fully matured will weigh anywhere from a 1,000 to 1,800 lbs depending on the breed. In comparison, the weight of an infant at birth is on the average 7lbs-9lbs, and at full maturity anywhere 150-250lbs.[1]

Cow's milk has been designed to prepare the calf to be on his feet within hours, since he is a prey in his natural environment. These large amounts of nutrients are designed to bring this calf into maturity at a faster rate out of necessity. Humans on the other hand are dependent upon the parents for a minimum of nine months and will not reach autonomous mobility until approximately a year. Human milk is tailored for the slow growth and development of a human, and like in all mammals, it is designed to support early infant development. It is much lower in calcium, sodium,

protein, iodine, iron, potassium and other nutrients. Humans are the only mammals that continue to consume milk after they have been weaned.

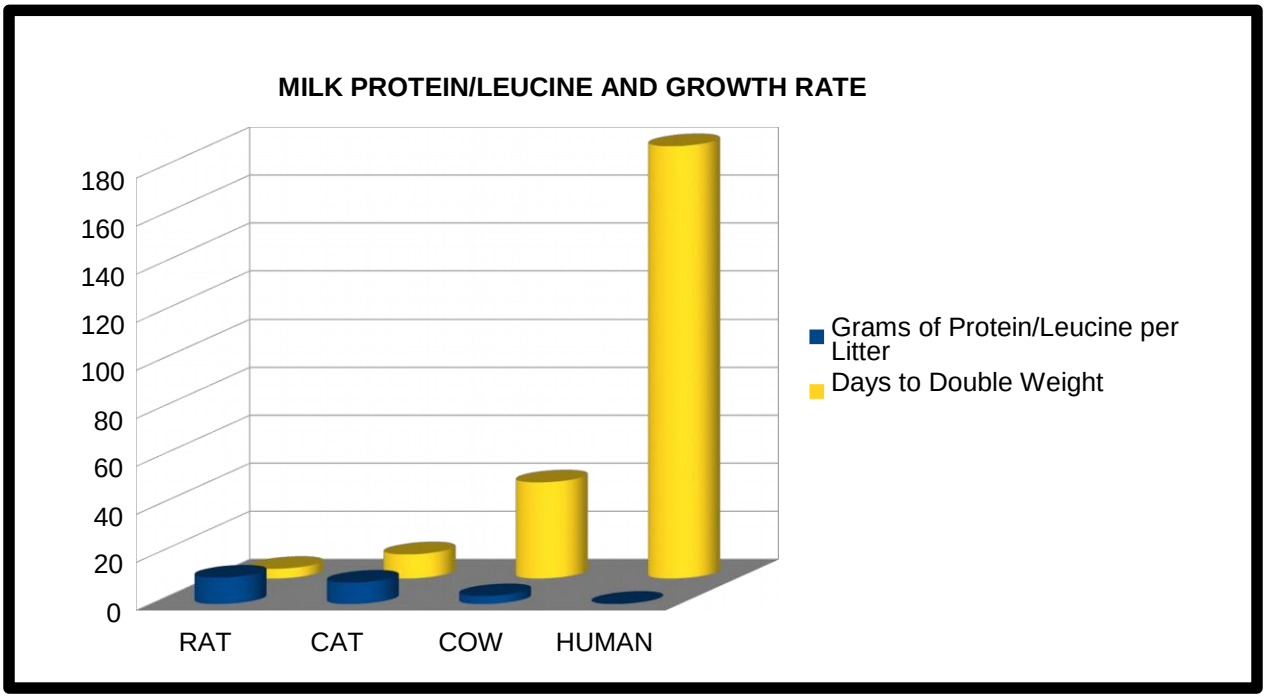
Human Milk vs. Cow's Milk Components

Cow's milk is low in essential fatty acids such as Omega-6 (LNA) and Omega-3 (ALA) and must be converted in the body into the longer chain versions to be assimilated. In comparison, human milk is high in both long-chain essential fatty acids for human brain development and function. Human milk is higher in Omega-6 fatty acid arachidonic acid (AA) and Omega-3 fatty acid docosahexaenoic acid (DHA).[2] These essential fatty acids are central to our development and health as well as proteins.

