

## REVIEW PAPER

# Recent Advances in Preparation and Functional Properties of Smoothie as Food: A Review

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### ABSTRACT

The aim of this study was to know the scenario of habit of consumption of fruits and vegetables amongst consumers and implement the concept of smoothie as an easy, nutritive and innovative form of their consumption. Smoothie is a liquid refreshing drink usually taken as health-conscious supplement for a healthy living. Smoothie contains either whole or different parts of fruit and vegetable. Fiber and juice are not separated from each other thus, increasing nutritive as well as digestive properties of the smoothie. Fruits and vegetables have low energy value but high nutritive physiological value. They are mainly constituted of starch and dietary fibers. They contain appreciable amount of micro-nutrients such as iron, calcium, phosphorus, magnesium, sodium and chromium. Fruits and vegetables are also rich in phytochemicals. These phytochemicals help in reducing the possibilities of cancer. To increase the uptake of phytochemicals, food industries offer an alternate source of utilization of fresh fruits and vegetables as smoothie. To create distinct flavour and ease in consumption corresponding fruit juices or concentrates can also be used. The natural pigments and antioxidants present in fruits and vegetables also help in glowing and smooth skin, also increasing better functioning and immunity of the body.

**Keywords:** Fruits, Smoothie, Consumption, Functionality, Nutritive value, etc.

Smoothie is an excellent and convenient substitute which promotes the intake to fresh fruits and vegetables on daily basis (Rodriguez-Verastegui, *et al.* 2015). They are non-alcoholic liquid refreshment drink usually made out of fresh or frozen fruits or vegetables. They are mixed together without straining and often served with crushed ice. Some smoothies may also contain other ingredients such as yoghurt, milk, ice-cream, lemonade, tea or spices and condiments. Their consistency is slightly concentrated than slushie (Castillejo *et al.* 2015). Smoothies have been mostly encouraged as fitness freak beverage option for wellbeing and healthy lifestyle. Considering the storage period,

non-thermally processed smoothies are stored for shorter duration only due to possibility of increased microbial growth. The longer storage time may also result in degradation of natural colour and total phenols (Cano-Lamadrid, *et al.* 2018).

### CATEGORIES OF SMOOTHIES

Smoothies can be sub-divided into three main categories viz. fruit only, Fruit and dairy product

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and functional smoothie. Functional smoothies are considered as the very recently available product in the market, usually containing probiotics amongst itself. Various types of Smoothies are described in Table 1. The advancement of consumption of fruits and vegetables is getting pronounced more than ever. This is caused by the desire of consumers for less processed, healthy and nutritive foods (Banigo *et al.* 2015; Zlabur *et al.* 2017). Smoothies are considered to contain one portion of fruit. Many commercially available smoothies are rich in calories and added sugars. Syrup-based fruit concentrates are being utilized instead of natural fruits, thereby resulting in a product high in sugar and lower in macro-nutrients especially vitamin C. The concept of consuming smoothie is not well known amongst citizens; almost more than a half of population prefers fruit juices over smoothies.

### ADVANTAGES OF SMOOTHIES

Foods grown from the ground are considered as one of the basic piece of human sustenance (Boeing *et al.* 2012). They contain huge measure of small scale supplements making them progressively significant regarding nourishing physiology. They are rich water-solvent nutrients provitamin A, phytosterols and assortment of minerals (Gebbers, 2007). Various investigations have been recorded which shows that foods grown from the ground help in counteraction of certain chronic sicknesses for example hypertension (Dauchet *et al.* 2007), coronary heart maladies (Dauchet *et al.* 2006; He *et al.* 2007), and the danger of stroke (Dauchet *et al.* 2005; He *et al.* 2006). Regardless of the way that admission of leafy foods diminishes the event of illnesses, the utilization of products of the soil stay beneath the suggested levels (Mytton

