



The Basic Principles of Pontian Diet

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Abstract

In this short communication, attempts have been made to provide the main characteristics and the health benefits of the Pontian Diet. A historical view as well as current evidence on the impact of such diet on human life and physiology has been discussed. Animal proteins are obtained from lactic acidic fermentation dairy products, while those of plant origin as well as carbohydrates are obtained from wheat crops. Dough products (pasta) during their preparation undergo the process of pre-baking, which improves their properties compared to common commercial spaghetti. The main lipid source for centuries was the cow milk butter and the most widely consumed animal fat which provides daily a sufficient amount of beneficial probiotic bacteria on human health.

Keywords: Pontus; Pre-baked pasta; Butter; Starch globules; Lactic acidic fermentation; Digestion

Introduction

Pontus is a region stretching along the southern coast of the Pontus Euxinus (Black Sea), from which the designation was later transferred to the country. It is a long and narrow strip of land corresponding nearly to the modern province of Trabzon (Turkey). The mountainous region is characterized by relatively high annual precipitation amounts and favorable conditions for rich vegetation and high ecological status [1]. Pontus has an abundant vegetation cover [2] that favors the breeding of large animals (i.e. cattle) which decisively influenced the daily diet in terms of animal proteins and fats.

The traditional Pontian diet has a 28 centuries history and was preserved by the pontians in modern Greece after the population exchange in 1923. It is a branch of the Mediterranean diet with some additional advantages derived from the climatology and geomorphology of the region. The intense preoccupation of the inhabitants with animal husbandry, especially of cattle contributed to minimize the involvement of meat in the diet. Large animals (oxen or cows) are rarely used as meat, while on the contrary it is much more profitable to consume the product from them, mainly after lactic acid fermentation. Males, on the other hand, were used as energy producers in agricultural work. Meat plays an auxiliary role and comes mainly from smaller animals, i.e. lambs, poultry and fish.

Lactic Acidic Fermentation Dairy Items

The Pontian diet is dominated by a number of lactic acidic fermentation dairy items as the main source of animal protein. Among them, cheese (tyrin), yogurt (oxygala) and butter milk (tan) predominate. In addition to the proteins and calcium of milk, which are now better absorbed, a vast number of beneficial Lactic Acid Bacteria (LAB) are introduced into the digestive system with lactic acid fermentation. In the recent years, the scientific reports show that LAB has many positive health effects [3]. They produce bacteriocins, which is anti-microbial compound [4], expelling unwanted pathogens, cleansing the intestinal flora and strengthening the immune system. The mechanical processes of digestion are facilitated; the food is better assimilated and does not stagnate in the digestive system, which would give the opportunity for pathological conditions. Additionally, LAB gives flavor to fermented dairy items and works as preservative agent [5].

Certain strains of LAB like genera *Lactobacillus* are believed to show immune modulator activity, anti-hypertensive, calcium binding activity and anti-cancer activity [6]. Lactic acid enhances the synthesis of vitamins, stimulates the human organism and helps it to overcome diseases. All this together synergistically leads to the coveted longevity. The scientific documentation of longevity with the daily consumption of acidic dairy products belongs to Élie Metchnikoff in the early 1900s. Metchnikoff suggested that LAB, when introduced into the digestive system, would prevent the reproduction of pathogenic microbes. This hypothesis is supported by the observation that

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Received Date: 23 Feb 2021

Accepted Date: 10 Mar 2021

Published Date: 17 Mar 2021

Citation:

Sawidis T. The Basic Principles of Pontian Diet. *Ann Nutr Food Sci.* 2021; 5(1): 1046.

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populations that regularly consume yogurt appear to be particularly long-lived [7]. Metchnikoff proved the inextricable link between longevity and consumption of acidic dairy products was awarded the Nobel Prize in Medicine in 1908 for his findings.