The protein content in milk is dependent and finely tuned to collaborate to meet the needs of each species, whether it is a cat, dog, rat or a human. One hundred grams of whole cow milk contains 3.3grams of protein which is double the amount of that in human milk 1.3grams because proteins are the building blocks needed to enable each species grow at a specific rate. Since calf's growth rate is at a higher rate than that of humans, more protein is needed. Leucine is an amino acid found in milk in high concentrations; this amino acid stimulates muscle growth synthesis. The higher the concentration of both protein and leucine, the quicker the growth and development. For example, cow's milk contains 3.3grams of protein and the calf doubles its birth weight in 40 days, nearly 40 times higher in comparison to human milk which contains 0.9 grams of protein and doubles its weight in 180 days.[2] (See Table 1.) These findings have led many researchers to investigate the link between formula feeding and overweight and obesity.[2] In addition to the difference in the amount of protein in cow's milk when compared to human milk, there are also major differences in the composition of these proteins - casein and whey.

Caseins and whey are the proteins found in cow's milk. There are four types of caseins (alpha 1, alpha 2, Beta and kappa casein). [2] Casein protein makes up 87% of cow's milk at a ratio of 80:20 casein to whey proteins. On the other hand, human milk contains casein and whey in ratio of 40:60 respectively. Casein is difficult to digest, it forms dense curds that are designed to be digested by a four-tiered stomach digestive system of a cow. With cow's milk containing large amounts of casein, the concern is the association and the range of diseases that have been linked to its consumption, including allergies, type 1 diabetes, cancer, and obesity. [2]

Table 1. Species with the highest milk protein concentration exhibit the most rapid growth rate



"Species with the highest milk protein concentration exhibit the most rapid growth rate. Leucine is a unique amino acid in that it stimulates muscle protein synthesis. The higher the protein plus leucine content of milk, the quicker the neonate doubles its birth weight. For instance, the leucine content of rat's milk is 11 grams per litre and the rat doubles its birth weight in just four days. Cat's milk contains 8.9 grams per litre and the cat takes 10 days to double its birth weight. Cow's milk contains 3.3 grams per litre and the calf doubles its birth weight after 40 days. Human milk contains 0.9 grams per litre and the human infant, the mammal with the slowest growth rate, doubles its birth weight after 180 days. The weight gain of calves during the first year (0.7-0.8 kg per day) is nearly 40 times higher than that of breastfed human infants (0.02 kg per day). It has been demonstrated that cow's milk-based infant formula feeding significantly increases serum concentrations of leucine, insulin and IGF-1 in comparison to breast-feeding (Melnik et al., 2012)."[2]

The prevalence of obesity, early menarche in children, and hormone-dependent cancers have come to the forefront in recent years. Is there a connection to the consumption of an animal-based diet, particularly milk? Is the milk that was consumed 100 years ago the same milk that is consumed today? Yes, but a lot of things have changed. One-hundred years ago our economy was mainly agrarian, the mass production of milk was in its infancy, and the use of hormones and synthetic hormones rBGH and rBST did not exist.

rBGH and rBST Hormones

In 1993 the Food and Drug Administration (FDA) permitted the use of recombinant bovine growth hormones (rBGH) and (rBST), synthetic hormones made in the lab using DNA technology (biotechnology) that allows the dairy farmers to increase their cow's milk production. Today its use is not permitted in the European Union, Japan, Australia, New Zealand, and Canada because of its potential health risks to humans. [3]

Somatotropin (BST), the naturally occurring hormone produced in humans and animals, is made by the pituitary gland, and it is the hormone that stimulates the growth of essentially all tissues of the body. Its levels rise during the normal physical growth in children and peak during growth spurt that occurs in puberty. [3] The major concerns associated with the consumption of dairy products, particularly milk, produced using rBGH is the potential risk of the increased levels of the hormone IGF-1 and the health of the cows; the cows tend to develop udder infection (mastitis). Therefore, increasing the need of the farmers to use antibiotics; thus, the subsequent use of antibiotics intensifies the growing problem of antibiotic resistant bacteria, increasing the potential risk of disease to a milk-drinking population.[3,4] The major difference between the milk of one-hundred years ago, and the mass production of milk today is the introduction and use of animal growth hormones.