**Table 1:** Different types of smoothies

Sl. No.	Constituents	Formulation	Analysis	Reference
1	Apple Smoothie	Apple phenolic extract, CMC, citric acid	Apple Fibre, N <sub>2</sub> Physisorption, FTIR, Total Dietary Fibre, Total Extracted Polyphenol Content, HPLC, Rheological measurement	Sun-Waterhouse <i>et al.</i> 2013
2	Carrots Smoothie	Carrot: Water= 1:1,	pH, TSS, titrable acidity, Browning index, Phenylalanine Ammonia-Lyase, Total antioxidant capacity, TPC	Formica-Oliveira <i>et al.</i> (2017)
3	Fruit Smoothie	Entire apple-29.5% Squeezed apple concentrates-29.5% Strawberry-21% Banana-12% Orange-8%	Polyphenols, HPLC-DAD (diode ray detector), Hunter Lab, Dynamic Oscillatory measurement, Sensory	Keenan <i>et al.</i> (2011)
4	Pomegranate Smoothie	Pomegranate: Figs + Jujubes + Quinces Puree (60:40 & 40:60), Rhubarb Juice (5%)	Hunter Lab, UPLC-PDA (Ultra-performance Liq. Chromatography-Photodiode Array), Polymeric Procyandins, Antioxidant Capacity, Four-way Anova	Cano-Lamadrid, <i>et al.</i> (2018)
5	Red and Green Smoothie	26% Cherries, 8% Tomatoes, 5% Blackberries, 31% Prunes for Red Smoothie 40% Kiwi, 7% Fennel, 8% Spinach, 15% Papaya for Green Smoothie White grape juice- 20% Aloe vera- 10%	Microbiological, pH, soluble solids, titrable acidity, apparent viscosity, colour, browning index, soluble dietary fibres, total polyphenolic compounds, Organic acids and sugars, ascorbic acid, antioxidant activity	Cagno, <i>et al.</i> (2011)

6	Purple Smoothie	Beetroot- 12% Purple grapes- 45% Cucumber- 35% Broccoli- 8%	Sensory, Microbial, Vitamin C, TPC, Total antioxidant content (TAC), Anthocyanin	Gonzalez-Tejedor <i>et al.</i> (2017)
7	Fruit Smoothie	Apple Juice- 33% Orange Juice- 33% Strawberry- 14% Whole Apple- 10% Banana- 10%	Sensory, Peroxidase enzyme activity, Polyphenol oxidase enzyme activity, Pectin methyl esterase enzyme activity, Antioxidant, Density, Viscosity, Total soluble and insoluble solids, Turbidity and Transmittance, Hunter Lab, Browning Index, Total Acidity, pH, Vitamin C, Total Phenols and Flavonoids, Sugars, Microbial	Hurtado <i>et al.</i> (2015)
8	Kiwi Smoothie	Kiwi- 3kg Sugar- 0%, 10%, 15%, 20%, 25%	Bioactive compounds, TAC, Total Chlorophyll, Total Carotenoid, Total Ascorbic Acid, Fluorometric measurement, FTIR	Park <i>et al.</i> (2016)
9	Mixed Fruit with Coconut Milk Smoothie	Pineapple- 50g Banana- 28g Apples- 12g Orange- 3g Coconut milk- 7g (per 100g smoothie)	Microbiological, Shelf-life analysis, Sensory analysis, Heat and Pulsed electric field and thermal pasteurization for preservation	Walkling-Ribeiro, <i>et al.</i> (2010)
10	Aloe gel- spiced ripened papaya Smoothie	Papaya pulp- 15% Sugar Syrup- 20% Aniseed, Ginger and Pepper- 5% Citric Acid- 0.1% Aloe gel- 10%, 20%, 30%	pH, Titrable acidity, TSS, non-enzymatic browning, Total and reducing sugar, Hunter Colour Lab, Vitamin C, Total flavonoids, Total polyphenols, Microbial analysis, Sensory acceptability	Ramachandran & Nagarajan (2014)
11	Dehydrated Smoothie	Dehydrated Banana, Dehydrated Strawberries, Dehydrated egg white, Demerara sugar (2%) Cold water/cold whole milk	Sensory, Viscosity, Hunter Lab	Guazi <i>et al.</i> (2019)

*et al.* 2014). Accordingly, to take out this propensity and present a sound living, exchanges, for example, juices, mixes, smoothies and matured and sustained refreshments are a well-known path for foods grown from the ground utilization (Wootton-Beard and Ryan, 2011; Corbo *et al.* 2014; Marsh *et al.* 2014; Ramachandran and Nagarajan, 2014 and Hurtado *et al.* 2015).

Due to health-promoting properties, diets rich in fruits and vegetables are highly recommended. They

possess a superior place due to their concentrations of vitamins, especially water soluble; minerals, especially electrolytes; and more commonly phytochemicals such as antioxidants (Slavin and Lloyd, 2012). Avocado, potatoes, dried beans and corn are wealthy in starch while yams are nearly sucrose and not starch. Natural products, aside from banana, and dull green vegetables contain next to zero starch. It is important to understand the categories of fruits and vegetables to ensure proper dietary intake in accordance with dietary recommendations. Fruits

and vegetables are usually low in energy density and excellent wellsprings of fiber and potassium (Hornick and Weiss, 2011).

