HEALTHY CHOCOLATE PRODUCTS — COMFORT FOODS AND DIET AIDS

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ABSTRACT

Chocolate in its original form has long been known to lift mood, increase mental activity, as well as to control appetite, but the molecular basis of these effects is only now beginning to be understood. Some of the health benefits of chocolate are attributable to its high content of natural polyphenolic antioxidants. However, the high sugar content of conventional brands has raised concerns that their consumption is contributing to the current obesity epidemic, to osteoporosis development in older women, and the raising diabetes incidence in the Western industrialized nations. This in turn has produced a growing demand for 'healthy' chocolate products with reduced sugar content replaced by extracts from tropical plants as spices and flavoring agents and other components like the probiotics present in Triple Treat CHOCOLATE. Evaluation of two healthy chocolate products revealed them to allow the enjoyment of chocolate as part of a healthy lifestyle and compatible in conjunction with weight maintenance and weight loss programs.

DISCLAIMER

The FDA has not evaluated these statements. None of the information or products discussed in the paper is intended to diagnose, treat, mitigate or cure any disease.

Conflict of interest Statement: The authors do not have a conflict of interest in relation to this paper.

INTRODUCTION

The consumption of chocolate has grown substantially during the past 150 years causing it today to be recognized as the most craved of all human foods. According to the International Cocoa Organization (ICCO), global chocolate sales reached US$ 74 billion in 2006, representing a more than 20 % growth over 5 years. Demand for chocolate is expected to grow by 50% over the next decade [1]. However, the increasing popularity of chocolate has led to claims that it is responsible for the current obesity epidemic, the increased incidence of

type II diabetes, and for osteoporosis development in women [2,3]. Whether valid or not, these claims have reached the general public and have created a demand for 'healthy' chocolate products. A number of such products have been developed and two of them, 'Triple Treat Chocolate' and 'TLC Liquid Chocolate', will be evaluated in the present account. However, in order to place these products into perspective, it is necessary to first delineate the history of conventional chocolate, its composition, nutritional value and demonstrated health effects.

From Cocoa Beans to Chocolate

Historical Developments.

The cocoa plant was unknown in Europe until Christopher Columbus (1451-1506) brought back some cocoa beans from one of his trips to the newly discovered American continent. However, as nobody knew what these beans were good for, they were discarded. The actual history of chocolate on the European continent began with Hernam Cortes (1485-1547) who, in 1528, after returning from his expedition to Mexico, introduced Spanish nobility to 'Xocoatl (or chocolatl'), the drink made from cocoa beans he had been offered by Aztec emperor Montezuma II (1480-1520) [4-6]. History has it that Montezuma II drank as many as 50 cups of 'xocoatl' a day, claiming that it is *"the divine drink, which builds up resistance and fights fatigue. A cup of this precious drink permits a man to walk for a whole day without food."* Spanish priests of the period also noticed its appetite-curbing properties and, with eventual Papal permission, recommended it as a food substitute during periods of fasting. However, the ancient Mayans also knew this drink and called it caucau [7] . Thus, today's 'chocolate' is of Aztec, 'cocoa', of Mayan origin.

As the drink was originally prepared from whole cocoa beans suspended in water with just vanilla and some spices added, it had a bitter taste, until in the late 16th Century, when cane sugar became available in Europe. The now exquisite taste of the sweetened drink may have prompted the Swedish botanist Carolus Linnaeus (Carl Linné) in 1753 to assign the Latin name *Theobroma,* 'food of the gods', to the cacao plant, even though cocoa was officially considered a drug rather than a food, and only obtainable in pharmacies until well into the 19th Century.

Since the early cocoa drinks were made from the whole, un-defatted cacao beans, they were perceived by most as too rich due to their high fat content. This led the Dutch chemist Coenrad J. Van Houten (1801-1887), in 1828, to patent a press for the extrusion of the fat from the cocoa bean paste [8]. This produced a nearly fat-free powder, which, when mixed with sugar and milk, yielded a beverage that already closely resembled the cocoa drinks of today. The cacao fat, or cacao butter, by-product of Van Houten's process, proved valuable for many uses, but also played a major role in the subsequent development of the chocolate industry. Thus, in 1848, the first chocolate bar was made by mixing

cocoa butter with defatted cocoa powder in the right proportion. The first milk chocolate bar was in fact obtained In 1875 by the Swiss entrepreneurs Daniel Peter (1836-1919) and Henri Nestlé (1814-1890) from defatted cocoa powder and sweetened condensed milk [9]. However, it soon became apparent that additional improvements of the chocolate making process were necessary, since the chocolate mass, consisting of a complex mixture of hydrophilic and hydrophobic substances, proved difficult to homogenize, causing the first chocolate bars to be somewhat hard and brittle.

