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Effect of Hydrocolloides On Fat Absorption on Batata Wada

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ABSTRACT:*Batatawada is popular Indian vegetarian fast food in Maharashtra, India. It is literally means potato fritters. It consists of a potato mash patty coated with besan, then deep-fried and served hot with chutney. While preparing batter of besanhydrocolloids were added in the concentration range of 0.5%, 1.0% & 1.5%.Among all the hydrocolloids studied at different levels for preparation of Batata Wada, it can be concluded that Batata Wada formulated with 1.0% MC were found statistically significant over all other hydrocolloids in oil uptake with optimum sensory quality characteristics. It becomes quiet stable at level of 1.0% formulation in remaining hydrocolloids i.e. CMC, HPMC. Thus, Batata Wada with low fat and low calorie content with better acceptance can be prepared in order to meet the demand of low fatty foods, of health cautious consumers.*

In Texture analysis profile, hardness and stickiness values found at the level of formulation of 1.0% of MC, CMC, HPMC is quiet stable as compared to other level of formulation.

Keywords: *Batatawada, hydrocolloids, texture analysis profile, oil uptake, sensory quality.*

I. INTRODUCTION

Today's consumers are becoming increasingly aware of the health risks associated with a high fat diet. As a result, more and more consumers are making it their goal to reduce overall dietary fat in their diets. The health risks are no longer challenged. Diets high in fat increase our risk for obesity, some types of cancer, and possibly gallbladder disease. Enough research has established strong evidence linking saturated fat intake with high blood cholesterol and an increased risk for coronary heart disease.

Other government reports promote reducing fat intake to 30% or less of total calories. The American Heart Association, the National Cancer Institute, and the American Diabetes Association also recommend that we consume less fat. People who are extremely overweight or who have extremely high serum cholesterol may need to reduce their dietary fat intake toless than 30%. However, it may not be appropriate for children under the age of two to limit their fat intake to 30%. [Sandra Bastin, Fat replacers, 1993].

Various strategies have been employed to minimize the problems related with fat reduction. The active approach is replacement of fat with fat mimetic ingredients which either replace fat or modify interactions of the remainingComponents. Such ingredients include starches, hydrocolloids, soy protein concentrate and/or isolates, collagen preparates. [Manish Kumar, division of livestock products technology, IVRI, 2007].

Reducing dietary fat is the primary dietary goal for many consumers. Trends in dietary fat intake, classification by nutrient source, energy density, specific application and functional properties of fat replacers will be reviewed. Specific application and potential effects on health status of fat substitutes also will be reviewed. [Claudia Felicia Ognean, Faculty of Agricultural Sciences, Romania, 2006].

II. FAT REPLACERS

Fat replacers are compounds incorporated into food products to provide them with some qualities of fat. [Claudia Felicia Ognean,Faculty of Agricultural Sciences, Romania, 2006].

The type of fat replacers used in a product depends largely on which of the complex and diverse properties of fat are being duplicated. In addition to flavour, palatability and creaminess, fats provide an essential lubricating action. In fried foods, fats and oils transmit heat rapidly and uniformly and provide crispiness.

The ideal fat replacers recreates all the attributes of fat, while also significantly reducing fat and calorie content. The challenge for food processors is to identify the fat replacers that works best for a given product. [Calorie control council, 2015].