Animal Protein and Disease Correlations

The prime minister of China, Zhou Enlai, in the early 1970s, having terminal cancer, initiated one of the largest and most thorough surveys. More than 600,000 researchers helped catalog the mortality trends caused by a variety of cancers from 1973-1975 which included over 2,000 counties and 880 million people. Zhou Enlai died before this project was completed. The result of this survey was a color-coded atlas showing the areas where certain types of cancers were high and where it was almost nonexistent. The data collected in this atlas showed that the areas with the highest incidents of cancer were 100 times higher than the areas with the lowest rates of cancer. What was considered remarkable in these findings was the massive variation in cancer incidents among different counties, although the population had similar genetics from place to place. A significant question was raised: Could it be possible that cancer is largely due to environmental and lifestyle changes and not genetics? [5]

In 1980, nutritionist and biochemist, Professor T. Colin Campbell, assembled a team of scientists: Dr. Chen, deputy director of the most significant government diet and health research laboratory in all China, Dr. Junyao Li, one of the authors of the *Cancer Atlas* and one of the leading scientist in China's Academy of Medical Sciences in the Ministry of Health, and lastly Richard Peto of Oxford University, considered one of the most prestigious epidemiologists in the world. Their goal was to study the correlation between diet and disease from 1973 to 1975 data contained in the *Cancer Atlas*. This study would become one of the most comprehensive studies in the world on the effects of diet and health, known as the China Study. [5]

The study design was conducted in 65 counties across China and the correlation between lifestyle, diet, and disease were compared. Urine and blood samples were collected and 350 workers were trained to carefully collect and catalog the data. In 1990, more than 90,000

correlations between diet and disease were discovered. Upon analyzing the data, which contained mortality rates for more than 48 different kinds of disease, they found 8,000 to 9,000 highly scientifically significant correlations between dietary factors and disease. [5]

Hundreds of charts and tables were produced, and this information was cross-referenced in multiple ways to demonstrate its validity and reliability. The study scrutinized 367 diet and health-related factors. It showed the association between dietary fat and breast cancer, and that by reducing dietary fat from 24% to 6% it lowered cancer risk.[10] It also showed the importance of reducing the consumption, not only of fat, but of animal derived foods specifically. It associated the consumption of high amounts of animal protein and a high-fat diet with an increase of female reproductive hormones and early age of menarche. A comparison was made between the United States' and China's young women. The analyzes found that the age of the first menstrual cycle of women in the United States was an average of 11 years old compared to an average of 17 years old in China. [5,10]

The study also found the association between higher blood levels of estrogen and early menarche. These hormone levels remained high during their reproductive years if diet was rich in animal-derived foods, such as dairy and meat. The conclusion of this study included the statistical significance of the various observations. The statistical significance of meat had a 99+% which means there was a 99 out of 100 probabilities that the observation is real. Animal protein and milk had a 99.9+% certainty, which means a 999 in 1,000 probability that the observation is real.[5,10]

Animal Proteins

Proteins are the building blocks of life-essential compounds for the existence of any living creature. Their importance to a healthy body is crucial and essential. These vital compounds come in thousands of different kinds, and function as enzymes, hormones, and structural tissue and

transport molecules which make life possible. In the natural metabolic process, proteins wear out on a regular basis and must be replaced. This is done by consuming a variety of foods, that are of high quality and efficient in promoting good health. [5]

