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# Effect of Addition of non-conventional Ingredients and Hydrocolloids on Desirable Quality Attributes of Pasta. A Mini Review

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**Abstract—***As consumption of pasta is becoming more popular especially among the school going children, pasta will supply essential nutrition. Moreover value addition of pasta with different non-conventional ingredients would be helpful in promoting utilization of these with advantage of having several health benefits. Further the results of this study could provide the industry useful information about potential utilization of different non-conventional ingredients in food formulations and product development for new functional foods.*

**Keywords***: Pasta, Functional foods, Non-conventional ingredients, Health benefits.*

## 1. INTRODUCTION

The general term pasta refers to unleavened fresh or dried wheat/semolina dough simply composed of water, flour and sometimes egg. These are manufactured by blending durum semolina and water to form a homogeneous mixture followed by kneaded and finally extruded into desired shapes and subsequently dried.[1]. Pasta utilization has increased due to its ease of transportation, handling and cooking preparation [2]. It is good source of carbohydrates 74 to 77% (db) and proteins 11 to 15% (db), but is deficient in lysine and threonin (the first and second limiting amino acids) common to most cereal products [3]. Pasta is considered highly digestible and provides complex carbohydrates, protein and vitamins. Being low in sodium and lipids; it has no cholesterol, producing a low-postprandial response to glucose and insulin in the blood.[2].World Health Organization (WHO) and Food and Drug Administration (FDA) consider pasta a suitable vehicle for incorporation of nutrients [4].With an increasing concern by health conscious people more nutritious pasta products rich in minerals, phenolic compounds and dietary fiber with low glycemic index have become the subject of primary significance. Its nutritional quality can be enhanced through addition of various non-conventional materials such as millets, pseudo cereals, vegetable pomace, rich in fibers [5,6] vitamins and polyunsaturated fatty acids [7,[8].It was observed that incorporation of non-conventional ingredients into pasta at higher levels does not show better pasta cooking quality characteristics, so there is need of addition of hydrocolloid [9].Generally hydrocolloids such as (carboxy methyl cellulose and guar gum) aid in gelling, thickening, water retention and texture improvement can be utilized for the development of healthy pasta products.

## 2. EFFECT OF NON- CONVENTIONAL INGREDIENTS ON FUNCTIONAL QUALITY ATTRIBUTES OF PASTA

Functional properties determine the quality characteristics of pasta including cooked weight, firmness, cooking loss.High quality pasta has a good cooking resistance, does not disintegrate and does not release an excessive amount of organic matter into the cooking water.

### Cooking loss

Cooking loss is considered an important indicator of pastaquality. It is referred as the total content of solids leachedout in gruel obtained from the cooked pasta. The loss of solidsrepresent resistance of pasta to disintegrate during boiling,thus low amount of solids into the cooking waterindicates good cooking quality.Studies of [10] reported increase in solid loss of pasta with amaranth flour blend addition. Results of [11]also reported cooking loss to about 8.6% by blending finger millet flour with whole wheat flour up to 50% level. Increase in cooking loss with increase in corn flour substitution up to 30% in noodles was also found by [12]. Increase in cooking loss of cereal bran enriched pasta,wheat and oat brans enriched pasta was also found by [13,14]. Similarly [15] reported increase in cooking losses of glucagel, psyllium and oat substituted pasta. Increase in cooking loss was reported by [16] in common bean flour added semolina pasta. Cooking loss of 5.0 to 8.2% was reported by [14] in dehydrated green pea flour (DGPF)

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pasta.[17]alsoreported decrease in cooking loss with increase mustard protein isolate supplementation. [18]found increase in percent solid loss with increase in semolina to peanut flour and carrot powder ratio in pasta. However [19] reported decrease in cooking loss with incorporation of millet and pulse flour to pasta. Increase in solid loss with increase in orange by-product fiber incorporation to pasta was also reported by [20]. Increase in cooking was also found by [9] with incorporation of carrot pomace and millet flour in durum semolina pasta. As reported by[21] incorporation of dried grape marc powder did not interfere solid loss properties of pasta after cooking.

**Weight gain**

Weight gain or cooked weight of pasta indicates gain in weight after cooking and good quality pasta should gain weight three times than its dry weight after cooking.[10]reporteddecreasein weight gain of pasta samples with amaranth flour blend addition. However [11] revealed that blending finger millet flour with whole wheat flour up to 50% level increased cooked weight more than 3.8 times in vermicelli. Increase in corn flour substitution up to 30% increased cooked weight of fresh noodles [12].While [14] found decrease in cooked weight of wheat and oat brans enriched pasta.[22]reported increase in cooking yield by increasing durian seed flour or pumpkin flour content in the pasta formulation. Results of [23] revealed no difference in weight gainof dried spinach leave based and control pasta.[14]mentioned cooking weight of 5.0-8.2% in dehydrated green pea flour pasta. While as[17]reported decrease in cooking weight of pasta with increase in supplementation level of mustard protein isolate. Cooked weight of pasta increased with incorporation of millet and pulse flour to pasta [19]. [20]reportedcooked weight of pasta incorporated with orange by-product fiber remained unaffected.

**Color**

Color plays a major role in consumer's perception and acceptability of product.[12] reported increase in yellowness (*b**)value and decrease in lightness (*L**)value with increase in corn flour substitution up to 30% of fresh noodles. [13]found increase in brightness value of cereal bran enriched pasta. Similarly [15]reportedcolor of raw samples were significantly darker, however after cooking all inulin pasta samples were brighter than durum wheat based pasta.[22] reported increase in redness *a** and decrease in *L*,b** value by increasing durian seed flour or pumpkin flour content in the pasta formulation.