Lipids

In Black Sea region real butter is one of the most popular dairy products and the main lipid source. Even today, traditional butter, also known as sari yağ (yellow fat/oil) is the most widely consumed animal fat, due to its aromatic characteristics and nutritive value. Yoghurt, made of the raw cow's milk, has been used in butter production for centuries [8]. The composition of butter shows variations depending on the animal species, the plant flora and seasonal or geographical variations [9,10]. The butter traditionally is obtained by churning vigorously and adding cold water using a special wooden barrel.

According to Hehn et al. [11] the discovery of butter and its name (butter = bus, ox + tyros, cheese i.e. cow's cheese) is unequivocally attributed to the Greek coastal colonies of Pontus. Van Lennep et al. [12] describes the relevant barrel of butter production with the corresponding illustration [13]. Butter was frequently used in meals or spread on slice of bread anytime during the day [9,14]. With the daily consumption of butter, a great number of probiotic bacteria are introduced into the **organisms**, which have a beneficial effect on human health.

Vegetable Proteins - Carbohydrates

The vegetable protein as well as carbohydrate source is wheat, which plays a key role in the form of bread or a variety of home-made pasta. The notice difference of pasta in the Pontian diet is the practice of pre-bake after dough shaping and not just drying or dehydration. This increases the shelf life of the food and avoids the growth of vexing microorganisms (fungi) in the wet environment of Pontus. Pasta of this type is home-prepared at a time chosen by the times and is available for a long period. Pre-baked pasta requires minimal cooking time, in some cases only few minutes. This relieves the landlady from prolonged cooking and saves time for other activities while enhancing her social presence.

Under Scanning Electron Microscopy (SEM), the surface of pre-baked pasta presents numerous starch grains of different size entrapped in a protein matrix (Figure 1,2). Starch granules appeared to be slightly swollen in size and shape closely associated with proteins. The rough surface of pasta means that the morphological components of the dough remain intact. In many cases indentations from the protein bodies can be seen on the surface of starch granules (Figure 3). In contrary, common trade pasta showed a flat surface with hardly visible starch granules associated with a protein film (Figure 4). Dough processing is submitted to shearing and elongational stress. Such heat and pressure stress can result in starch gelatinization leading on a smoothed external surface [15,16]. Starch gelatinization or encapsulation by proteins could limit water absorption by starch granules, limiting enzyme diffusion [17].

In cross section under SEM the internal structure of pre-baked pasta revealed a spongy texture with numerous holes (Figure 5) depicted as a maze with endless galleries (Figure 6). In pre-baked pasta the rapid water uptake rate (1 min to 2 min) depending on its ability to diffuse through the labyrinthine network the internal structure remains intact. This is also a reason that the cooking time is minimized in a few minutes. Moreover, the behavior of pre-baked



Figure 1: The historical area of Pontus along the coasts of Turkey in Black Sea.

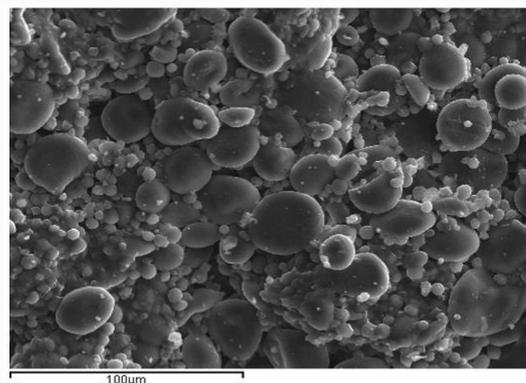


Figure 2: A scanning electron micrograph of pre-baked, home-made pasta surface showing starch granules of various sizes entrapped in a matrix containing numerous protein bodies.