In 1879, Rodolphe Lindt, (1855-1909), also from Switzerland, improved chocolate production by repeatedly forcing the chocolate paste through special presses for as long as 72 hours. The compressions caused the mass to warm up and to melt, allowing some air to be bubbled through it to remove volatile malodorous and bitter tasting by-products. This process, now referred to as 'conching' [10], yielded a highly homogeneous product, which, as an additional bonus, exhibited a much lower softening temperature, causing it to melt on the tongue, to the delight of the consumers. Improved methods of 'conching' shortened the duration of the process to 9 hours. Chocolate Sprüngli AG acquired Lindt's company in 1899 for 1.5 Million Swiss Francs, at the time, an unheard of sum [11]. Today, Sprüngi and Lindt is one of the world's leading manufacturers of premium chocolate products with close to $ 1 billion in annual worldwide sales [12].

In the U.S.A., the first milk chocolate was produced in 1900 by Milton. S. Hershey (1857-1945), who, in just 10 years, had sold so much of it that he was able to buy two entire towns, one in Pennsylvania, where he made the chocolate, and one in Cuba close to his sugar mill, and to name them after him [6,13]. In the following years, chocolate consumption increased in all of the Western industrialized countries. In 2007, the 4 World leaders in per capita annual chocolate consumption were Germany with 11.12 kg (up 7.8% from 2002), Belgium, 11.03 kg (up 24.2%), Switzerland, 10.74 kg (down 1.7%) and the United Kingdom, with 10.22 kg (up 2%); the United States with 5.58 kg (up 4.1%), ranked 11th [14].

Environmental and Social Issues

Although the most of the cocoa plants are still grown in the shady rainforests of Ivory Coast, Ghana, Nigeria, Cameroon, Indonesia and Brazil, cocoa farmers increasingly switch to what is referred to as 'sun farming', resulting in the deforestation of ever larger areas, loss of wildlife habitat, the increased use of synthetic pesticides, and mounting social problems. The pay of the cocoa farm laborers is low, and in the West African Nation of Ivory Coast, where 43 % of the world's cocoa is produced, boys often as young as 9 years are working on the farms without any pay and performing dangerous jobs — an example of re-emerging child slavery and trafficking [15].

On the positive side, cocoa and its products bring pleasure to hundreds of millions of people all over the world without requiring the mass production and slaughter of animals, while providing a valuable export commodity for some of the most disadvantaged developing countries.

Composition of Chocolate.

Macronutrients.

The composition of different brands of chocolate varies widely, but in general, the dark varieties are richer in cocoa bean-derived ingredients than the brown varieties. A dark chocolate may contain 75% of cocoa mass, 25 % of sugar, 0.3-0.5 % of lecithin E322 (used as an emulgator) and 0.01 % of natural vanilla. A semisweet brand may contain just 38 % cocoa mass, 12 % cocoa butter and 50% sugar. A lighter brown milk chocolate may consist of only 10 % cocoa mass, 28 % cocoa butter and 37 % sugar, but contain 27 % whole milk powder. Even a white 'chocolate' is produced, consisting only of a mixture of cocoa butter, sugar and milk solids. As it contains neither cocoa solids nor chocolate liquor, it is not allowed to be called 'chocolate' in some countries [16]

From a nutritional perspective, chocolate is primarily a source of sugar and fat. It is not a significant source of protein; since even the protein content of milk chocolate may be a little higher due to the added milk solids, but this would still not make it a significant protein sources since at least a pound of this chocolate would have to be consumed per day to meet the protein requirement of an adult.

The cocoa lipids are composed of 35 % stearic acid, 35 % oleic acid and 25 palmitic acid.

Minerals and trace elements.

The mineral and trace element content of the cocoa bean depends on soil composition, shade, fertilization, irrigation and season. Chocolate is a good nutritional source of copper, since one 100 g bar of the dark variety typically furnishes 1 mg of Cu, or 50 % of the RDA. As women in childbearing age are at risk of developing copper deficiency, their craving for chocolate thus could be a sign of copper deficiency. Chocolate is also rich in magnesium, with one 100 g bar providing about 75 % of the RDA, and a moderate source of potassium and of iron. It furthermore contains some of iodine, fluorine and nickel, but is a poor source of calcium, zinc and selenium. Fertilizer increased the levels of manganese and phosphorus, decreased the levels of copper and molybdenum in the beans [17].

Minor components

Vitamins.

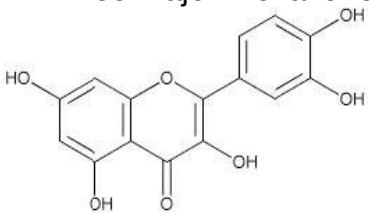
In general, chocolate is a negligible source of vitamin A, of B-vitamins, folic acid, of vitamin C and D, but with 5.3 mg/100 g it is about as good a source of vitamin E as is butter.

