

Dyno Doh – A Nutritious Alternative to Junk Food

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Abstract: Children these days prefer processed food or junk food, which is harmful and unhealthy. These food have artificial food dyes that trigger chemicals such as dopamine dyes inducing the kids to eat more. This leads to an unhealthy diet and is one of the major risk factors for a range of allergies, chronic lifestyle disorders such as diabetes, obesity, and dangerous diseases such as cardiovascular diseases and cancer. Hence, we propose a new type of food product made of edible playdough. This will be made with natural food colors, holistic nutrient ingredients. As the kids can play and eat the same dough food, it will be attractive and entertaining for them. This will naturally reduce the consumption of addictive junk foods and increase a healthy lifestyle.

KEYWORDS

Processed food, Nutritious, Playdough, Natural colors, Natural flavours.

1. INTRODUCTION

Despite being the fifth largest economy in the world, [40] India has slipped to 150th on health and survival ranking [31]. India sees a 40% rise in the fast food and processed food industry every year. [2] However, studies show, 43% of children under 5 years are underweight and 48% are stunted, due to severe malnutrition around the world. [26] Malnutrition in children is very harmful. Malnutrition causes physical and mental exhaustion, low weight to height ratio, loss of elasticity of the skin, exaggerated skeletal contours, and stunt in growth. [22] Any impairment in the first two years of their life is largely irreversible. [8]

Malnutrition violates a child's human rights and has a bi-directional impact on poverty, national development, education, health, and productivity of a nation. [16] This is a major worry for the transition countries as well as developing countries. In low-income countries, malnutrition is caused by limited access to food and medical care, whereas it is often caused by disease in in-transition countries. [20] Since malnourishment disturbs the immune response of the children, it affects wound healing while increasing the risk of infections. In comparison with adults, children are most vulnerable to malnutrition, having a lower caloric reserve and higher nutritional requirements per unit of body weight, to account for growth [5].

The chemical dopamine fits into receptors in the brain, just like a key fits into a lock and when the fit is right the pleasure is sensed [37]. Food manufacturers understand this and add chemicals or other common substances to trigger dopamine release and hence attract people to keep eating their product [39]. Chemicals such as monosodium glutamate, artificial food coloring, sodium nitrate, guar gum, high-fructose corn syrup, artificial sweeteners, carrageenan, sodium benzoate, trans fats, xanthan gum, artificial flavors, and yeast extract are used for this purpose [27]. As more junk food or processed food is consumed, the brain neurons pump excess dopamine to the brain, which stimulates pleasure [15]. This makes junk food or processed food more addictive [14] and this leads to overeating and obesity [30]. It has been reported that some of the food additives may cause sensitization, inflammation of tissues, and potential risk factors in the development of several chronic diseases [32]. Foods that are high in contents such as fat, sugar, and salt can increase the risk for high cholesterol, high blood pressure, obesity, kidney diseases, and atherosclerosis. [18]

Specific food dyes such as Blue 1, Red 40, Yellow 5, and Yellow 6 have been associated with allergic reactions in some people.[13] Food dyes were synthesized originally from coal tar and now petroleum [35]. Many food dyes have been banned because of their very harmful effects on laboratory animals or inadequate testing [25]. Artificial food coloring may also increase hyperactivity in children [9] while some food dyes even may cause cancer in people. Food dye such as Red 3, which is also known as erythrosine increases the risk of thyroid tumors, so now it is replaced by Red 40 in most foods. Some of the food dyes such as Red 40, Yellow 5, and Yellow 6 are even contaminated with benzidine or other carcinogens [14].

Natural food colors have been categorized as 'exempt from certification' category of FDA. They are obtained from a wide range of sources such as vegetable and fruit juices, oils, extracts, endosperm, and other edible natural sources [17]. Natural food colors also have antimicrobial properties, which makes them safer for kids in particular. These natural food colors neither contain harmful chemicals nor carcinogenic components, which are common to artificial or synthetic food colors [15].

2. MATERIALS AND METHODS

2.1 Objectives and Motivations

The food playdough product was developed to eradicate malnutrition caused due to the high cost of nutritious food, and eradicate health disorders like obesity, cardiovascular diseases, and cancer in extreme cases due to the consumption of unhealthy food.

The food playdough makes the food fun for children and attracts them to play and eat. This ensures that children eat what is needed for them and makes it easy for parents to feed food to their kids.

It also provides nutritious and tasty food for children to stay healthy and fit using vitamin enriched ingredients, natural flavors, and natural colors.

Other reasons include using our natural resources. Fast food and the ingredients used in today's world are mostly synthetic and harmful in large quantities. However, natural ingredients have already been experimented with for centuries, and native grown millets and other vegetation can be used without fear.