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III. MATERIALS

- **Medium sized potatoes**: The potato is a starchy, tuberous crop from the _Solanum tuberosum_. Potatoes are commonly used in every home.
- **Besan (Bengal gram flour)**: Gram flour, also known as besan, is a pulse flour made from ground chickpeas known in a number of Asian countries as *gram*. It is a staple ingredient in Indian cuisines. Gram flour contains a high proportion of carbohydrates, no gluten and a higher proportion of protein than other flours.
- **Baking soda** :Sodium bicarbonate is a white solid that is crystalline but often appears as a fine powder. Sodium bicarbonate is a chemical compound with the formula $NaHCO_3$. It is a salt composed of sodium ions and bicarbonate ions.
- **Cloves of garlic**: ***Allium sativum***, commonly known as **garlic**, is a species in the onion genus. Garlic is easy to grow and can be grown year-round in mild climates. Garlic is a fundamental component in many or most dishes. When expressed per 100 grams, garlic contains several nutrients in rich amounts, including vitamins B_6 and C, and the dietary minerals, manganese and phosphorus. Per 100 gram serving, garlic is also a good source of certain B vitamins including thiamine (Vitamin B_1), and pantothenic acid (Vitamin B_5), as well as certain dietary minerals including calcium, iron, and zinc.
- **Turmeric powder**: Turmeric is used as flavour in most of spicy dishes. In Ayurveda practices, turmeric has been used to treat a variety of internal disorders, such as indigestion, throat infections, common colds or liver ailments, as well as topically to cleanse wounds or treat skin sores.
- **Salt** : Salt is used for test purpose in Batata Wada.
- **Vegetables oil**: Fortune rice bran oil blended with Rice bran oil (80%) and Soyabean oil (20%) with an added advantage of Vitamin E, Oryzanol, and Fatty acids with Omega 3 was used for frying the product.
- **Chilly powder**: Chillypowder has been a part of the human diet.
- ***HPMC***: **Hydroxypropyl methylcellulose** (**HPMC**) is a semisynthetic, inert, viscoelastic polymer used as an ophthalmic lubricant, as well as an excipient and controlled-delivery component in oral medicaments, found in a variety of commercial products. As a food additive, HPMC is an emulsifier, thickening and suspending agent, and an alternative to animal gelatin. Its Codex Alimentariuscode (E number) is E464. It is generally recognized as safe by the FDA.
- ***CMC***: **Carboxymethylcellulose** (**CMC**) or **cellulose gum** is a cellulose derivative with carboxymethyl groups ($-CH_2-COOH$) bound to some of the hydroxyl groups of the glucopyranose monomers that make up the cellulose backbone. It is often used as its sodium salt, sodium carboxymethyl cellulose. CMC is used in food science as a viscosity modifier or thickener, and to stabilize emulsions in various products including ice cream. As a food additive, it has E number E466.
- **Methyl cellulose (MC)**: It is a chemical compound derived from cellulose. It is hydrophilic white powder in pure form and dissolves in cold (but not in hot) water, forming a clear viscous solution or gel. It is use as a thickner and emulsifiers in various foods. It has E number E461.

IV. METHOD FOR PREPARING BATATA WADA

Potatoes were boiled and mashed in big bowl and kept aside. Green chillies ginger and garlic paste was prepared in mixture grinder. Curry leaves and mustard seeds were added in saucepan till they popped up and whole mix was pounded in a mashed potatoes with spices paste. This mixture was thoroughly mixed at elevated temperature. Then turmeric powder and other spices mixed into that compounded mix. Then salt was added along with chopped coriander leaves. BatataWada stuffing mix was made into equal sizes of about 18-20 gm and kept aside for further coating of batter to it.

Bengal gram flour, salt, baking soda and chilly powder were mixed to prepare batter. To this batter, hydrocolloids such as HPMC, CMC & MC were added in concentration range of 0.5%, 1.0%, and 1.5% on dry basis. Gradually water was added to make batter of average thick consistency. Stuffing balls of Batata Wada were dipped in gram flour batter then slowly released in frying pan having oil temperature of 135^0C-145^0C and fried till golden brown colour was obtained. These Batata Wada were served to sensory panellist along with chutney or ketchup.

Table No. 1: Formulation Of Batata Wada

Besan	100 gm.
Water	100 ml (for thick consistency)
Chilly powder	2 gm.
Salt	3- 4 gm. or as per our taste
Baking soda	1 gm.
Hydrocolloid	As per concentration

V. PHYSICO-CHEMICAL AND SENSORIAL ANALYSIS OF BATATA WADA OIL CONTENT

Oil Content was determined by using Soxhletmethod using the Pelican Soxhlet apparatus.