Bioflavonoids.

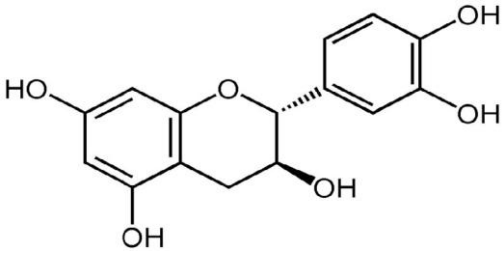
The cocoa solids have a complex composition containing as many as 300 different organic compounds, some of the most important of which are the bioflavonoids quercetin, catechin, epicatechin, and their precursors, the procyanidins, whose structures are given in Schemes I and II.

Example I

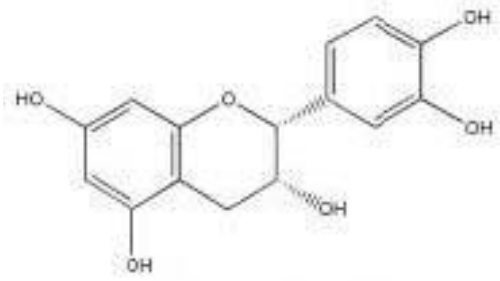
Three Major Bioflavonoids of Chocolate



Quercetin



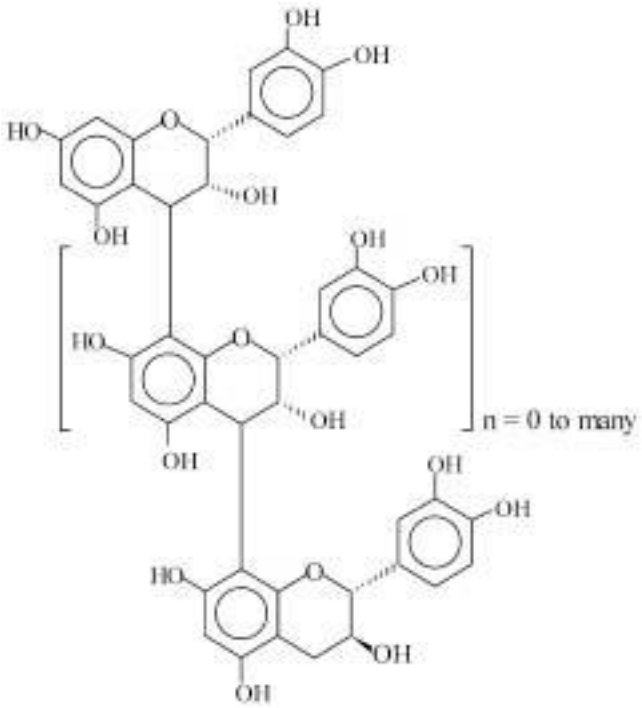
Catechin



Epicatechin

Example II

Basic structure of the procyanidins in chocolate



The bioflavonoids are water-soluble compounds that belong to a group of natural pigments whose primary function is to protect organic plant components against damage by oxygen radicals. In humans, their unchecked production has been shown to speed-up the aging process and to increase the risks of developing cancer and of cardiovascular disease. Since oxygen radicals are some of the most reactive chemical species known, they must be absorbed or otherwise inactivated before they can reach vital components of organs and tissues. The bioflavonoids were initially considered to be vitamins (‘vitamin P’), until newer research established that they were, in fact powerful natural antioxidants [18,19].

ORAC Value.

Laboratory methods have been developed to asses the antioxidant activity of a food, vitamin or compound by measuring their oxygen radical absorption capacity (ORAC) [20]. These demonstrated that dark chocolate has one of the highest ORAC values of all foods, 13,120 per 100 grams. Although this high value arises in part from the fact that chocolate is a highly concentrated food with a low water content, it is nevertheless high by any measure and probably arises

primarily from the presence of the bioflavonoids and their precursors. Whether the chocolate antioxidants are bioavailable depends on the brand. Thus, a study with human subjects demonstrated that dark chocolate increased plasma antioxidant levels, but not milk chocolate, or dark chocolate when consumed with milk [21], suggesting that components in milk interfere wit the uptake of the antioxidants from chocolate.

The antioxidant activity of dark chocolate was found to be substantial enough to be detectable in humans under normal dietary conditions. Thus, a study revealed that adding just half an ounce of dark chocolate to an average American diet increases its total ORAC value by four percent, and lessens oxidation of LDL cholesterol [22]. Other studies demonstrated that eating chocolate lowers blood pressure and 'bad' cholesterol, boosts the immune system, improves cardiovascular health, and produces an anticlotting effect almost as strong as aspirin.

