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Review Article

Dynamic Concerns of Protein Ice-Cream: An Analysis

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Abstract

Protein ice-cream encompasses a significant amount of protein and low amount of sugar (alternative to traditional ice-cream). Whey and milk protein are chiefly present in protein ice-cream holding 08-22 grams of protein per pint (473 mL) of protein. It is considered as low calorie sweeteners, prebiotics, protein and fiber could increase the nutritional content of ice-cream. Low calorie present in protein ice-cream could reduce 8% body weight in 3 – 12 months. These healthy contents play an imperative role in providing beneficial assets to human body. Protein ice-cream is a home-made recipe which is prepared by utilizing protein powder and frozen banana. Added sugar could increase the calories which should be consumed less than 10% of total calorie intake. High quality of protein could be obtained from milk protein concentrate (MPC) and whey protein concentrates (WPC). Analysis and experiments results showed that by passing through various methods of cold treatment protein content increases gradually. Soybean is an expensive source of protein for ice-cream manufacturing. Chemical and sensory qualities of ice-cream were investigated different levels of fish protein powder during storage at -18^{0}C for 4 months. Fortification of ice-cream with 50 and 30g kg-1 fish protein has significantly higher nutritional status and value for protein ice-cream. Fiber is added in protein ice-cream impart beneficial biological properties. It is demonstrated by epidemiological and clinical studies that dietary fiber prevents cancer, obesity, type two diabetes and cardiovascular diseases. Protein ice-cream has minimum range of calories by reducing sugar which is most beneficial in weight loss. As compared to regular ice-cream, protein ice-cream decreases 8% body weight over 3 – 12 months. Obesity, type 2 diabetes (T2D), coronary heart diseases (CHD and other metabolic diseases are reported in patients consumed added sugar in excessive quantity. Protein plays a significant role in tissue repair and building of strong skeletal muscles. Protein ice-cream could be manufactured by adding probiotic strains. Gastrointestinal diseases are usually treated with probiotics. Irritable bowel disease, inflammatory bowel disease (IBD), necrotizing enterocolitis (NEC), pouchitis in ileal pouchanal anastomosis and acute diarrhea are also beneficially treated by probiotics.

Keywords: Protein Ice-Cream; WPC; MPC; FP; SPC; Advantages of Protein; Probiotics and Prebiotics

Introduction

Protein ice-cream encompasses a significant amount of protein and low amount of sugar as alternative to traditional ice-cream act as beneficial healthy food product could be consumed by health conscious people. Sources of protein ice-cream are whey protein and milk protein concentrate hold 8 – 22 grams of protein per pint (473 mL) of protein source. Low calorie sweeteners, prebiotics, protein and fiber could increase the healthy content of ice-cream. These healthy contents play an important role in providing nutritional properties to body. Low calorie present in protein ice-cream could reduce 8% body weight in 3 – 12 months. By utilizing the protein powder and frozen banana, protein ice-cream is a home-made recipe. Added sugar has the tendency to intensify calories should be consumed < 10% of total calorie intake. Drawback of protein ice-cream could be considered by having minimum nutrient would lead to nutritional deficiencies. Protein ice-cream could cause mild digestive issues and encourage overeating. In a nutshell, protein ice-cream intake should be moderate as snake food and could enjoy as healthy product [1].

Sources of protein ice-cream

Patel., *et al.* (2006) reported that high quality of protein could be obtained from milk protein concentrate (MPC) and whey protein concentrates (WPC). Analysis and experiments results showed that by passing through various methods of cold treatment protein content increases gradually. After 7 treatments protein content increased up to 90% of treatment [1]. 3.78% was mix protein content during treatment 1 after 7th treatment, 7.18% of increased content was reported. Production of ice-cream with high level of protein content would be possible [2].

Akesowan., *et al.* (2009) reported that ice-cream samples were determined to check the physical properties and sensory qualities

of skimmed milk powder with soy protein isolate (SPI). Soybean is an expensive source of protein for ice-cream manufacturing [3].