"In the nineteenth century, protein was synonymous with meat and this connection has stayed with us for well over a hundred years."[5(p27)] There is much confusion on what constitutes the basic questions about protein, such as what are good sources of protein? Is it necessary to meticulously combine plant foods in a meal to get complete proteins? How much protein should one consume?[5] Is some protein considered high quality and some low quality?[5] To answer these questions, we must briefly revisit history. In (1821-1908), scientist Carl Voit, a prominent German scientist and dietitian, found that man needed only 48.4 grams per day, yet he recommended 118g. This same scientist was the teacher to another early century nutrition researcher by the name W.O. Atwater (1844-1932) who later came to develop the science of nutrition in the United States of America. (USDA). Although the science did not back up his recommendations, they became the standard established for the general population and even promoted a higher daily recommendation of 125 grams per day. This concept of high protein intake was ingrained in our culture regardless of the scientific fact, which was that humans needed three times less protein to maintain good health.

In the beginning of the 20th-century, consumption of meat per person was 120 lbs per year. In 2007 it increased to 222 lbs of meat per person per year. In 1909, Americans consumed 294 lbs of dairy products apiece; by the year 2006 that amount had more than doubled to 605lbs per person per year.[6] The massive consumption of these products can be attributed to the large sums of dollars spent in promotions and marketing these products to enhance sales and sell the general population the idea that protein in large amounts is necessary to maintain health.

Today, the correlation by the scientific community is revealing the association with the consumption of animal protein and health risks. In the past two decades, a concerning trend in the occurrence of breast cancer, uteri cancer, and early onset of prepubertal precocity in preadolescent children has generated a vast volume of research and data that needs to carefully be studied and analyzed. Other explanations for the rise of these types of cancers besides diet has been the estrogen-like substances in the environment.

"Milk Does the Body Good?"

Milk and dairy products have been part of the human diet for centuries, but not until the last few decades have the concern of the presence of hormones has become a matter of discussion. A considerable number of studies have been done to demonstrate that the hormones in cow's milk are essential for infant growth and maturity, but in recent years a large number of studies indicate that hormones have the potential to interfere with the physiological function of the endocrine system.[7] The endocrine system and nervous system are primarily responsible for maintaining homeostasis in the body. The only method of communication by the endocrine system is through chemical signaling, therefore any minor changes in the function of the endocrine system may create disruptions in the growth, development and reproduction in animal and humans.[6] Milk and other dairy products contain many biologically active molecules including hormones and growth factors.[7,8,9]

Hormones in Dairy Foods

Some of most important hormones found in milk consist of prolactin, estrogens, endrogen and Insulin-like growth factor -1(IGF-1).[9] These hormones can potentially enter the body through diffusion and active mechanism. Active mechanism has the capabilities to intervene in specific physiological and pathological functions. Prolactin (PRL), a peptide hormone, found in milk of

cows, goats, rats and humans is a hormone that is released during lactation or under certain milking stimuli. It also has wide range of function in the body, acting on the reproductive system, influencing behavior and the immune system.[9]

Some experimental studies on rats have shown that this hormone, when injected subcutaneously in rats, accumulates in milk glands. Most hormones are endocytosed, a form of active transport. This is a process in which a cell ingests a molecule (protein) that cannot pass through hydrophobic plasma. In contrast, Prolactin (PRL) is transported by transcytosis, (active mechanism) a type of cellular transport in which the molecules are transported across the interior of a cell via vesicles. This allows for the hormone (PRL) to be released in the milk either intact or cleaved forms. Prolactin hormone in milk is abundantly found after giving birth and it stimulates milk production. Studies have suggested that milk (PRL) is absorbed and can impact biological change "differentiation and maturation of neonatal neuroendocrine, regulation of the reproductive and immune system in the neonates."[9(p4)] Prolactin was detected in milk by using bioassay and radioimmunoassay.[9]