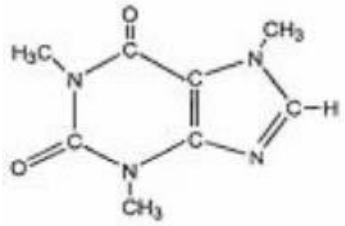
Theobromine and caffeine.

Two well-known organic constituents of chocolate are theobromine, so named because it was first isolated from cocoa beans, and caffeine [23]. Theobromine is a central nervous system stimulant and a close chemical relative f caffeine, see Scheme III.

Example III

Theobromine and caffeine, two methyl xanthine derivatives isolated from cocoa beans.

Theobromine



Caffeine

Theobromine affects humans similarly to caffeine, but to a much lesser extent. It is mildly diuretic, acts as a mild stimulant, and relaxes the smooth muscles of the bronchi in the lungs. Theobromine has been used clinically for its diuretic effect, and because it dilates blood vessels, also to treat high blood pressure. Most brands of chocolate also contain some caffeine, although usually only small amounts and not enough to cause insomnia. Thus, a typical 1.65-oz Hershey

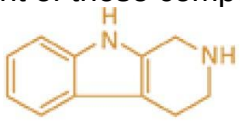
milk chocolate bar contains only 10 mg of caffeine (22 mg/100 g) and 92 mg of theobromine (197 mg/100 g). For comparison, a cup of coffee usually contains 80–100 mg caffeine, and no theobromine.

Phenylethylamine (PEA), C_6H_5-CH_2 CH_2-NH_2.

PEA is a highly bioactive compound which is normally produced in brain tissue but is also found in cocoa [24-26]. It amplifies the activity of key neurotransmitters in the brain to uplift mood, mental activity, to increase the attention span, motivation, alertness, creativity, energy, stamina, physical activity, creates pleasurable feelings, sexuality, and sensory awareness. In addition, PEA controls appetite and promotes weight loss by reducing food intake and stimulating fat burning in the body's adipose tissues. Although present in chocolate in only small amounts (0.4 – 6.6 micrograms/g), these amounts suffice to elicit all the effects previously noted by chocolate lovers. It also has been suggested that the craving for chocolate may be an attempt of the body to 'self-regulate' appetite and mood via PEA

Alkaloids.

A recent study conducted in Spain found that ordinary cocoa and chocolate bars contain two groups of alkaloids known as tetrahydro-beta-carbolines (THBCs) and tetrahydroisoquinolines (TIQs) [27]. It is believed that suggests that these compounds influence the production of endogenous opioids (endorphins), also known as the 'feel-good chemicals' produced by the brain. Other studies suggest that THBCs might play a role as neuromodulators via effects on monoamine oxidase (MAO), the enzyme that is largely involved in
the production and breakdown of neurotransmitters (i.e., serotonin and dopamine) that are critical to functions such as appetite, motivation, cravings, mood, and sleep. Specifically, THBCs appear to inhibit monoamine oxidase (MAO), thereby potentiating the effects of biogenic amines in chocolate such as PEA, and others, reducing the breakdown of neurotransmitters and extending their duration of action [28].
The concentration of two THBCs in chocolate and cocoa was found to be comparable to that of alcoholic beverages such as wine, beer, and liquor, which contain a relatively high amount of those compounds.

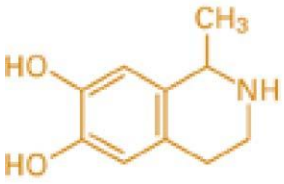


Tetrahydro-beta-carboline

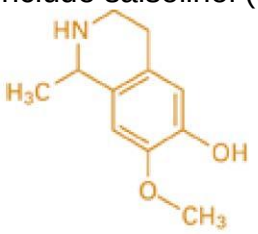
Tetrahydroisoquinoline

Salsolinol and Salsoline.

The TIQs found in chocolate include salsolinol (SAL) and salsoline:



Salsolinol

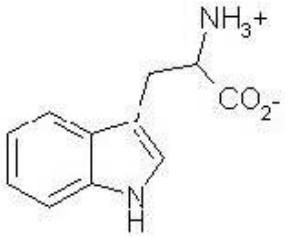


Salsoline

SAL is a dopaminergic active compound, which binds largely to dopamine receptors. These receptors have been associated with neuropsychiatric disorders such as drug addiction. It has been suggested that SAL may influence the production of endogenous opioids (endorphins), and that the amount of SAL in 100 g of chocolate would be sufficient to interact with the dopamine receptors [29,30].

Tryptophan.