Shaviklo., *et al*. (2011) reported that nutritional value of food products could be enhanced by fish protein powder. Chemical and sensory qualities of ice-cream were investigated different levels of fish protein powder during storage at -18^{0}C for 4 months. Fortification of ice-cream with 50 and 30g kg-1 fish protein has significantly higher nutritional status and value for protein ice-cream [4].

Substances	A	B	C
Lactose	51 ± 1.9^c	69 ± 2.1^b	83 ± 1.6^a
Fat	42 ± 1.1	41 ± 1.4	41 ± 1.5
Protein	113 ± 1.8	111 ± 1.7	108 ± 1.2
Solids	188 ± 1.2^c	204 ± 1.6^b	215 ± 1.7^a
pH	0.08 ± 0.01	0.09 ± 0.01	0.09 ± 0.01
Acidity	6.7 ± 0.10	6.8 ± 0.10	6.8 ± 0.10

Table 1: Compositions (g kg^{-1}), acidity and pH of ice cream prototypes [4].

Friedeck., *et al.* (2003) reported that soy protein concentrate (SPC) could be served as major protein source. Soybean fortified with ice-cream is marketed at significant nutritional level [5].

Dietary fiber in protein ice-cream

Lattimer and Haub., *et al.* (2010) reported that parts of plants or carbohydrates contain dietary fiber provides resistance to digestion process offers as prebiotics to body. Fiber is added in protein ice-cream impart beneficial biological properties. It is demonstrated by epidemiological and clinical studies that dietary fiber prevents cancer, obesity, type two diabetes and cardiovascular diseases. The valuable constituents are found in dietary fiber promotes nutritional properties [6].

Non Starch Polysaccharides and Oligosaccharides	Analogous Carbohydrates	Lignin substances linked with the NSP and lignin complex
Hemi Cellulose	Indigestible dextrins	Phytate
Cellulose	Resistant potato dextrins	Waxes
Arabinogalactans	Resistant maltodextrins	Saponins
Arabinoxylans	Synthesized carbohydrates compounds	Cutin
Inulin	Methyl cellulose	Tannin
Polyfructoses	Polydextrose	Suberin
Oligofructans	Hydroxypropylmethyl cellulose	
Galacto-oligosaccharides	Resistant starches	
Mucilages		
Gums		
Pectins		

Table 2: Substances of dietary fiber according to the American Association of Cereal Chemists [7].

Low calorie protein ice-cream benefits

Protein ice-cream has minimum range of calories by reducing sugar which is most beneficial in weight loss. As compared to regular ice-cream, protein ice-cream decreases 8% body weight over 3 – 12 months [8].

Strychar., *et al.* (2006) reported that overweight causes severe chronic diseases like obesity during recent years. 60% of population has become obese because of limited medical resources utilization. By reducing calories in our diet, body weight could be lower in a significant manner. Proper body weight maintenance strategies should be adopted by consuming low calorie diet [9].

Baer., *et al*. (2011) determined the impact of supplemental whey protein (WP), soy protein (SP) and is energetic quantity of carbohydrate (CHO) by conducting double blind clinical test trial on body weight and obese healthy participants. Participants were provided 56 g/day protein twice daily. The body weight and composition data of participants were determined monthly. Results suggested a clear reduction in body weight and fat mass of the participants consuming the whey protein by 1.8 kg ($P<0.006$) and 2.3 kg ($P<0.005$), respectively. Protein ice-cream is obtained from whey protein could determine the loss in body weight [10].