Natural products generally contain sugars and fibers, for example, gelatin, that are widely matured in the internal organ. Natural products, for example, apples and pears, are packed in fructose (Southgate *et al.* 1978). Apples display 6% fructose and 3% sucrose though pears contain about 6.5% fructose and 1.3% sucrose; these qualities would be predictable in their particular juices. Admission of foods grown from the ground decreases the event of oxidative pressure related infections (Escudero-Lopez *et al.* 2016). Smoothies are a great and appropriate choice to advance the everyday usage of products of the soil (Rodriguez-Verastegui *et al.* 2015). Epidemiological examinations show that there is an away from between admission of products of the soil and diminished pace of heart infections mortality, normal malignant growths and other degenerative illnesses including maturing (Steinmetz and Potter, 1996; Garcia-Closas *et al.* 1999; Joseph *et al.* 1999; Dillard and German, 2000; Prior and Cao, 2000; Wargovich, 2000). It mainly helps in reducing the risk of cancers of the mouth and pharynx, oesophagus, lung, stomach and colon.

Blending is an alternate to reduce under-utilization of vegetables, fruits, spices and condiments. It may be attributed to alter dietary intake, taste preference and way of life of consumers. The demand of blended smoothies has been increasing with each passing year due to their health benefits and amazing taste. Therefore, to enhance taste, flavor, palatability, aroma and nutritive properties of any particular fruit or vegetable, it is aimed to be convenient to blend it with highly nutritive fruits and vegetables of other variety.

## BEVERAGES

Water balance inside human body can be maintained by consuming an adequate amount of water which is equal to amount of water being excreted out. Human body keeps water balance in harmony state

by controlling admission and discharge (Sayed and Abdellatif, 2018). Refreshments add to prerequisites of water in human. Troiano *et al.* 2000 detailed that around 20-24% of vitality consumption originates from drinks. Notwithstanding satisfying essential prerequisite, drinks turned into a piece of culture of human culture. Assortment of drinks taken influences arrangement of present day diet (Stubbs and Whybrow, 2004). These drinks are in top ten contributing nourishments for a few supplements. Natural product juices adds to vitality, calcium, iron, vitamin C, vitamin A and fiber consumption while milk adds to vitality, protein, fat, calcium, and nutrient An admission (Zohouri, *et al.* 2004).

## SMOOTHIE

The concept of smoothies came into vision in 1990s and is one of the major growing sectors of beverage industry (Mordor Intelligence, 2017). Smoothies are progressively famous method of expending organic product. It should contain minimum of one portion of fruit. To increase the consumption and eating interest of consumers, it is the best way to process fruits and vegetables through different methods (Bates and Price, 2015). Smoothies are generally made up by joining entire foods grown from the ground which keeps up fiber despite the fact that squeezing will in general abandon a mash containing fiber however in any case holds its dietary benefit (Clemens *et al.* 2015).

As of late, smoothies have increased a lot of notoriety for example development of item ascends from 2.39 occasions from 2002 to 2007 according to food merchandiser (Lal, 2007). Smoothies are a superb and helpful source to improve the day by day utilization of products of the soil (Rodriguez-Verastegui *et al.* 2015). Comfort and fitness food properties are two most significant variables for high-pace way of life. Changes in dietary admission are most earlier treatment for development of human wellbeing (Williams *et al.* 2004; Sabbe *et al.* 2009; Verbeke *et al.* 2009; Faresjo *et al.* 2010; Krystallis *et al.* 2010).

## PREPARATION AND PRESERVATION OF SMOOTHIES

The time span of usability of unpasteurized smoothies is relatively shorter because of microbial development accordingly negligible degree of preparation are related with these items. These are ordinarily expended either new or protected for brief timeframe (1–3 weeks) by putting away them under refrigeration conditions. A few specialists proposed that it could be worth to utilize a gentle warm sanitization treatment (Walkling-Ribeiro, *et al.* 2010) or a warm and high hydrostatic weight handling to degree their time span of usability and for predominant shading maintenance, polyphenols and other quality characteristics, ensuring purchasers acknowledgment and sanitation (Keenan, *et al.* 2011; Tiwari, 2018).