Chocolate also contains some tryptophan, an essential amino acid needed for the synthesis of serotonin in the brain [31]. Studies have shown that women produce less serotonin at some points during their menstrual cycle. This could be the reason why chocolate is so popular among women as it helps restore the serotonin and promote calm feelings.



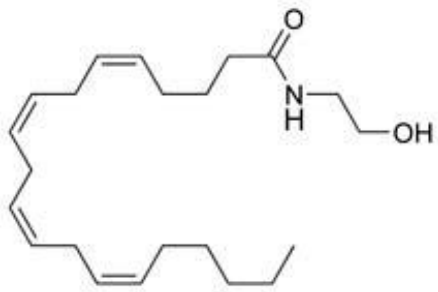
Tryptophan

Of interest within this context are the results of a recent Australian study published in the British Journal of Psychiatry [32], which showed that almost half of people who suffer depression have chocolate cravings, and most claim it improves their mood.

Anandamide.

The last psychoactive compound in chocolate to be mentioned is the newly discovered anandamide; its name is derived from the Sanskrit word "ananda," for

peaceful bliss.



Anandamide

Anandamide binds to the same receptor sites in the brain as cannabinoids - the psychoactive constituents in marijuana, and produces feelings of euphoria [33].

Nutritional Value and Health Effects

From a nutritional perspective, chocolate is primarily a source of sugar and fat. It is not a significant source of protein; since even if the protein content of milk chocolate may be a little higher due to the added milk solids, but, this would still not make it a significant protein sources since at least a pound of this chocolate would have to be consumed per day to meet the protein requirement of an adult.

As to cocoa butter, there has been concern that its high content of stearic acid might be detrimental, but studies with human subjects demonstrated no negative effects on serum lipid levels [34]. In fact, the special composition of cocoa butter may cause it to be more beneficial for diabetics than other fats since a recent study demonstrated that a feed rich in cocoa butter caused rats to develop improved insulin sensitivity compared to other kinds of fats [35]. Eating a square of dark **chocolate** every day was also found to raise the blood levels of nitric oxide, causing the reduction of systolic and diastolic blood pressure by several points [36].

Another study conducted at Johns Hopkins University and presented at a recent meeting of the American Heart Association also revealed chocolate to be beneficial to circulation and overall heart health [37]. The protective effects of chocolate have been attributed to its content of bioflavonoids [38]

The healthy chocolate products

The two products evaluated **Triple Treat Chocolate and TLC Liquid Chocolate,** are examples of newly developed types of enriched chocolate. Additional ingredients are plant-derived flavorings and spices, and Triple Treat

Chocolate contains encapsulated (for stability) probiotics.
'Triple Treat Chocolate' comes in packages of 8-gram pieces of chocolate containing an assortment of Lactobacillus Helveticus and Bifidobacterium Longum.In addition each piece contains 3 g of fat (from organic cocoa butter and cocoa liquor), 0.8 g of fiber, 0.6 g of protein, 40 mg potassium, 10 mg of calcium, 4 mg of magnesium, 1 mg of iron and 0.5 mg of zinc, and a proprietary blend of herbs, plant products and spices, including Wild Craft Blueberry exctract and Quercitin (an antioxidant rich Polyphenol) with each piece providing 40 calories.
Its ORAC rating is 11552 per piece.
Triple Treat Chocolate is not marketed for weight loss, but as a food 'to be enjoyed anytime as part of a healthy lifestyle and to promote a healthy weight. It is recommended to eat one piece, followed by 8 ounces of water, and waiting 10 minutes before eating anything else. Actually, users of the product report that a feeling of satiety develops almost immediately after eating the piece so there is no urge to eat anything. This feeling persists in most users questioned for at least four hours, enabling one to skip a meal without in-between hunger attacks. The appetite-curbing effect of the product is attributable to its chocolate content. Following one subject for 3 months, the product was found neither to raise blood cholesterol nor to raise blood glucose levels.

'TLC Liquid Chocolate' consists of a viscous chocolate with to which additional herbs and natural flavoring agents are added, including açaí, mangosteen, cupuaçu, goji berry and cherry, making it an exceptionally rich source of numerous polyphenolic, natural plant antioxidants such as xanthones, anthocyanins and other phytonutrients, giving it an ORAC of 135000 per liter and 3994 per fl oz, plus vitamins A, B1, B2, B3, C, E, potassium, magnesium, zinc and phosphorus all complementing perfectly the beneficial properties of chocolate, allowing one to quench the craving for chocolate. Yet, as one serving (1 fl oz) of TLC Chocolate has an energy value of just 19 calories, *it allows one to quench the craving for chocolate with only about 1/10 of the caloric burden of the same amount of conventional chocolate.*

The Role and the Importance of Probiotics

Generally, people do not think about their intestines very often, or about the bacteria inhabiting the intestine, whose population largely outnumbers the cells of our organism. In order to encourage you to think about the inhabitant of your intestine and to help you better understand their importance, here are some considerations about the vital role the intestinal bacterial population plays in the maintenance of your health.