2.2 Raw materials

The ingredients for the dough were nutritious flour and salt for taste enhancement. The white dough was made using vitamin-enriched rice or brown rice [16]. Additional flavours of dough were made using almonds [19], amaranth [24], coconut [34], arrowroot [4], oats [1], and tapioca [10]. Dough using ragi [33] and other millets were beyond our scope. They could be considered to enhance the flavor profile and the nutty texture of the dough.

The coloring and flavoring agents were natural plant extracts that ensure organic vitamins and a healthy diet. Depending on the phytochemical present in the extract, the food coloring varied. Examples include carotenoids, anthocyanin, indole, lycopene, chlorophyll, flavonoids, folate, and anthoxanthins. [23]

Table 1. List of sources of phytochemicals required for natural coloring

Colour	Source	Phytochemical	Health benefits
Pink	Strawberries, Raspberries	Anthocyanin, d, e	Prevent obesity, ¹⁹ Prevent cardiovascular diseases ²⁴
Red	Beetroot	Betalain, f	Chemoprevention ³⁴
Orange	Sweet potato, orange, carrots	Phenolic acids, g Flavonoids, h Phenolics and flavonoids	Anti inflammatory ⁴ , Antimutagenic ¹
Yellow	Saffron, turmeric, palm oil fruit	Crocin, a Curcumin, b β carotene c	Antioxidant ¹⁰ , Antibacterial ³³ , Retinol synthesis ³⁶
Green	Matcha, Spinach	Catechin, i	Increase useful intestinal bacteria ²⁹
Blue	Red cabbage + baking soda	Anthocyanin, j	Antioxidant ³⁹
Purple	Blueberries, purple sweet potato	Anthocyanin,	Antioxidant
Brown	Tea, Cocoa	Chlorogenic acid,k	Wound healing ¹¹

These extracts were added in a glycerine medium and made into a gel and packaged.



Fig 1. Making of dough using rice flour, water, and turmeric extract



Fig 2. Finished dough using rice flour, water, and turmeric extract

2.3 Packaging

Packaging the playdough requires artificial preservatives and stabilizing agents. In order to reduce that, it was investigated and found to package the flour directly. The consumer can use warm water and knead the flour into a dough when required. The flavoring and coloring nutrients are packed as gels and can be added to the dough in the end. To create variety and make the price effective, each packet offers two different colors and flavors.

To attract children and make our product different from others, dough cutters and rolling pins are also packed as surprise gifts in each package. This will ensure children's enthusiasm to play with something different and eat it as well. Parents needn't worry about any toxic chemicals or unhealthy food



Fig 3. Finished prototype of the product using beet extract and turmeric powder as food colouring

2.4 Business Model Canvas

The key features of our food product are highlighted below:

2.4.1 KEY PARTNERS

This mainly includes our investors and other partners. The main investor is the company 'Chocolate in the Box'. Main partners include suppliers, online shopping platforms, our retail chains.

2.4.2 KEY ACTIVITIES

We produce edible 'Dyno Doh' for kids. We collect raw materials from farmers and process them in our industries. Later these are packed and delivered to outlets by our distribution units. Advertising and promotion of our products are done by our PR department. We also have a team working on innovating and improving the product.

2.4.3 KEY RESOURCES

Resources include Human resources, which are the employees and staff working in this company. Financial support for the working is provided by the investors of the company Chocolate in the Box. Intellectual resources include our branding, Patents, and IPR's on our products and copyrights. Physical resources involve buildings, equipment, and other inventories.

2.4.4 VALUE PROPOSITION

In many families nowadays children almost hate having homemade foods and prefer junk foods, which is bad for their health at this age. Because of which most of them lack proper nutrition and faces various health issues. Our solution to this is, 'Dyno Doh' which is a highly nutritious edible doh made up of rice flour for kids. They are tasty and could be remolded and played with it. Which makes kids attracted to it. They are available in different flavors & colors. This doh also contains various natural Immuno boosters, vitamins, and other nutrients that are essential for child growth.

2.4.5 CUSTOMER RELATIONSHIPS

We will be reaching our customers mainly through our advertisements and brand awareness. We also have a 24*7 customer service hotline for registering customers' complaints and suggestions to improve the product. We also have help desks across all the states of the country. We also conduct surveys to know about the public's opinion about our product.

2.4.6 CHANNELS

We will be raising awareness among customers about the products and services through social media and advertising. We will be selling our doh through supermarkets, stores, and retailers. You could also get this as a nutrient supplement for kids from doctors or hospitals. You could also buy this from online stores.