Insulin-like Growth Factor-1 (IGF-1) is a 70 amino acid polypeptide. Also called somatomedin C, it plays an important role in childhood growth and continues to have anabolic effects in adults and is produced mainly by mammary glands and liver. It is powerful growth hormone that instructs all cells to grow. It is a hormone that is an identical match between human and cow, with the exact order of the amino acid sequence. Many studies suggest that this growth factor could possibly trigger an abnormal response, such as increasing the risk in childhood cancers, breast cancer, and corpus uteri cancer.[9] A study which took incidence and mortality data of different cancers from 40 countries and associated the rates with dietary factors found a close relationship between the consumption of meat and breast cancer incidence. Milk was correlated to

ovarian cancer followed by animal fats and cheese. In addition, the study relates that the combination of both cheese and milk make the greatest contribution to the incidence of ovarian cancer.[10] The main concern is that a large percent of the milk consumed today is from pregnant cows in their third semester, where the (IGF-1) levels are higher. Estrogens and IGF-1 mutually impact the increase of breast cancer cell reproduction. [7,9,10]

Estrogens are steroid hormones that are produced primarily in the ovaries. The related hormones that make up the family of estrogens include estrone, estradiol, and estriol. Like other hormones, they are chemical messengers that tell specific tissues to behave in a certain way. Estrogens are also responsible for the female reproductive system, menstrual cycle, and development of breasts. Estrogen also exists in men, but are found in higher amounts in women. Estrogen travels by the way of fluid, usually through the bloodstream, and interacts with cells in different target tissues in the body to deliver the message. For example, estrogen levels rise suddenly prior to ovulation; after ovulation this hormone decreases. In this case, the chemical message delivered was to ovulate. [10,8]

In the western diet the major source of estrogen is from animal-derived sources (60% to 70%), dairy, and meat-related products.[9,10] This has prompted many studies over concern about safe levels of dairy consumption and the long-term health risks. [9]

Estrogens Levels and Potential Health Risks

In a study, Estrone and Estrone Sulfate Concentrations in Milk and Milk Fractions, the researchers acknowledged that dairy products naturally contain estrogens.[11] The objective of the research was to provide information for the nutrition professionals to better estimate potential exposure to estrone 1 (E_1) and estrone 1 sulfate (E_1S) and to demonstrate that the presence of these compounds in milk products at the present level is not a health concern. The research proposed

that the recommendations by the FDA are safe for the consumer of dairy products. The Dietary Guidelines for Americans 2010 recommended three servings (24 fl. oz. total) of dairy products daily for children 9 years of age and up. Based on the results of the experiment, if an individual consumed three glasses of whole milk per day, the concentration level of E_1 would be 7 ng/day and E_1S would be 61ng/day; this would be within the FDA recommendations. Their recommendations took into consideration the body's normal production rate of 54,000 ng/day for girls and 100,000 ng/day in prepubertal boys. The FDA states that no physiological effects occur when consumption of estrones is 1% of what the body normally produces. Based on this, the threshold rate for girls would be 540 ng/day.[11]

In another study, the different characteristics and functions of phytoestrogens were studied. Phytoestrogens exhibit hormone-like characteristics. They are referred to as phytochemicals, which means "plant chemical." This study discussed the numerous biological functions of phytoestrogens - from exhibiting oxidation to enhancing the immune system. The most potent of the plant estrogens have only 0.001 potency of estradiol. Estradiol is the most potent naturally-occurring ovarian estrogen in mammals. Although very weak in comparison to estradiol, phytoestrogens do exert physiological changes even with their extremely low potency.[12]

Another study researched the effect of ethinyl estradiol-cyproterone acetate, a synthetic hormone used for hormone replacement therapy in menopausal women. It was determined that the use of this hormone in obese women may increase resting metabolic rate (RMR) and should be used with caution, due to the associated deterioration of glucose tolerance, especially in women with family history of type 2 diabetes. This research demonstrates that the use of these powerful substances has unpredictable side effects and do produce physiological effects, and that extreme caution should be exercised when weighing the health benefits against the risks. [13]