First, there are good and bad bacteria in the intestine and they are in constant struggle to each occupy a largest as possible part of our intestine (total surface is more than 2000 square feet).
Where does the bacteria come from?
The intestine of a newborn baby is sterile and, after birth, becomes rapidly colonized by the available germs ([39]. A newborn inherits bacteria primarily from his mother. Bacteria passes from mother to child through the birth canal, as well as through breast milk.
Then what makes one group of bacteria (the bad or the good) thrive more than the other? *Knowing the answer may give you an advantage on improving and maintaining your health*. Too much sugar and grain in the diet, as well as exposure to chemicals and to antibiotics promotes the growth of the "bad" bacteria.
It is very easy: correcting your diet accordingly and supplementing with probiotics promotes the growth of the good bacteria.

1 – DIGESTION of FOOD
- Probiotics help digest otherwise hard to assimilate foods like some starches, the lactose that makes lactose intolerant people stay away from diary products [40] and possibly the gluten responsible for celiac disease in gluten intolerant people [41].

2 –ABSORPTION of FOOD
It is well known that phytate rich food reduces mineral absorption. The good news is, however, that probiotics degrade phytates, thus, protecting mineral absorption [42].

3 – OTHER EFFECTS
A – On Inflammation
Probiotic bacteria have anti-inflammatory effects in healthy adults [43]. When you consider the importance of inflammation processes and their role in a variety of health conditions like heart disease, arthritis or Alzheimer, it becomes obvious, that you don’t have to be sick to consume Healthy Chocolate.

B – On Tooth Decay
Children consuming probiotics have less tooth decay [44]

C –On Bronchitis
Children receiving probotic supplements have less airway infections [45].

D – On Cancer
The property of probiotic bacteria to bind with the cancer promoting molecules produced by frying meat explains how probiotics may protect meat eaters against colon cancer [46].
E – On Immunity

The good bacteria also boosts your immune system, preventing allergy and avoiding auto-immune reactions where the immune system attacks the cells of the body.
Lactobacilli supplementation greatly improves the condition of children with atopic eczema [47].

F – On Obesity
Probiotics supplementation is also credited with reducing fat deposit [48].
Early supplementation with probiotics reduces the risk of obesity later in life.
At the17th European Congress on Obesity, in Amsterdam, Netherlands, May 6-9, 2009, Kirsi Laitinen described a link between probiotic supplementation during pregnancy, and less unnecessary weight gain during pregnancy as well as unwelcomed obesity in the offspring.
“The advantage of studying pregnant women to investigate the potential link between probiotics and obesity is that it allows us to see the effects not only in the women, but also in their children,”.
“Particularly during pregnancy, the impacts of obesity can be immense, with the effects seen both in the mother and the child.” [49]

Own observations and conclusions.

Interviews by the present authors of users of Triple Treat Chocolate and TLC Liquid Chocolate revealed both products to be well tolerated. Frequently, comments such as ‘we now can enjoy chocolate again without feeling guilty’ were made, and many liked the products because they allowed them to achieve weight loss or weight maintenance without difficulties. One of our subjects reported a drop of his serum C-Reactive Protein (CRP-) level from 1.04 to 0.38 mg/L after 4 weeks of ingesting one ounce of TLC Liquid Chocolate per day instead of breakfast. In accord with this finding is the result of a recent Italian study [50], which showed that the average serum CRP level of 1.10 mg/L of 824 subjects who regularly ate dark chocolate was significantly lower than the average value of 1.32 mg/L of 1317 subjects that did not any chocolate. Although the difference was small, it was statistically highly significant with $P<0.0001$ but was deemed large enough by the authors to cause a decrease of the risk of cardiovascular disease of the subjects in the dark-chocolate consuming group. The much larger drop of the CRP value in our subject suggests that TLC Liquid Chocolate potentially has more powerful CRP-reducing properties than dark chocolate. Hence, a study of its CRP-lowering effect with a sufficiently large number of subjects would be of interest.