Ingredients	Quantity	Deriv. By
Water	40.3	
Energy	137	Calculated
Energy	573	Calculated
Protein	2.31	
Total lipid (fat)	7.26	
Ash	0.594	
Carbohydrate, by difference	15.6	Calculated
Fiber, total dietary	0.462	Estimated formulation based on ingredient list; Linear program used to estimate ingredients; Claim on label/serving
Sugars, total including NLEA	14	
Calcium	84.5	
Iron	0.059	
Magnesium	9.24	
Phosphorous	69.3	
Potassium	131	
Sodium	52.8	
Zinc	0.455	
Copper	0.015	
Manganese	0.005	
Selenium	1.19	Analytical
Fluoride	10.2	Analytical

Total ascorbic acid	0.396	
Thiamin	0.027	
Riboflavin	0.158	
Niacin	0.077	
Pantothenic acid	0.383	
Vitamin B-6	0.032	
Folate, total	3.3	
Folic acid	0	Estimated formulation based on ingredient list; Linear program used to estimate ingredients; Claim on label/serving
Folate, food	3.3	
Folate, DFE	3.3	Calculated
Choline total	17.2	
Vitamin B-12	0.257	
Vitamin B-12 added	0	Estimated formulation based on ingredient list; Linear program used to estimate ingredients; Claim on label/serving
Vitamin A, RAE	77.9	Calculated
Retinol	76.6	Estimated formulation based on ingredient list; Linear program used to estimate ingredients; Claim on label/serving
Carotene, beta	12.5	Analytical
Carotene, alpha	0	Analytical
Cryptoxanthin, beta	0	Analytical
Vitamin A, IU	278	Estimated formulation based on ingredient list; Linear program used to estimate ingredients; Claim on label/serving
Lycopene	0	Analytical
Lutein + zeaxanthin	0	Analytical
Vitamin E (alpha-tocopherol)	0.198	Estimated formulation based on ingredient list; Linear program used to estimate ingredients; Claim on label/serving
Vitamin E, added	0	Estimated formulation based on ingredient list; Linear program used to estimate ingredients; Claim on label/serving
Vitamin D (D2+D3)	0.132	Nutrient that is based on other nutrient/s; value used directly, ex. Nut.#204 from Nut.#298
Vitamin D3 (cholecalciferol)	0.132	Nutrient that is based on other nutrient/s; value used directly, ex. Nut.#204 from Nut.#298
Vitamin D	5.28	Other procedure used from imputing
Vitamin K (phylloquinone)	0.198	Analytical
Fatty acids, total saturated	4.48	Estimated formulation based on ingredient list; Linear program used to estimate ingredients; Claim on label/serving
Fatty acids, total monounsaturated	1.96	Estimated formulation based on ingredient list; Linear program used to estimate ingredients; Claim on label/serving
Fatty acids, total polyunsaturated	0.298	Estimated formulation based on ingredient list; Linear program used to estimate ingredients; Claim on label/serving
Cholesterol	29	
Tryptophan	0.03	
Threonine	0.096	
Isoleucine	0.129	
Leucine	0.209	
Lysine	0.17	
Methionine	0.053	
Cystine	0.019	
Phenylalanine	0.104	
Tyrosine	0.102	
Valine	0.143	
Arginine	0.083	
Histidine	0.058	
Alanine	0.08	
Aspartic acid	0.165	
Glutamic acid	0.449	
Glycine	0.061	
Proline	0.215	
Serine	0.117	
Alcohol, ethyl	0	Assumed zero (Insignificant amount or not naturally occurring in a food, such as fiber in meat)
Caffeine	0	Estimated formulation based on ingredient list; Linear program used to estimate ingredients; Claim on label/serving
Theobromine	0	Estimated formulation based on ingredient list; Linear program used to estimate ingredients; Claim on label/serving

Table 3: Food data Central search results of vanilla ice-cream (USDA) portion: 137 calories in 1 serving ½ cup (66g). Protei n ice-cream contain less than half calories of that amount [11].

Drawbacks of added sugar

Vreman., *et al.* (2017) reported that obesity, type 2 diabetes (T2D), coronary heart diseases (CHD and other metabolic diseases are reported in patients consumed added sugar in excessive quantity [12].