Hormone Exposure in Critical Populations

If hormones are a potential culprit in endocrine disruptions and physiological effects, what could be the possible health risks? Studies have suggested that endocrine disruptions could be related to low-dose and long-term exposure of hormones, especially for specific and sensitive populations at their critical stage of development; particularly fetal, newborn, and prepubertal children. It needs to be noted that these population's natural production of estrogens is extremely low, because of their stage of development.[14] There have been cases of accidental exposure of children to estrogens from exogenous sources such as one case where gynecomastia (swollen male breast tissue) was observed in three prepubertal boys exposed to estrogen cream belonging to their postmenopausal mothers.[9]

In another study, milk, muscle, and liver/kidney products were analyzed to quantify concentration of estrogen levels in these various foods. A theoretical food intake was performed based on the levels of 17-estradiol and 17 testosterone and was compared to the acceptable daily intake (ADI) established by the JECFA for 17-testosterone and 17-estradiol (equivalent to 2ug kg^{-1} of body weight per day and 50ng kg^{-1} of body weight per day, respectively) it was also compared to the maximum daily intake established by FDA for 17-testosterone and 17-estradiol (equivalent to 320 and 65 ng day^{-1}, respectively).[14] These two systems of reference, though very different in values, were still taken into consideration when analyzing the theoretical food intake and the study concluded that the recommendations set by the FDA and JECFA were adequate.[14] However, other androgen that are precursors to testosterone, which also exert a biological activity in the body, were not taken into consideration.[14]

Also, according to this study, testosterone is mainly consumed in meat and milk appears to be most significant in estradiol, in addition it points out that the recommendations set by the FDA

for determining the normal production of estradiol in the body for prepubertal children, traditionally were determined using radioimmunoassays (RIA) from the 1970s, and the findings presented huge variability in the levels of natural estrogen in the blood of prepubertal children. This variability triggered several other studies which reevaluated the established recommendation by the FDA. New studies used the confirmatory MS techniques to re-evaluate these concentrations, and confirmed that the natural production of the body's hormones is actually lower than previously reported. The studies concluded that even a small exogenous variation would bring a major change in the total activity of these hormones in this critical population. [14,15,]

Children Highly Sensitive to Sex Steroid Action

In 1994, KO Klein and coworkers hypothesized that estradiol levels are higher in prepubertal girls than in prepubertal boys and that these concentrations might bring early puberty in girls. They developed a new ultrasensitive assay to measure estrogen levels. The assay uses a strain of Saccharomyces cerevisiae, a species of fungus, because of the extreme sensitivity to estrogen. In addition, it was highly specific for estradiol; the detection limit was <0.02 pg/ml. (one trillionth of a mole).[15,16] This study concluded that the ultrasensitive recombinant yeast bioassay (RCBA) detected that estradiol concentrations levels in prepubertal children was almost 100-fold lower than previously reported concentrations, and significantly lower estradiol levels in prepubertal boys compared to girls.[15,16,17,18]

Children are highly sensitive to sex steroid action, and even a small exogenous intake could have a major change in the body.[15] Estrogen and androgen receptors are expressed in sex steroid sensitive tissues throughout childhood. Prepubertal children are highly responsive, because the child's normal blood circulating levels of sex hormones are very low, that even a small exogenous intake could have major effects in the body. In infancy for example, temporary palpable

breast tissue in newborns can be observed right after birth and this has been correlated to the maternal hormones in utero or through breastfeeding. Furthermore, in a study of 1126 3-month old infant's serum levels of estradiol were significantly higher in girls compared with boys.[15] This observation shows the significance of steroids in early life. The reaction of breast tissue to estrogen is also manifested later in childhood, as the development of premature thelarche - the development of breasts in girls before the age of 8 years, without any other sexual maturation. Another tissue sensitive to estrogen is bone tissue. If estrogen receptor mutations exist, and it lacks estrogen action, then there may be a delay in epiphyseal maturation, normal skeleton proportions, and bone mineralization in both sexes.[15]