(Revised and updated July 2010)

References

[1] International Cocoa Organization (ICCO) Quaterly Bulletin of Cocoa Statistics, London, 2007. Chocolate consumption, ICCO.
[2] B. Liebman (2001) The chocolate myths factory. Nutrition Action Healthletter, March issue.
[3] J. M. Hodgson, A. Devine, V. Burke, I. M. Dick R. L. Prince (2008) Chocolate consumption and bone density in older women. American Journal of Clinical Nutrition, Vol. 87, No. 1, 175-180.
[4] Louis E. Grivetti, Chocolate: History, Culture, and Heritage Howard-Yana Shapiro, Wiley (New York), 2009 ISBN: 978-0-470-12165-8.
[5] A. Bensen (2008), A Brief History of Chocolate. Smithsonian.com, March 01, 2008.
[6] Jack Weatherford's History of Chocolate (1988) Ballantine 0-449-90496-2
[7] W.J. Hurst et al. (2002) Cacao usage by the earliest Maya civilization. Nature 418: 289–290.
[8] S.D. and M.D. Coe (1996) The True History of Chocolate Thames & Hudson.
[9] M. Russell (2008), "Chocolate - History Of Nestle Company." EzineArticles.com.
[10] S.T. Beckett (1999) Conching. In: Beckett, S.T., Editor, , 1999. Industrial chocolate manufacture and use (3rd ed.),, Blackwell Science, Oxford.
[11] H. R. Schmidt (1970) "Die Pioniere Sprüngli und Lindt," in Schweizer Pioniere der Wirtschaft und Technik 22, Zurich, Switzerland: Verein für wirtschaftshistorische Studien.
[12] L. Leff, International Business Times, February 14, 2007).
[13] Ch. Simon (1998): Milton Hershey: Chocolate King, Town Builder . Children's Press (Grolier Publishing Co., Inc.
[14] The International Cocoa Organization (icco.org) & the article 'Gourmet Chocolate: Beyond Just Valentine's Day (Lisa Leff, International Business Times, February 14, 2007).
[15] M. Gbetibouo, C. L. Delgado. "Lessons and Constraints of Export Crop-Led Growth: Cocoa in Ivory Coast." The Political Economy of Ivory Coast. Ed. I. W. Zartman, et al. New York: Praeger, 1984.
[16] A. T. Borchers, C. L. Keen, S. M. Hannum, M. E. Gershwin (2000) Cocoa and Chocolate: Composition, Bioavailability, and Health Implications Journal of Medicinal Food. 3: 77-105.
[17] R. G. Lockard, J. C. Burridge (1965) The Levels of Macro- and Micronutrients in the Beans of Cacao (Theobroma Cacao L.) in relation to Shade, Fertilizer, Irrigation, and Season. Ann. Of Botany 29: 377-382.
[18] B. Sokoloff, W. H. Eddy, J. B. Redd (1951) The biological activity of a flavonoid (vitamin P) compound. J Clin Invest. 1951 April; 30(4): 395–400.
[19]P.C. Hollman, M.B.Katan (1999) Dietary flavonoids: intake, health effects and bioavailability. Food Chem. Toxic. 37: 937-42.
[20] J. R. Cronin (2004) Comparing antioxidant values with the ORAC method. Alternative and complimentary Therapies 10: 167-170.
[21] M. Serafini, R. Bugianesi, G. Maiani, S. Valtuena, S. De Santis. & A. Crozier

(2003) Plasma antioxidants from chocolate Nature 424: 1013.
[22] Y. Wan, J. A. Vinson, T. D. Etherton, J. Proch, S. A Lazarus, P. M Kris-Etherton (2001) Effects of cocoa powder and dark chocolate on LDL oxidative susceptibility and prostaglandin concentrations in humans American Journal of Clinical Nutrition 74: 596-602
[23] B. L. Zoumas, W. R. Kreiser, R. Martin (2006) Theobromine and caffeine content of chocolate products. J. of Food Sci., 45: 314 – 316.
[24] H. C. Sabelli, R. L. Borison, B. I. Diamond, H. S. Havdala, and N. Narasimhachari (1978) Phenylethylamine and brain function. Biochemical Pharmacology 27: 1707-1711, 1729–1730.
[25] H. C. Sabelli, R. L. Borison, B. I. Diamond, H. S. Havdala, and N. Narasimhachari (1978). "Phenylethylamine And Brain Function". Pharmacol. 27 (13): 1707–1711.
[26] P. R. Paetsch, A. J. Greenshaw (1993) 2-Phenylethylamine-induced changes in catecholamine receptor density: implications for antidepressant drug action. Neurochem. Res. 18: 1015-22.
[27] T. Herraiz (2000) Tetrahydro-beta-carbolines, potential neuroactive alkaloids, in chocolate and cocoa. J. Acric. Food Chem. 48: 4900-04.
[28] E. Di Tomaso, M. Beltramo M, D. Piomelli (1996) Brain cannabinoids in chocolate. Nature 382: 677-678.
[29] M. F. Melzig, I. Putscher, P. Henklein, H. Haber (2000) In vitro pharmacological activity of the tetrahydroisoquinol-ine salsolinol present in products from Theobroma cacao L. like cocoa and chocolate. J Ethnopharmacol. 73: 153-179.
[30] K. Morris, D. Taren, 'Eating Your Way to Happiness: Chocolate, Brain Metabolism, and Mood'.
[31] S. E. Moller (1992) Serotonin, carbohydrates, and atypical depression Pharmacol Toxicol. 71 Suppl 1: 61-71.
[32] G. Parker, J. Crawford (2007) Chocolate craving when depressed: a personality marker. The British Journal of Psychiatry (2007) 191: 351-352.
[33] E. di Tomaso, M. Beltramo, D. Piomelli, Brain cannabinoids in chocolate Nature, 382, 677-8 (1996).
[34] P. M. Kris-Etherton, V. Mustad, J. Derr (1993) Effects of dietary stearic acid on plasma lipids and thrombosis. Nutrition Today.
[35] Source: The Diabetes Blog - May 28, 2007.
[36] D.Taubert, R. Roesen, C. Lehmann , N. Jung, E. Schömig (2007) Effects of low habitual cocoa intake on blood pressure and bioactive nitric oxide: a randomized controlled trial. JAMA. 298: 49-60.
[37] D. Becker, Meeting of American Heart Association, Chicago, Nov. 2006, Chicago.
[38] F. M. Steinberg, M. M. Bearden, C. L. Keen (2003) Cocoa and chocolate flavonoids: implications for cardiovascular health. J Am Diet Assoc. 103, 215-223.
[39] Salminen S, Bouley C, Boutron-Ruault MC, et al. (1998) Functional food science and gastrointestinal physiology and function. Br J Nutr; 80 (suppl 1): 147-