According to dietary guidelines for Americans, the most recent studies indicate that excessive consumption of calories from added

sugar should be reduced at significant level. Several food components are provided in diet should be minimized to attain optimal nutritional interventions. Guidelines reported after analysis and experiments that less than 10% calories/day should be consumed [13].

Beneficial aspects of protein in tissue repair

Buckley., *et al*. (2010) reported that protein plays a significant role in tissue repair and prevent from muscle damage. Assessing effects on recovery of peak isometric torque (PIT) was used to evaluate the potential for whey protein isolate (WPI). 28 sedentary males were suffering from muscle soreness (MS), serum creatine kinase (CK) activity, plasma TNF_, and PIT assessed in a double-blind randomized parallel trial at baseline. Participants were consumed 250 ml of flavored water (FW) composed of 25 g WPI (n = 11) or 25 g WPIHD (n = 6). PIT reduced approximately 23% following ECC, stay restrained in FW and WPI, but recovered fully in WPIHD by 6 h (P = 0.006, treatment × time interaction) [14].

Protein (amino acids) building strong muscles

Witard *et al*., (2016) reported that building of strong skeletal muscles is highly necessary for human health. To stimulate protein muscle synthesis (PMS) for the regulation of skeletal muscle mass (SMM), consumption of protein from good protein sources is required. Recent reviews studies demonstrated that it is more complex to find guidelines for the preservation of SMM than protein intake guidelines [15].

Pennings., *et al*. (2011) reported that postprandial muscle protein accretion is stimulated more efficiently by whey protein (WP) as compared to casein and casein hydrolysate. Whey protein (WP) is regarded as beneficial source for protein ice-cream preparation. For this purpose, a test was conducted in which a total of 48 older men aged 74 ± 1 y (mean ± SEM) were arbitrarily consigned to ingest a meal-like amount (20 g) of intrinsically L-[1-^{13}C] phenylalanine–labeled whey, casein, or casein hydrolysate. Protein ingestion was combined with continuous intravenous L-[ring-$^{2}H_{5}$] phenylalanine combination to evaluate in vivo digestion and inclusion kinetics of dietary protein. Postprandial mixed muscle protein fractional synthetic rates (FSRs) were considered from the ingested tracer [16].

Wu., et al. (2016) reported that dietary protein is recommended as 0.8 g/kg body weight (BW) per day for normal functioning of immune system and skeletal muscles. 1.0, 1.3 and 1.6 g of dietary protein is required for adults to meet the basic needs for the accomplishment of body requirements. Consumption of healthy product like protein ice-cream contains protein in handsome amount for the maintenance of body system [17].

Amino Acid	Whey	Casein	Casein Hydrolysate
Arginine (g)	1.0	0.6	0.6
Alanine (g)	0.5	0.7	0.7
Cysteine (g)	2.3	1.3	1.3
Aspartic Acid (g)	0.7	0.1	0.1
Glycine (g)	3.2	4.1	4.1
Glutamic Acid (g)	0.4	0.3	0.3
Isoleucine (g)	0.4	0.5	0.5
Histidine (g)	1.2	1.1	1.1
Lysine (g)	2.5	1.7	1.7
Leucine (g)	2.1	1.4	1.4
phenylalanine (g)	0.4	0.5	0.5
Methionine (g)	0.7	0.9	0.9
Serine (g)	0.7	2.1	2.1
Proline (g)	0.7	1.3	1.3
Tryptophan (g)	0.9	0.8	0.8
Theronine (g)	0.5	0.2	0.2
Valine (g)	0.8	1.1	1.1
Tyrosine (g)	1.0	1.3	1.3
Total NEAA (g)	20.0	20.0	20.0
Total AA (g)	10.7	12.1	12.1
Total EAA (g)	9.3	7.9	7.9

Table 4: Amino acid composition of the proteins [16].