Shift in Pubertal Timing

The difference in estradiol levels in prepubertal girls and boys can help understand the difference in body composition, skeletal development and the timing of puberty. Higher levels of estradiol in girls may explain the early onset of puberty. Diet is the main human exposure to estrogens (sex hormones) one glass of milk may contain more than 70% of animal source estrogens.[9]

Two more recent epidemiological studies carried out in the United States by (PROS and NHAMES III), discovered an unexpected early sexual maturation in girls.[15,17] The average age of breast development was at 8.87 and 9.48 years old. In black Americans girls it was 9.96 years and 10.38 years and in Caucasian girls and in a comparison of previous studies it showed that the development of breast due to pubertal onset was 10.8-11.2 years. It showed that the higher levels of estradiol increased the onset of early puberty in girls. [15]

Although the accuracy of these findings has been questioned, because of the type of study design, many other studies in other countries have demonstrated similar trend in early sexual

maturation in girls related to the high levels of sex hormones. One such study known as the China Study observed the same findings.

> What does the China Study show regarding these risk factors? Higher dietary fat is associated with higher blood cholesterol and both factors, along with higher female hormone levels, are associated, in turn, with more breast cancer! and earlier age of menarche. [5]
>
> The much later age of menarche in rural China is remarkable. Twenty-five women in each of the l30 villages in the survey were asked when they had their first menstrual period. The range of village averages was fifteen to nineteen years, with an average of seventeen years. The U.S. average is roughly eleven years! [5]

In Europe the pubertal onset for boys comes at a much later age compared to boys in the United States, black American boys average age of puberty 10.1 and for white boys 9.5. European boys enter puberty between the ages of 11.2 and 11.8 years. In Denmark a study on Precocious puberty from 1992-2001 showed that girls ages 5-9 years was 8 per 10,000 and boys of the same age 1 to 2 per 10,000. These observations support the increase trend in precocious puberty associated with high levels of estrogens.[15]

These findings have raised many questions and some suggestions of changing what has been the normal age of menarche to the new early age, but this approach may lead to unprecedented health risks because it is ignoring the possible pathological condition, which has been implicated with early menarch.[15]

Conclusion

The purpose of this research paper was to identify the possible health risk of exogenous endocrine disrupting factors such as hormones in our food chain. The human body is a magnificent machine that is finely tuned and capable of withstanding a tremendous amount of misuse with an

inmense ability to adapt. Like all machinery it is susceptible to breaking down because of abuse. Today we are living longer, but we are also suffering from a variety of diseases more than ever before. We are facing a health crisis. According to the data from the National Health and Nutrition Examination Survey (NHANES) more than 2 in 3 adults are overweight or have obesity, Cancer of the reproductive system is the highest levels among women, Type 2 diabetes is the fastest growing disease among our children, and the onset of precocious puberty is a great concern for this hormone sensitive population. According to a 2003 study in the Journal Endocrine Review the age of menarche in the United States has been decreasing about 0.3 years per decade, in the mid-1800s girls had their first menstrual period on average at 17 years until the 1960s.

Today the average age of menarche in the United States in girls is about 11 years old. The cause of this precocious puberty in our youth and specifically in girls have been associated with the large exposure of exogenous hormones in our environment. A large number of studies have been conducted to investigate this trend that is associated with disease in women.

In the early 1970s the data that was established was based on existing technology and the recommendations set by the FDA was based on the data and technology available. Recently studies based on highly sensitive and accurate technology has brought these recommendations of the 1970s into question. The findings demonstrated that the threshold for the detection of hormones are 100-fold lower than previously reported, bringing concerns of health issues, such as cancer, and early menarche in our youth and more specifically girls.

In analyzing these studies there were two different views concerning the safe levels appropriate for this sensitive population. However, both studies agree that hormones via our food chain, e.g., dairy, meat products do contain hormones that can exert significant effects even in small doses.