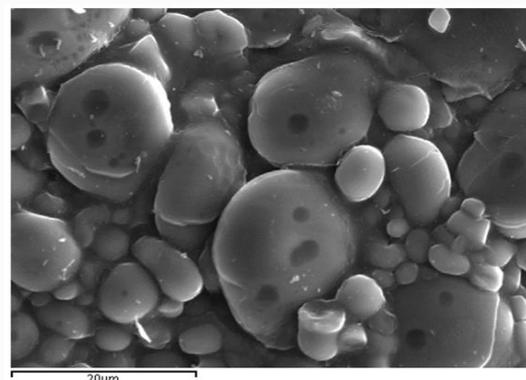


Figure 3: Almost intact, slightly swollen starch granules showing indentations from the protein bodies on their surface.

pasta in the digestive system is their quality difference compared to the rest of the trade. The spongy network facilitates the rapid absorption of water, increased volume and a feeling of satiety in the stomach. During the digestive process that follows the spongy mass allows the easier access of digestive enzymes (proteases) and hydrochloric acid to pass easily inside to the minimum necessary amount. Consequently, the unnecessary enzyme over-secretion limited avoiding irritation of the internal stomach walls and heartburn.

In addition to the mechanical facilitation of enzymes, due to the spongy structure, the pre-baked process with high temperatures preserves the protein network at the microscopic level, facilitating digestion and nutrient absorption. The heating process promote partial break down of carbohydrates, making its molecules more accessible to hydrolyzing enzymes [18]. On the other hand, their taste

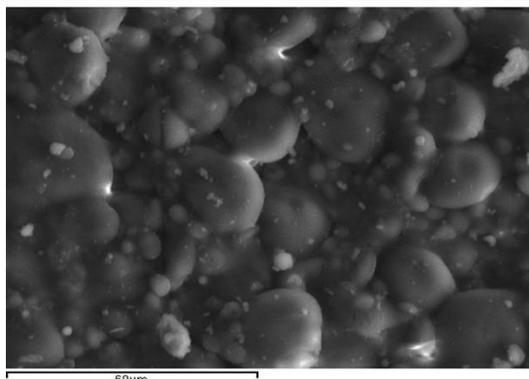


Figure 4: Relatively smooth surface of common trade pasta with hardly visible starch granules associated with a protein film.

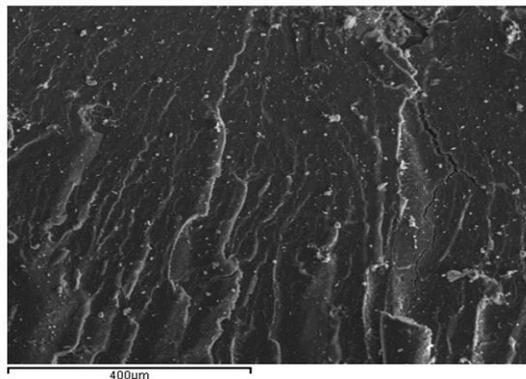


Figure 7: Cross section of common trade pasta showing compact internal structure. The starch granules and protein bodies have been completely crushed and homogenized during the mechanical processing of the dough. Some cracks or discontinuities are rarely apparent.

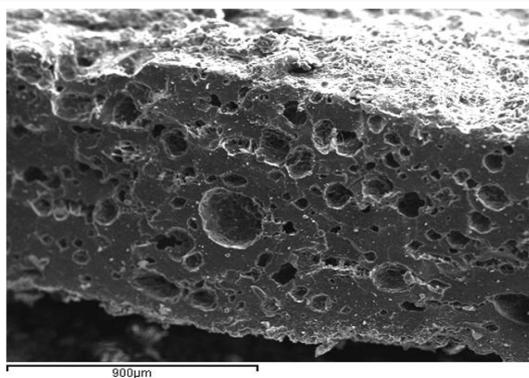


Figure 5: Cross section of pre-baked pasta revealing a spongy texture with numerous galleries facilitating the rapid absorption of water and digestive enzymes.