Low thermal processing is projected which enables retaining colour, consistency, fresh flavour, and ascorbic acid content. Acidification may convert low acid juice to an acidic juice allowing milder thermal process conditions (Agarwal & Kumar, 2017).

## FUNCTIONAL PROPERTIES OF SMOOTHIE

The rule job of products of the soil was by and large generally explored from most recent a very long while because of its high fiber substance and wealth of nutrients and minerals. It has been acknowledged because of its recipient impact on human wellbeing, introducing general wellbeing endeavors, for example, '5 per Day for Better Health', DASH diet and incorporation in the American Heart Association (AHA) dietary rules to upgrade utilization to improve human wellbeing (Tucker, 2004). Expanded admission of products of the soil helps in counteraction of constant and degenerative illnesses. In this way products of the soil are accepting a nickname as "useful nourishments" (Whitney and Rolfes, 2008).

Useful non-mixed drink industry is a quickest developing division and it is ceaselessly getting new items and bundling styles advertise. Increment in purchaser's interest for helpful beverages and

its suggestion on solid way of life is the impetus of industry's development. Being non-improved included characteristic flavors and enhanced with nutrients and minerals is a sound option in contrast to sodas (Suhag and Singh, 2017). Certain practical drinks have been created to give explicit health advantages. Numerous epidemiologic and clinical researches depicts multi advantages of products of the soil in human day by day diet for avoidance from intense and interminable afflictions (Lock *et al.* 2004).

Smoothies are generally made up from products of the soil which are wealthy in phenolic mixes. These phenolic mixes are acceptable wellspring of cell reinforcements liable for wellbeing advancing properties, for example, calming, antitumoral, forestalling neurodegenerative and interminable infections (El Gharras, 2009). Essential (shikimate) and auxiliary (phenylpropanoid) pathways are most regular pathways that occurred for the biosynthesis of polyphenolic mixes which happens within the sight of key chemical phenylalanine smelling salts lyase (PAL) (Dixon and Paiva, 1995). It was proposed that PAL movement can be expanded by a variety of biotic and abiotic stress-actuated components, for example, injuring, radiation presentation, hyperoxia capacity, chilling injury, water pressure, low minerals, hormones, ultrasounds, and pathogen assault (Cisneros-Zevallos, 2003; Cuellar-Villarreal *et al.* 2016).

Apple is considered as a best source of a healthy diet. They contain high amount of polyphenolic compounds and dietary fibers. It helps in preventing digestive problems, chronic disorders, respiratory cancer, asthma, diabetes type 2, thrombotic stroke and ischaemic heart problems (Lee *et al.* 2003; Boyer and Liu, 2004; Schulze *et al.* 2004; McGhie *et al.* 2005; Okoko *et al.* 2007; Hansen *et al.* 2009; Sun-Waterhouse *et al.* 2008a, b, 2011; Chai *et al.* 2011). Fresh apple prevents constipation, reduces dental caries, controls obesity and provide extra energy for heavy exercise. The apple fruit pulp is found to be richest source of phytochemicals like catechin, quercetin, phloridzin and chlorogenic acids. They are strong antioxidants which decrease the risk of cancers, cardiovascular

diseases, asthma and diabetes. These phytochemicals inhibits cancer cell proliferation, reduces lipid oxidation and lower cholesterol (Boyer & Liu, 2004).

Green leafy vegetables are separated and investigated independently from fruits and vegetables. There are few studies according to which green leafy vegetables possess protective effects and studies have shown that including them in regular diets is beneficial as due to their superiority in nutritive quantity amongst fruits and vegetables (Hung *et al.* 2004; Johnston *et al.* 2000; Zhang *et al.* 2011).

Milk is considered as a rich source of calcium, which is an essential nutrient for growth and development of strong bones and teeth, muscle movement and nerve signals. Many related organizations exclaim that getting enough amount of calcium in daily diet results in preventing bone fracture and osteoporosis. It is also a good source of potassium which helps blood vessels dilate and reduce blood pressure. Increased level of potassium rather than sodium intake helps in reducing blood pressure, lowering risk of heart disease and stroke (Miller *et al.* 1995; McCarron, 1998). The components such as calcium, vitamin D, lactic acid bacteria, linoleic acid and bioactive peptides present in dairy products could protect against colon cancer (Mobarhan, 2009; Garland *et al.* 1991; Ouwehand *et al.* 1999; McIntosh, *et al.* 1998).