Moisture Content: The Moisture Content was determined using Hot Air Oven.

Sensory Quality : The Batatawada's were evaluated for sensory quality by using the Hedonic method. Attributes like texture, flavour, taste, colour and overall acceptability were evaluated by a semi trained panel of 7 judges on 9 point Hedonic scale (1- extremely dislike, 9- extremely like).

Texture analysis : Texture Profile Analysis is a popular double compression test for determining the textural properties of foods. It is occasionally used in other industries, such as pharmaceuticals, gels, and personal care. During a TPA test samples are compressed twice using a texture analyzer to provide insight into how samples behave when chewed. The TPA test was often called the "two bite test" because the texture analyzer mimics the mouth's biting action.

VI. RESULT AND DISCUSSION

Moisture loss and oil uptake

The data on moisture and oil contents of BatataWada revealed that the product when it was formulated with 0.5%, 1.0% and 1.5% CMC, HPMC, MC shows variation in moisture and oil uptake. It is known that the hydrocolloids forms a film on the product and decrease the tendency of the product to absorb the oil and loose moisture. The oil content of batatawada decreased considerably with addition of hydrocolloids, irrespective of the type of hydrocolloids as compared to control. One of the most important properties of hydrocolloids is their ability to form films and sheets and act as a very effective barrier to oil and therefore used in number of food applications including adhesion, film forming. The film forming characteristics of these hydrocolloids have prevented the absorption of oil and at the same time helped to retain the natural moisture of foods. This could be the reason of using these hydrocolloids in deep frying of fried products [Ang, 1993; Koelsch and Labuza, 1992; Mallikarjunan*et al*., 1997; Williams and Mittal, 1999; Sakhale*et al.*, 2011].

Table No.2: Effect of levels of HPMC on oil uptake of Batatawada:

Hydrocolloids	Levels of Addition (%)	Moisture Content (%)	Oil Content (%)	% Reduction in oil uptake
Control		40.11	27.20	
HPMC	0.5	35.45	18.23	32.97
HPMC	1.0	34.11	14.51	46.65
HPMC	1.5	37.34	13.02	52.13

1) The addition of HPMC in Batata Wada was varied form 0.5, 1.0 and 1.5% and corresponding oil uptake was observed and is reported in Table No.2. From the values we see that the moisture content (37.34%) was highest on the addition of 1.5% HPMC followed by 0.5% and then 1.0%. Also, the oil content during 1.5% HPMC was the least as compared to control (13.02%), 0.5% and 1.0% HPMC.

From the observations we conclude that the best results were found during the addition of 1.5% HPMC in the Batata Wada with the reduction in oil uptake up to 52.13%.

Table no.3: Effect of levels of CMC on oil uptake of Batata wada.

Hydrocolloids	Levels of Addition (%)	Moisture Content (%)	Oil Content (%)	% Reduction in oil uptake
Control		40.11	27.20	
CMC	0.5	36.46	25.43	6.50
CMC	1.0	38.81	24.32	10.58
CMC	1.5	38.83	22.38	17.72

2) The addition of **CMC** in Batata Wada was varied form 0.5, 1.0 and 1.5% and corresponding oil uptake was observed and is reported in Table No.3. From the values we see that the moisture content (38.83%) was highest on the addition of 1.5% CMC followed by 0.5% and then 1.0%. Also, the oil content during 1.5% CMC was the least as compared to control (22.38%), 0.5% and 1.0% CMC.

From the observations we conclude that the best results were found during the addition of 1.5% CMC in the Batata Wada with the reduction in oil uptake up to 17.72%.

Table No.4: Effect of levels of methyl cellulose on oil uptake of Batata Wada.