Recent data have shown that the endogenous levels of sex hormones in this population is very low and that even small exposure can exert biological activity. A fine balance between the pituitary gland, responsible for growth and sex organs and gonad exists. This balance can be interrupted by the consumption of certain food, particularly, dairy, and animal-based products, because they contain high levels of hormones interfering with normal hormonal action.

These findings are of great concern for the general population, but more specifically to the nutrition industry, because diet containing animal source estrogen is the main human exposure to exogenous, estrogens. These studies have raised relevant questions on the possible effects of hormone exposure on children and the health-related risks, such as cancer, obesity, Type 1 diabetes and particularly the increasing occurrence of precocious puberty in girls. The current threshold for the safe levels of these hormones should be revised, estimated daily production rates have been highly overestimated.

References

1. Water K. SDSU iGrow. *Factors Affecting Birth Weight* [website]. March 25, 2013. Available at http://igrow.org/livestock/beef/factors-affecting-birth-weight/.
2. Butler DJ. A Viva! Health Report. Bristol, England 2014.
3. The American Cancer Society. September 10, 2014. Available at: https://www.cancer.org/cancer/cancer-causes/recombinant-bovine-growth-hormone.html.
4. *Report of the Canadian Veterinarian Medical Association Expert Panel on rBSt 2012.*
5. T. Colin Campbell P. Thomas M. Campbell II MD. *The China Study*. First Edition ed. United States: BenBella Books: 2005.
6. Fulkerson L. Forks over Knives [film]. Virgil Film and Entertainment, 2011.
7. Baumrucker CR. Encyclopedia of dairy sciences. *Hormones in Milk.* 2011.
8. Young, Womble M, Johnson E, Johnson JE, Korol O. *Anatomy and Physiology.* Houston; 2013.
9. Malekinejad H, Rezabakahsh A. Hormones in Dairy Foods and their Impact on Public Health – A Narrative Review Article. *I J. Public Health.* June 2015; 44((6));742-758.
10. Davaasambuu G, Sato A. The possible role of female sex hormones in milk from pregnant cows in the development of breast, ovarian and corpus uteri cancers. *Medical Hypothesis.* 2001;65(6);1028-1037.
11. Elsiever. Estrone and Estrone Sulfate Concentrations in Milk and Milk Fractions. *J Acad of Nutr Diet.* May 2012
12. Are Phytoestrogens Natures Cure for What Ails Us? A Look at the Research. *J Am Diet Assoc.* 1998;98:974-976
13. Academy of Nutrition and Dietetics. Evidence Analysis Library. 2005. Available at: www.andeal.org/topic.cfm?evidence summary id=88&home=1&hightlight=hormones.

    LC MP, Vauhkonen I, Koivunen RM, Ruokonen A. Martikainen HK, Tapanainen JS. Academy of Nutrition and Dietetics. 2005.
14. Courant F, et al. Exposure Assessment of Prepubertal Children to Steroid Endocrine Disruptors. 2. Determination of Steroid Hormones in Milk, Egg, and Meat Samples. *J Agric Food Chem.* 2008;56:3176-3184
15. Aksglaede, L., Juul, A., Leffers, H., Shakkebk, N., & Andersson, A., (2006). The sensitivity of the child to sex steroids: possible impact of exogenous estrogens. *Human Reproduction update,* 12(4), 341-349
16. Klein, K., Baron, J., Colli, M., Mcdonnell, D., & Cutler, G. (1994). Estrogen levels in childhood determined by an ultrasensitive recombinant cell bioassay. *J Clin Invest, 94*(6), 2475-80.
17. Herman-Giddens, M., Kaplowitz. P., & Wasserman, R., (2004). Navigating the recent articles on girls' puberty in Pediatrics: What do we know and where do we go from here? *Pediatrics*, 113.(4),911-7
18. Naturally Occurring Estrogens in Processed Milk and in Raw. *J. Agric. Food Chem.* 2006;54.