Smoothies are made up by combining together fruit, fruit juice, ice, and yoghurt or milk. Between 2002 and 2006, the market share increased to 214% in Republic of Ireland (Mintel Group, 2008). Oey *et al.* (2008) have investigated various possible substitutes to warm preparing of natural product beverages to limit the conceivable negative effect that warm handling may have, coming about in negligibly prepared new items without concession towards timeframe of realistic usability. The execution of high hydrostatic weight (HHP) (up to 700 Mpa) can impact in protein inactivation and a gentle sanitization to food items at encompassing temperatures (Meyer *et al.* 2000; Weemaes *et al.* 1999).

Patras *et al.* (2009) suggests that, HHP can be used

to retain nutritional attributes of antioxidant rich fruits due to its property of affecting high atomic weight sub-atomic structure, for example, sugars and proteins in food. It doesn't influence littler particles connected along with organoleptic, dietary and wellbeing advancing properties. Smoothies are considered as a mainstream method of devouring organic product homogenates containing mash. They contribute towards a healthier diet and lifestyle. It comprises of numerous ingredients from fruit to dairy products, from pulp to yoghurt and sometimes sweeteners (Walkling-Ribeiro *et al.* 2010).

According to Hurtado *et al.* (2015) studies published up till now on high pressure processing (HPP) was carried out on individual fruit products. In recent years, some studies and researches have also been developed on blended fruit mixtures. Different pressurizing conditions were trialed to obtain products with organoleptic and nutritional characteristics normally in relation with "minimally processed" fruit.

Balaswamy *et al.* (2013) in their study regarding advancement of smoothies from chosen organic products pulps/juices aimed to blend different fruit pulp i.e. mango, banana, sapota, papaya and juices viz. grapes, phalsa, pineapple, watermelon and pomegranate of optimal quantities. The fruits were mixed in a manner that it provide required consistency as well as was compliant to thermal preservation processes in glass bottles. The blending also helped in manageable sugar acid ratio together with better colour and flavour without using preservative. Combining and mixing various fruit pulps and juices helps utmost use of natural product pulps and squeezes and furthermore help to sustain wholesome status of the populace.

## MARKET SCENARIO

It is important for the consumers to increase their awareness level followed with new trends and innovations. Awareness regarding ingredients associated with product and nutritional and adverse effects of the final product. It is an important criteria as some ingredients can be consumed by every age

group while some may cause fatal symptoms on wellness of the person (Olivo, 2015). Consumption of fruits and vegetables either in their original form or other variety is directly in relation to prevention and treatment of any acute or chronic diseases. As functional foods provide more than just nutrition thus it is gaining popularity around the consumers. According to Levy & Tapsell, (2007), due to emerging trends and consumers' specific needs, new variety of products could be witnessed in the market with natural and functional ingredients.

All around, admission of foods grown from the ground by larger part of individuals is underneath the day by day suggested dietary necessities. Researchers exclaimed that in developed countries such as Australia, Europe, Canada, UK and USA a large gap is observed between actual intake of fruits and vegetables to recommended servings. From an investigation inside 52 low and center salary nations about 77.6% men and 78.4% ladies are expending not as much as that of suggested dietary cutoff points. According to the same study, 74% low consumption is reported amongst adult of India (Hall *et al.* 2009).

India being the second largest producer of fruits and vegetables in the world grows almost all varieties of fruits and vegetables which contribute about 92.3% of total horticultural production within the country. Yearly utilization (kg/individual/annum) of organic products was 9.6 for provincial, 15.6 for urban and generally speaking India is 11.8 though if there should arise an occurrence of vegetables 74.3 (rustic), 79.1 (urban) and 76.1 (India) (NSSO). From the aggregate

of green creation, just 2% of these yields are prepared into esteem included items, for example, sticks and jams, squeezes and thinks, canned and dried out items, mash, pickles and chutneys. In the contrary, processing of these value-added products ranges between 80% to 30% in countries like USA, China, South Africa, Brazil, Chile, Philippines, Malaysia, Thailand, etc. (Kaul, 1998; Goyal, 2006).

McCartney *et al.* (2018) designed an online survey among Australian adults constituting about 79% female to recognize the smoothie consumption pattern and individual motives behind its intake. Candidates reported consuming 98% fruit, 46% fruit juice, 66% yoghurt, 52% honey and 58% milk and 46% nutritional supplements in their smoothies. Visit smoothie purchasers were found to devour more center food and rather less intentional things, for example, nectar, frozen yogurt, and so on in contrast with rare smoothie buyers. These frequent smoothie consumers perceives smoothie as nutritious (84%) while infrequent smoothie consumers regarded smoothie as indulgent beverages (62%).