Protein ice-cream added probiotic and prebiotic

Salem., *et al.* (2005) reported that protein ice-cream could be manufactured by adding probiotic strains. The evaluation of probiotic ice-cream was done by evaluating sensory properties as well as physical qualities. Five different probiotic strains utilized for ice-cream preparation were *Lactobacillus gasseri* B-14168, *Lactobacillus rhamnosus* B-445 and *Lactobacillus reuteri* B-14171, *Lactobacillus acidophilus* La-5 (DVS) and *Bifidobacterium bifidum* Bb-12 (DVS) [18].

Species	Strains
Yeast	
Saccharomyces boulardii	Unspecified Strain
Bifidobacterium	
B. adolescentis	ATTC 15703, 94-BIM
B. amimals (lactis)	Bb- 12 (Chr. Hansen)
B. bifidus	(Danisco), HN019
B. breve	Bb-11
B. essensis	Yakult
B. infantis	Danone (Bioactivia)
B. longum	Shirota, Immunitass, 744, 01

Other LAB	
Carnobacterium divergens	V41, AS7
Enterococcus faecium	SF68, M-74
Streptococcus thermophilus	CCRC 14097, CCRC 14085, F4, V3
Non- lactic bacteria	
Propionibacterium	SJ (Valio)
Lactobacillus	
L. acidophillus	La-1/La-5 (Chr. Hansen), NCFM (Rhodia)
L. bulgaricus	(Nebraska Cultures), LAFTI L10
L. casei	Lb12
L. fermentum	Immunitals (Danone)
L. helveticus	(Yakult)
L. johnsonii	RC-14 (Urex Biotech), KLD
L. reuterii	B02, L89
L. rhamnosus	LA1 (Nestle)
L. paracasei	ING1
L. plantarum	GG (Valio), HN001
L. reuteri	33 (Uni-President Enterprises Corp.)
L. rhamnosus	(Probi AB), 299v, Lp01, ATTC 8014 (Valio)
L. salivary	SD2112 (also known as MM2)

Table 5: Types of microorganisms used as probiotics [19].

Degnan., *et al*. (2008) reported that probiotics are the beneficial micro-organisms utilized for the body functioning. US Food and Drug Administration (FDA) govern the regulations for the probiotics by the data collection if probiotics strains employed for the production of different products [20].

Didari., *et al*. (2014) reported that gastrointestinal diseases are usually treated with probiotics. Irritable bowel disease, inflammatory bowel disease (IBD), necrotizing enterocolitis (NEC), pouchitis in ileal pouchanal anastomosis and acute diarrhea are also beneficially treated by probiotics [21].

Sanders., *et al*. (2010) reported that most of the microbes are considered as probiotics in which theoretical risk of transfer to the gut microbial community in the presence of transferable antibiotic resistance were determined [22].

Hassan., *et al*. (2018) reported that assessment of efficacy of probiotics were determined by 21 studies (N = 2982 participants) trials. Probiotics may decrease the occurrence of diarrhoea in patients with cancer [odds ratio (OR) = 0.52, 95% confidence interval (CI) 0.34–0.78, 95% prediction interval (PI) 0.3–0.92, I-sq 36.9%, 5 studies] and the time interval of pyrexia [standardized mean difference 0.39 days, 95% CI 0.35–0.43, I-sq 0.01%, 5 studies]. 25 studies (N = 2242) were incorporated in the safety analysis. Five case reports demonstrated that probiotic-related bacteraemia/fungaemia/positive blood cultures. Efficacy of probiotics was determined to treat cancer and diarrhoea diseases [23].

Conclusion

Health-conscious persons consider the consumption of protein ice-cream determined to have low calories and high in protein. For this purpose, protein is extracted from whey protein concentrate (WPC), milk protein concentrate (MPC), fish protein (FP) and soy protein concentrate (SPC). Fiber, prebiotics, probiotics and low calorie sugars are also added in protein ice-cream for the consumption of healthy product. Protein calculated and gathered from different protein sources is determined for the treatment of chronic diseases, tissue repair and building of strong skeletal muscles.

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