Hydrocolloids	**Levels of Addition (%)**	**Moisture Content (%)**	**Oil Content (%)**	**% Reduction in oil uptake**
Control		40.11	27.20	
Methyl cellulose	0.5	32.01	15.95	41.36
Methyl cellulose	1.0	36.58	10.81	60.25
Methyl cellulose	1.5	36.11	11.72	56.91

3) The addition of **Methyl cellulose** in Batata Wada was varied form 0.5, 1.0 and 1.5% and corresponding oil uptake was observed and is reported in Table No.4. From the values we see that the moisture content (36.58%) was highest on the addition of 1% methyl cellulose followed by 0.5% and then 1.5%. Also, the oil content during 1% methyl cellulose was the least as compared to control (10.81%), 0.5% and 1.5% methyl cellulose.

From the observations we conclude that the best results were found during the addition of 1% methyl cellulose in the Batata Wada with the reduction in oil uptake up to 60.25%.

VII. TEXTURE PROFILE ANALYSIS

Texture Profile Analysis is a popular double compression test for determining the textural properties of foods. During TPA test samples are compressed twice using texture analyser to provide insight into how samples behave when chewed. The TPA test often called the "two bite test" because the texture analyser mimics the mouth's biting action.

Texture is a major factor in determining consumer acceptability of Batatawada. Texture can be defined as the sensory manifestation of the structure of the food and the manner in which this structure reacts to the applied forces, the specific senses involved being vision and hearing. To put it more simply, it is how the food feels in the mouth on manipulation and mastication, and how it handles during transport, preparation and on the plate. [Tameshia Ballard, Application of Edible Coatings in Maintaining Crispness of Breaded Fried Foods, 2003].

The textural identity of any food is rarely a simple matter of understanding a singular attribute such as hardness or stickiness. The texture of any food is multifaceted and tied to consumer's sensory expectations. It is not sufficient to deliver a food with a target hardness and springiness value if consumers do not like it and does not meet their expectation for that food type.

A sample was tested using instrument "TA-XT Plus by Stable Micro System" using P/6 cylindrical probe. Each time sample was placed below the probe and test was run, firstly it penetrates the sample and it comes back. On the screen, peak force that occurs during the first compression gives the "Hardness" and negative value on the graph gives "Stickiness". All the values are in "gm force", is given in Table No. 5.

Table No. 5: Hardness and Stickiness values of Batata Wada:-

Hydrocolloids	Concentration %	Hardness (gm)	Stickiness (gm)
Control		193.719	-6.891
CMC	0.5	261.071	-2.89
CMC	1.0	330.756	-20.672
CMC	1.5	140.149	-3.557
MC	0.5	132.036	-3.557
MC	1.0	332.312	-2.445
MC	1.5	258.07	-5.779
HPMC	0.5	197.387	-2.89
HPMC	1.0	201.054	-3.112
HPMC	1.5	175.381	-3.223

Sensory quality of Batata Wada: -

The sensory quality is an important aspect in considering the overall acceptability of food product. Deep fat frying is widely used in industrial preparation of foods, because consumers prefer the taste, appearance and texture of fried food products [Saguy and Pinthus, 1994]. The batatawada prepared by addition of various hydrocolloids in varied levels were subjected to sensory evaluation for various quality parameters like colour, flavour, taste, texture and overall acceptability by semi trained panel using nine point hedonic scale. The sensory scores obtained with respect to various quality attributes were statistically analysed and presented in Table No.6. The results on sensory quality of Batata Wada with different hydrocolloids showed that coating with MC at 1% level was found superior in quality with respect to overall acceptability as compared to all other hydrocolloids.