**RECENT TRENDS AND INNOVATIONS**

Varous recent trends and Innovations made in Smoothies preparation are summarized in Table 2.

**Limitations**

The study regarding smoothie and its consumption is limited because of a little awareness about physiological and nutritional value of ingredients and amount present in final product among

**Table 2:** Recent Trends and Innovation

Sl. No.	Constituents	Formulations	Observations	Reference
1	Cereal-milk fruit smoothie	Full Cream Milk- 42.4% Banana-26.2% Blueberry- 14.5% Yoghurt-11.3% SMP- 3.0% Psyllium husk- 2.5% Water	Comparative survey on difference in dietary behaviour	McCartney <i>et al.</i> (2019)

2	Detox Smoothie	Mixed e.g. Green and red juice smoothies, Wellness shots, Nuts shakes and filling smoothie	Recipe Book consisting of different types of healthy smoothies	Maranik, E. (2015)
3	Flour-Milk based smoothie	Dairy animals milk: 3% Fat, 8.5% SNF Sprouted finger millet flour, Germinated sorghum flour, Germinated green gram flour, Germinated chickpea flour, flour went between 2-6% Mango mash 10% 15% and 20%, Sugar-9% 10% and 11%	Sensory evaluation, Effect of apple juice and mango pulp on sensory attributes, Effect of flour levels on sensory attributes, Effect of sugar level on sensory attributes	Rani <i>et al.</i> (2016)
4	Green coconut smoothie	Solid albumen of green coconut-20% Acerola pulp, pineapple pulp and coconut water- different ratios	Vitamin C content, Antioxidant capacity, Sensory acceptability, Total Phenolic Compounds, pH, Titrable acidity, TSS	Teixeira <i>et al.</i> (2019)
5	Chikoo Chia Smoothie	Chikoo – 50g Curd- 25g Honey- 10g Milk- 125ml Chia seeds in ratios 4g, 8g and 12g	Colour, Consistency, Taste, Overall acceptability	Battalwar & Shah (2015)
6	Pumpkin leaves fortified Smoothie	Pineapple, Banana, Apple, Pumpkin leaves (4.5%, 3% and 1.5%)	Proximate analysis, Vitamin C, Mineral content, Total flavonoids, Total Phenolic, Antioxidants, Sensory	Aderinola (2018)
7	Jamun Synbiotic Smoothie	Skim milk, SMP, Yoghurt, Sugar, Jamun juice	Proximate analysis, Shelf life at refrigerated temperature, Sensory evaluation, Prebiotic effect for microencapsulation, pH, acidity, viscosity, total viable count, antioxidant, total phenolic compounds, ascorbic acid.	Saranyambiga, <i>et al.</i> (2017)
8	Soy/Carrot Flavoured with Beetroot	Soybean milk: water= 1:10 Beetroot/Carrot pulp: water= 1:4	Viscosity, pH, TSS, Sensory Evaluation, Proximate Analysis	Banigo, <i>et al.</i> (2015)
9	Olive Leaf Extract fortified smoothie	Sodium cyclamate, sucrose, sodium chloride, citric acid, Strawberry-Banana smoothie, Olive leaf extract with oleuropein content, modified starch	Threshold Test, Ranking Test	Kranz, <i>et al.</i> (2010)

consumers. The smoothie is not well differentiated from the term soft drinks and health beverages. Numerous researches are available on consumption of whole fruit in its actual form or alternatives like juices, concentrates, etc. but no specific clinical health research is exhibited regarding consumption of smoothies. Smoothies being available in market are

high in sugar content and thus making it unhealthy in perspective of energy and low calorific food product.

### CONCLUSION

The review paper highlights the preparation of various smoothies depending on availability of seasonal fruits and the taste of consumers. Various

types of smoothies, market scenario, limitations and functional properties of smoothie are well covered in this review paper. Numerous researches are available on consumption of whole fruit in its actual form or alternatives like juices, concentrates, etc. but no specific clinical health research is exhibited regarding consumption of smoothies. Furthermore, many of the constraints in smoothies can be minimized through its commercialization and research that makes in utilizing various perishable seasonal fruits into value added nutritive products, which in turn enhances its economic demand.

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