2.4.7 CUSTOMER SEGMENTS

The 'Dyno Doh' is mainly focused on a group of kids who are in the age group of 3-7, who are unwilling to have regular homemade food, or parents with kids who don't have enough time to feed their kids or malnourished kids. This helps your kids to enjoy their meals and engage them with fun activities at the same time.

2.4.8 COST STRUCTURE

Our company 'Chocolate in the Box' bears the cost of all the ingredients and supplies which are required to make Dyno doh. We are giving free dough cutters along with our product, so that also requires a good amount of money. Packaging and manufacturing fees are also required to make the product available in adequate quantity in the market. We have to keep in mind the distribution cost as this should be accessible to everyone and especially to the below poverty line families. Our company looks after the proper salary and safety of the employees whom all are working under our company.

2.4.9 REVENUE STREAMS

Mainly revenue is generated by the wholesale and retail selling of the product. Revenue is also generated by partnering up with several online shopping sites and various other companies that are involved in the packing and distribution units.

Business Model Canvas

Key Partners	Key Activities	Value Propositions	Customer Relationships	Customer Segments
<ul style="list-style-type: none"> Investors Farmers Manufacturers Suppliers Retail Chain Online shopping platforms 	<ul style="list-style-type: none"> Manufacturing Production Distribution Marketing and promotion Branding Innovating and improving the product 	<ul style="list-style-type: none"> Produce nutritious food for kids Eradicate malnutrition Support child growth Make parent's life easy 	<ul style="list-style-type: none"> Brand awareness and advertisements 24*7 customer service Hotline Help desks Public surveys 	<ul style="list-style-type: none"> Parents of age group 3-7 Busy parents Kids with malnutrition Playful kids who refuse food
	Key Resources		Channels	
	<ul style="list-style-type: none"> Financial-Investors Human resource-Staffs and employees Intellectual-Branding, patents, IPR's Physical-buildings equipment's and other inventories 		<ul style="list-style-type: none"> Advertising and social media Retailers Supermarkets Hospitals 	
Cost Structure		Revenue Streams		
<ul style="list-style-type: none"> Ingredients and supplies Manufacturing cost Packaging cost Employees Distribution costs 		<ul style="list-style-type: none"> Retail and wholesale sales Production and distribution Patent and copyrights Online shopping 		

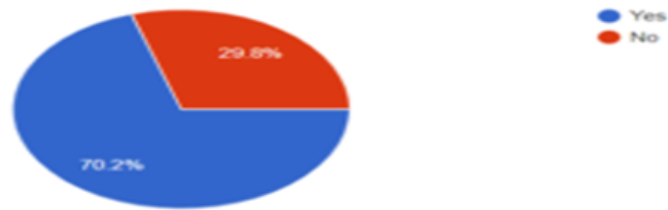
3. RESULTS

An online questionnaire was prepared and malnutrition data from local hospitals were collected. A Google survey form was used to see the different food habits of children among 94 families.

After analyzing the result of the survey it was found that:

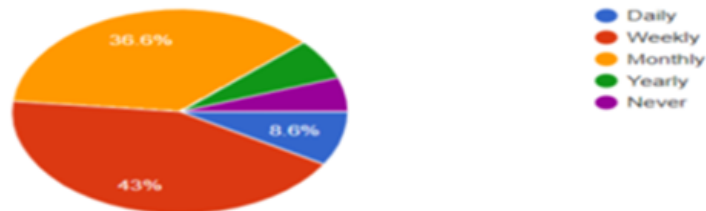
Do your kids eat whatever you cook for them?

94 responses



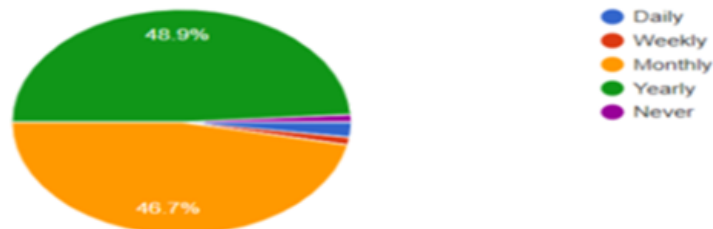
How often does your kid consume store bought food aka processed food?

93 responses



How often do they fall sick?

92 responses



Do they consume enough food?

94 responses



Fig 4. Graphical representation of survey results.

From these pie charts, we conclude that:

Most of the children fall sick monthly as they prefer store-bought foods over homemade food, and although most of the children consume enough food still 17% of them don't consume foods properly which at a later stage leads to malnutrition.

Working parents have a tough time feeding their kids and children give their parents a hard time while eating home-cooked meals. Hence, parents find it hard to feed their kids without threatening them. This causes more stress and a healthy diet is not maintained.