Table No.6 :- Sensory evaluation of Batata Wada

Hydrocolloids	Concentration	Texture	Flavor	Taste	Colour	Overall acceptability
Control		8	7	8	8	8
CMC	0.5	8	7	7.5	7.2	7.5
CMC	1.0	7.6	7	7.3	7.6	7.8
CMC	1.5	7.6	7.5	8	7	7.6
MC	0.5	7	6.7	7.9	7	7.8
MC	1.0	8	7.5	8.5	8	8.5
MC	1.5	8	8	8	7	8
HPMC	0.5	7.5	6.8	6.9	7	7.4
HPMC	1.0	7.5	7.8	8	7	7.6
HPMC	1.5	7.8	7	8	8	7.3

VIII. CONCLUSION

Among all the hydrocolloids studied at different levels for preparation of Batata Wada, it can be concluded that Batata Wada formulated with 1.0% MC were found statistically significant over all other hydrocolloids in oil uptake with optimum sensory quality characteristics. It becomes quiet stable at level of 1.0% formulation in remaining hydrocolloids i.e. CMC, HPMC. Thus, Batata Wada with low fat and low calorie content with better acceptance can be prepared in order to meet the demand of low fatty foods of health cautious consumers.

In Texture analysis profile, hardness and stickiness values found out at the level of formulation of 1.0% of MC, CMC, HPMC is quiet stable as compared to other level of formulation

REFERENCES

[1]. AachalPurwar,*Department of Chemical Technology, SGBAU Amravati*, American Journal of Engineering Research (AJER) Volume-04, Issue-02, pp-27-32,Optimization of Hydrocolloids Concentration on Fat Reduction in French Fries

[2]. Ang, J. F. 1993. Reduction of fat in fried batter coatings with powdered cellulose. Journal of the American Oil Chemists' Society 70: 619-622

[3]. Calorie control council, Atlanta, 2015, fat replacers

[4]. Claudia Felicia Ognean, C.F. Ognean, et all. Journal of Agro alimentary Processes and Technologies, Volume XII, No. 2 (2006)

[5]. Deep Narayan Yadav, Fibres as an additive for oil reduction in deep fat fried poori, Association of Food Scientists & Technologists (India) 2011

[6]. JittraSingthong, Using hydrocolloids to decrease oil absorption in banana chips, Department of Agro-Industry, Faculty of Agriculture, UbonRatchathani University, 85 Sathonmark Road, Warinchamrap, UbonRatchathani 34190, Thailand

[7]. Koelsch, C. Labuza 1992. Edible water vapour barriers: properties and promise. Trends in Food Science and Technology 5: 76-81

[8]. Mallikarjunan, P., Chinnan, M.S. and Balsubramanium, V.M. 1997. Edible coatings for deep fat frying of starchy products. Journal of Food Science and Technology 30: 709 -714

[9]. Manish Kumar, Division of Livestock Products Technology, Indian Veterinary Research Institute- Izatnagar, India, Evaluation of Sodium Alignate as a Fat Replacer on Processing and Shelf-life of Low-fat Ground Pork Patties, April 2007

[10]. PunchiraVongsawasdi, Using modified starch to decrease the oil absorption in fried battered chicken, As. J. Food Ag-Ind. 2008, 1(03), 174-183 Asian Journal of Food and Agro-Industry

[11]. R.Mongha, 2013, B.Tech, Chemical Technology Thesis, SGBAU Amravati

[12]. Saguy, I.S. and Pinthus, E.J. 1994. Oil uptake during deep fat frying: Factors and Mechanisms. Food Technology 49 (4): 142-145,152.

[13]. Sakhale, B. K., Badgujar, J. B., Pawar, V. D. and Sananse S. L. 2011.Effect of hydrocolloids incorporation in casing of samosa on reduction of oil uptake. Journal of Food Science and Technology (Online) DOI: 10.1007/s13197-011-0333-0

[14]. Sakhale, B. K., Effect of blanching and coating with hydrocolloids on reduction of oil uptake in French fries, Department of Chemical Technology, Dr.BabasahebAmbedkarMarathwada University, Aurangabad, Maharashtra, India

[15]. Sandra Bastin, Fat replacers, 1993, cooperative extension service, university of Kentucky

[16]. Tameshia Ballard, Application of Edible Coatings in Maintaining Crispness of Breaded Fried Foods, 2003

[17]. Williams, R. and Mittal, G. S. 1999. Low fat fried foods with edible coatings: modelling and simulation. Journal of Food Science 64: 317-322.