71
[40] Sanders ME February 2000. "Considerations for use of probiotic bacteria to modulate human health". The Journal of Nutrition 130 (2S Suppl): 384S–390S. PMID 10721912.
http://jn.nutrition.org/cgi/pmidlookup?view=long&pmid=10721912
[41] Lindfors et al. 2008. Live probiotic Bifidobacterium lactis bacteria inhibit the toxic effects induced by wheat gliadin in epithelial cell culture - Clin Exp Immunol. 2008 Apr 16.
[42] Haros M, Carlsson NG, Almgren A, Larsson-Alminger M, Sandberg AS, Andlid T (2009). Phytate degradation by human gut isolated Bifidobacterium pseudocatenulatum ATCC27919 and its probiotic potential. Int J Food Microbiol. 2009 Sep 30;135(1):7-14. Epub 2009 Jul 22
[43] Kekkonen RA, Lummela N, Karjalainen H, Latvala S, Tynkkynen S, Jarvenpaa S, Kautiainen H, Julkunen I, Vapaatalo H, Korpela R. 2008. Probiotic intervention has strain-specific anti-inflammatory effects in healthy adults.. University of Helsinki, Institute of Biomedicine, Pharmacology, PO Box 63, 00014 Helsinki, Finland. World J Gastroenterol. 2008 Apr 7;14(13):2029-36.
[44] Näse L, Hatakka K, Savilahti E, et al. (2001). "Effect of long-term consumption of a probiotic bacterium, Lactobacillus rhamnosus GG, in milk on dental caries and caries risk in children". Caries Research 35 (6): 412–20. doi:10.1159/000047484. PMID 11799281.]
[45] Hatakka K, Savilahti E, Pönkä A, et al. (June 2001). "Effect of long term consumption of probiotic milk on infections in children attending day care centres: double blind, randomised trial". BMJ 322 (7298): 1327. doi:10.1136/bmj.322.7298.1327. PMID 11387176]
[46] Wollowski I, Rechkemmer G, Pool-Zobel BL (February 2001). "Protective role of probiotics and prebiotics in colon cancer". The American Journal of Clinical Nutrition 73 (2 Suppl): 451S–455S. PMID 11157356.
http://www.ajcn.org/cgi/pmidlookup?view=long&pmid=11157356
[47] Pessi T, Sütas Y, Hurme M, Isolauri E. (2000) Interleukin-10 generation in atopic children following oral Lactobacillus rhamnosus GG. Clin Exp Allergy 2000; 30: 1804-08..)
[48] Takemura N, Okubo T, Sonoyama K. Lactobacillus plantarum strain No. 14 reduces adipocyte size in mice fed high-fat diet. Exp Biol Med (Maywood). 2010 Jul 1;235(7):849-56.
[49] Source: European Congress on Obesity
www.iotf.org/documents/Probioticsrelease.pdf
[50] R. Giuseppe, A. Di Castelnuovo, F. Centritto, et al. (2008) Regular Consumption of Dark Chocolate Is Associated with Low Serum Concentrations of -Reactive Protein in a Healthy Italian Population. J Nutr; 138: 1939-1945.