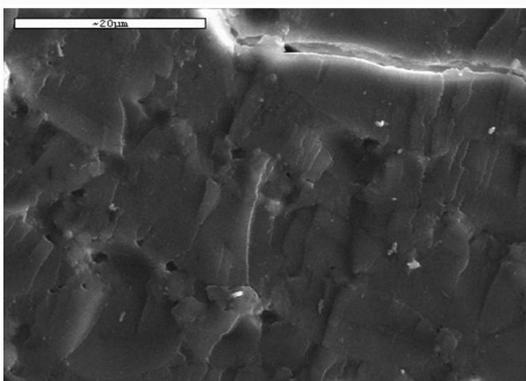


Figure 8: Some small holes are apparent in the vertical surface of cross section, probably due to mass tension in the compact dough during drying procedure.

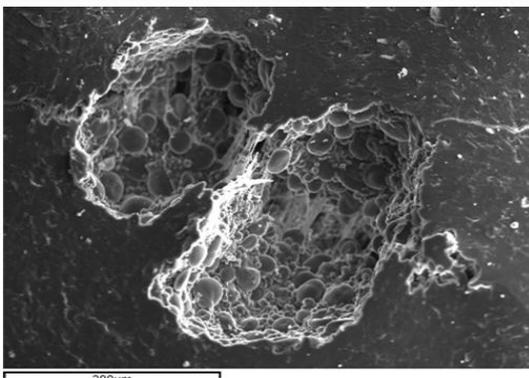


Figure 6: Galleriescross section of pre-baked pasta under SEM revealing the almost intact of starch and protein fractions.

is significantly improved and the addition of various types of sauce in the final meal is no longer necessary. This is the reason that, this kind of pasta can be consumed even directly as a snack during the day. Movement along the intestine is also beneficial the pre-baked pasta consumption, as the stable, spongy mass mechanically drifts its content, clearing the intestinal tract of pathogens.

In the case of common trade pasta, the internal structure is compact, whereas the spongy texture disappears (Figure 7). Some cracks or small holes are apparent in the vertical surface of cross section (Figure 7,8) probably due to mass tension in the compact

dough during drying procedure [16]. The compact appearance is obviously the consequence of mechanical forces involved during modern practices of dough processing. The intensive elaboration of the dough leads to a moderate damage of the starch and protein fractions. The successive steps throughout forming and drying process could strengthen the protein network, and therefore better preserving starch from enzymatic attack. Consequently, the digestibility of starch is reduced in cooked pasta [19-21].

The prolonged machining and compression of the dough creates a compact mass with minimal adsorption capacity. After cooking, the dense internal structure can be divided into three clearly distinguished concentric regions (external, intermediate and central) according to degree of water absorption and consequently to degree of starch or protein deformation [15,22,23]. In comparison to the pre-baked pasta no such a regional division was observed. Modifying the process parameters should therefore tend to improve the structure of the pasta in order to maintain its nutritional properties. This may require adaptation of traditional manufacturing processes tested over time. It is a fact that the nutritional properties of pasta are closely related to its structure after processing during production [21].

Attempts have been made to correlate the low glycemic index of pasta with its structural peculiarities. The physical structure of the pasta affects enzymatic digestibility of starch, the absorption of its hydrolysis products and glycemic response [24,25]. The dense

structure of pasta combined with the encapsulation of starch by protein film and the integrity of starch granules are the main hypotheses that have been tested to explain the reduced enzymic susceptibility of starch in cooked pasta. The occurrence of an intact starch-protein network in the spongy structure of pre-baked pasta may account for the decreased glycemic response. The pre-baking procedure of dough sheet significantly improves the glucose response causing reductions in glycemic index, which estimates the effect on blood sugar level [26]. Reduced glycemic index pasta prevents diabetes type 2 and supports cardiovascular system [27].

Conclusion

Fermentation with LAB is an effective and inexpensive preservation method which improves nutritional value of dairy products. The acidic dairy products in the Pontian diet are harmoniously combined with cereal products, which are known to be the cornerstone of Western civilization. Among cereal products, home-made pasta is an interesting source of vegetable proteins and slow-release carbohydrates. Thus, it is important to educate the new generations about the vital role of lactic acid fermentation dairy products and the hygiene properties of pre-baked pasta. Moreover, this combination also completes people's expectations.

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