Children prefer store-bought food (processed food) but parents prefer they eat food with more nutritional value (eg. Ragi and millets).

4. DISCUSSIONS

Children nowadays do not eat healthy food. Acid reflux is most common in babies, it can also have an impact on kids much older, even if they weren't diagnosed as an infant. This will lead to malnutrition, the malnourished children are more susceptible to infectious diseases, which increases the risk of dying [29]. So, malnutrition is the major reason for child morbidity and mortality [38]. Malnutrition continues to be a major health burden in many developing countries because of its two constituents of protein-energy malnutrition and micronutrient deficiencies. Malnutrition is the most important risk factor for illness and death. Apart from the marasmus and kwashiorkor (the 2 forms of protein-energy malnutrition) the deficiencies in iron, iodine, vitamin A and zinc are the main indications of malnutrition in children. Nutrition is very important at every age. Children need proper nutrients to stay healthy and strong, and also to grow up fit and strong. By increasing the dietary diversification, which is the most important factor for providing a wide range of micronutrients and protein energy. To achieve this objective, it requires an adequate supply, access, and consumption of a variety of foods. With the right food combinations and with appropriate food processing and preparation techniques, the low bioavailability of some micronutrients from foods, such as iron is considerably enhanced.

Since parents don't get enough time to spend time with their children, due to various reasons, they most often don't care about their child's food habits. Children who don't eat proper healthy foods are more likely to develop long-term health problems and the dopamine triggering substances make children more addicted to junk food or processed food [39]. It has been reported that some of the food additives may cause sensitization, inflammation of tissues, and potential risk factors in the development of several chronic diseases [11]. Artificial food colorings have a role in hyperactive behavior in children and many food dyes cause allergic reactions in people. Some food dyes may even cause cancer in people. Because of these problems we produce a new food product, the food product which is rich in a wide range of micronutrients and protein content. This food product is in the form of dough. Natural food dyes are used in this product because there are no side effects for such dyes. Natural food colors also have antimicrobial properties, which makes them safer for kids in particular. These natural food colors neither contain harmful chemicals nor carcinogenic components [21].

Malnutrition has been an important problem for our country. Especially, the number of children affected by malnutrition has increased over the years. It's "an imbalance between nutrient requirement and intake, resulting in cumulative deficits of energy, protein, or micronutrients that may negatively affect growth, development, and other relevant outcomes" [3]. Rates of malnutrition have also been high among adolescent girls, pregnant and lactating women. In the case of children, this could affect them in several ways including stunting, childhood illness, and retarded growth. It is also linked with 45% of child death in 2011 and is also linked with mental retardation and cerebral palsy [28]. It is recently apparent that quality protein and essential amino acids are missing in the diet and may have adverse consequences for child growth. Since nutrition assessment is an important part of the medical assessment and care of children, it is an important criterion for malnutrition [12]. This is also because of the lack of availability of food, unhealthy eating habits in children [7]. In this article, we focus on malnutrition caused due to a lack of nutritious food intake by kids. While interpreting the data, we found that children are hesitant to have homemade food. This will lead to malnutrition and other diseases in them. Thus, we introduced our product DYNO DOH for kids, which is highly nutritious and provide every other supplement for their growth. Thus, we could eradicate malnutrition.

Companies all over the world had come up with various nutritious food products. But there is still a majority of the population whom all cannot afford healthy and nutritious foods. Our product Dyno doh is especially for kids who refuse to eat healthy foods and for people who can't afford it. We have tried to make our product which is attractive, healthy, and nutritious at a reasonable cost. The main advantage of our product is that it is an all in one product. We have used rice, millets, ragi oats together to make the product. Natural sweetening agents are used along with organic stabilizing agents like agar and pectin. Natural sweeteners are generally safe but consuming too much of them may lead to health problems like tooth decay, weight gain, poor nutrition, and increased triglycerides. Thus, the optimum amount is used in our product. Without using artificial chemicals natural immunity boosters like the juice of citrus fruits are used which is rich in Vitamin C. Vitamin C increases the production of white blood cells which are key to fighting infections. So, this vitamin from the citrus fruits is squeezed into Dyno doh. Moreover, this product will attract children of various colors. Natural

coloring agents are used, so it won't be harmful to the children and would bring relief for the parents who find it difficult to feed their children with healthy foods.

5. CONCLUSION

Dyno Doh boosts the immunity of children. Parents don't complain about their child's eating habits anymore. Children are preferring Dyno Doh over store-bought foods and they have reduced consuming more processed food. We have faith that Dyno doh will be successful in its long-term goal of making a world without malnutrition.

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