## 3. EFFECT OF NON-CONVENTIONAL INGREDIENTS ON ANTIOXIDANT ACTIVITY AND TOTAL PHENOLIC CONTENT OF PASTA

Recently antioxidants have emerged as biomolecules of ultimate interest of human health. These are gaining importance due to their main roles as lipid stabilizers and suppressors of excessive oxidation. Polyphenols are diverse class of compounds occurring naturally in a wide range of food plants and these play no role in nutrition (non-nutritious), but are having several properties such as anti-carcinogenic, anti-inflammatory etc.[24, 25]reported significantly higher levels of total phenolic content and antioxidant activity in apple peel powder incorporated pasta compared to control pasta. Raw pasta added with 15% apple pomace powder showed highest total phenolic content (TPC) and antioxidant activity (AOA) 1.4g Gallic acid equivalent GAE/kg and 0.8mg GAE/100g.Similarly grape marc incorporated pasta showed higher total phenolic content and antioxidant activity compared with control pasta [26].[27]also reported increase in total phenolic content and antioxidant activity of edible wakame *(Undariapinnatifida*) seaweed incorporated pasta from 0.10 to 0.94 mg Gallic acid equivalent (GAE)/g and 0.16 to 2.14mg respectively.Similar studies of [28] revealed that incorporation of red sorghum flour and white sorghum flour at 20%, 30% and 40% to durum wheat semolina showed an increase in total phenolic content and antioxidant capacity at all incorporation levels compared to the control pasta. With addition of common bean flour, total phenolic content and antioxidant capacity were high than control pasta made from durum wheat[29]. Effect of spirulina biomass substituted at 5, 10 and 20% level to soft wheat flour was studied by [30]. Results revealed that spirulina incorporated pasta presented high phenolic content and antioxidant activity compared to control pasta.Increase in polyphenol content and antioxidant activity was reported by [31,21, 20] in mango peel incorporated macaroni, grape marc incorporated pasta and orange by-product fiber incorporated pasta. [32] also reported increase in antioxidant activity and total phenolic content of rice bran enriched pasta samples. Results of [33] also reported increase in phenolic content and antioxidant activity in millet based developed pasta than control pasta.

## 4. EFFECT OF HYDROCOLLOIDS ON DIFFERENT QUALITY ATTRIBUTES OF PASTA

Hydrocolloids are high molecular weight polymers generally used in food products as thickeners, stabilizer, gelling agents and emulsifiers. They also improve the texture of products, increase water retention, regulate rheological properties, maintain overall quality of product during storage and participate in chemical transformations. These can also be used to mimic the viscoelastic properties of gluten thus improves structure mouth feel, acceptability and shelf life [6]. The United State Food and Drug Administration these compounds as either food additives or generally recognized as safe (GRAS) substances. As basic ingredient in most foods is wheat, these hydrocolloids improve granular structure and pasting behavior of starch during cooking or baking of products. When pasta products are made from non-conventional sources, the quality of pasta differs substantially from the pasta manufactured from semolina. In this case, addition of functional ingredients such as hydrocolloids is

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necessary. Besides this having neutral taste and aroma this property also allows their free use in food products. Hydrocolloids are also having good source of soluble dietary fiber, thus reduce the concentration of cholesterol and improve gastrointestinal functions and glucose tolerance [34].

**Effect on texture**

Texture is the main criteria for assessing the overall quality of cooked pasta. Results of [25]reported with incorporation of carboxy methyl cellulose improvement in firmness and significant ($P \leq 0.05$) reduction in stickiness were observed in non-wheat based pasta containing pearl millet, barley flour and whey protein concentrate. Similarly onion substituted pasta added with hydrocolloids such as xanthan gum, Hydroxyl propyl methyl cellulose (HPMC), guar gum, gum arabica and fructo-oligosaccharide showed all quality characteristics comparable to control pasta[35]. [36] found improvement in firmness with addition of additives such as gluten and hydroxyl propyl methylcellulose (HPMC) to black gram dhal flour incorporated durum pasta.[37]also reported increase in firmness with addition of hydroxyl propyl methylcellulose. [14] revealed that the addition of additives helped in formation of rupture free structure with a continuous network. Addition of carboxy methyl cellulose to millet, carrot pomace based pasta also showed improvement in firmness [9].

**Effect on cooking loos, cooked weight**

Decrease in cooking loss, increased cooked weight of pasta with addition of hydroxyl propyl methylcellulose was noticed by [37]. Results of [38] showed that the response such as cooking loss were most affected by changes in gum levels and to a lesser extent by sweet potato flour and water levels.[39] also noticed that when additive such as xanthan gum was incorporated to spaghetti dough, the quality factor, cooked weight were improved significantly and cooking loss reduced noticeably.Increase in cooking yield of noodles with addition of guar gum and carboxy methyl cellulose at 1%, 0.5 and1.0% was also observed by[40].

## 5. CONCLUSION

From the present investigation it can be concluded that addition of non-conventional ingredients to durum wheat semolina showed negative effects on various pasta quality attributessuch as cooking loss, cooked weight and firmness. But showed increase in antioxidant activity, phenolic content and nutritional profile.However with addition of hydrocolloids pasta with better cooking quality attributes can be prepared.Thus it can be concluded that nutritionally rich with desirable quality attributed pasta products can be prepared from non-conventional ingredients along with hydrocolloid.

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