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Study on Traditional Technology of Nepalese Fried Snack Woh

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Woh is a deep oil fried spongy Nepalese indigenous product. This work was done to find out the basics of woh and to prepare best from different formulations using unlike particle size and different frying media. Green gram and black gram in a ratio of 100:0, 50:50, 60:40, and 70:30 were mixed and ground on stone grinder and mixer grinder for different particle sizes. Batter mixed with spices were whipped and deep fried in mustard, soybean and sunflower oil separately at 204 ± 2ºC for 2.5 ± 0.5 minutes. Woh with 60:40 combination having 103 µm particle size fried in soybean oil was found to be nutritious with less oil uptake and less anti nutritional factors.

Keywords: *Woh,* deep fried, sensory evaluation, anti-nutritional factor

Introduction

Nepal being a country of ethnical, cultural and religious diversity various kind of traditional foods can be found in Nepal inherited by their ancestors (Subba and Katawal, 2013). *Woh* (*Bara* in Nepali) is a traditional Nepalese product made by the people of *Newar* community. It can be prepared from different types of legumes like green gram, black gram, field pea, and lentil. Generally, it is prepared from black gram and green gram. It is made in ring or doughnut shape which is deep fried. It is prepared during special occasions like *Sitinakha*, *Dashain*, *Tihar,* etc (Shrestha and Rao, 2007).

Deep fried snacks are sold as ready-to-eat food and are especially prized for their sensory appeal despite of their high fat and calorie contents. In general, people from different cultures prefer deep fried snacks for their crunchy texture and delicious flavor. The process of frying comparatively is easier and needs a shorter cooking time due to a very high oil temperature. The high temperatures of the frying oil lead to the evaporation of water at the surface of the food. Due to evaporation, water in the external layers of the product moves to the surrounding oil and surface.

The work was done to find out essentials of traditional fried food of Newari community of Nepal and to find out best formulation among various formulations using unlike particle size and different frying media.

Materials and Methods

A survey was conducted among one hundred people in *Newar* community of Kathmandu (45), Kirtipur (15), Lalitpur (15) and Bhaktapur (25) with a set of questionnaire to find out appropriate formulation and methods practiced for *Woh* preparation.

Table 1. Recipe formulation

Formulation	Green gram : Black gram
A	100 : 0
B	50 : 50
C	60 : 40
D	70 : 30

The ingredients were purchased from a local market of Kathmandu. All the formulations were soaked for 12 hours in distilled water at room temperature (23 ± 2ºC). Seed coats were removed by manual dehulling. The dehulled pulses were ground using stone grinder and mixer grinder for 15 minutes and 1.24 minute respectively. Spices as presented in Table 2 were added in batter and mixed properly. Whipping was done manually by aerating batter in up and down motion with addition of 9 mL water. The consistency of batter was checked by dropping small ball of batter into glass of water. The correct consistency was achieved, when that small ball of batter started to float on water. The batter was made into ring shape and deep fried at 204±1ºC for 2±0.5 minutes using mustard oil, soybean oil and sunflower oil.

Table 2. Spices and their proportion

Ingredients	Amount (g/100g soaked pulses)
Cumin	0.5
Salt	1.0
Chilly powder	0.3
Hing	0.05
Ginger paste	0.45

Sensory evaluation of *Woh* was carried out by using 9 point hedonic scales. Before evaluation, ten panelists (teachers and students of National College of Food Science and Technology, Kathmandu, Nepal who were familiar with the product) were instructed to give maximum scores for the product they like most.

Particle size analysis of wet ground batter was carried out as per Sharma *et al.,* (2008) and Solanki *et al.,* (2005) taking 1000 mL batter to successive sieving from large to small sieves (50-100–150–200-250 mesh sieves). The moisture content (hot air oven method), crude protein (Macro Kjeldahl method) and crude fat (Soxhlet extraction method) were determined as described by Ranganna (2005). The crude fiber content was determined by the acid and alkali hydrolysis method as per AOAC (2005). Total ash was determined as per Ranganna (2005). Total carbohydrate was obtained by difference method. The oil uptake capacity was determined by Soxhlet extraction apparatus using petroleum ether following the method described by Ranganna (2005) for all frying mediums. Oxalic acid content was determined as per Patil and Gaikwad (1968). Tannin content was determined as per Ranganna (2005). Phytic acid was determined by the method described by Sadasivam and Manickam (2008).

All the triplicate data obtained in this study were analyzed by Microsoft Excel 2003 and Genstat Discovery Version 4 (Lawes Agricultural Trust (1995).

Results and Discussion

Results of survey

From the survey, it was found that green gram (*moong*), black gram (*mash*), lentil (*musur*) and field pea (*Sano kerou*) were the most preferred ingredients by Newar community to make *woh*. As shown in Figure 1, among 100 people 46%, 33%, 11% and 10% preferred green gram, black gram, field pea and red gram for preparing *woh*. As majority of people prefer to make w*oh* from green gram and black gram, *woh* was prepared from these pulses during experiment. It was found that 100% people used cold water for soaking. From Figure 2, 36 used tap water, 35 people used tube-well water, 22 used deep boring water and 7 used purified water. The spices generally used were cumin, ginger, *hing*, chilli powder and salt. The spices can be used according to taste.

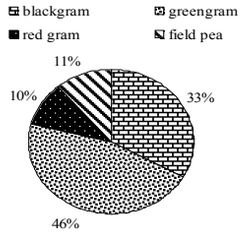

Figure 1. Use of different pulses

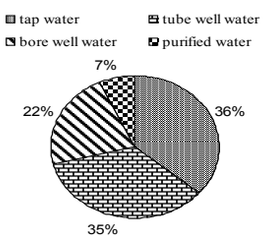

Figure 2. Water used for soaking of pulses

As seen in Figure 3, the removal of seed coat was practiced in different manner. Out of 100, 45 removed seed coat completely during dehulling while only 20 removed about half and 35 removed little only. Traditionally, stone grinder was firstly used for wet grinding. Subsequently, home scale table top wet grinder was introduced into the market. Further improvement in the mechanical wet grinder led to the development of mixer grinder. Among hundred respondents, 38 use stone grinder, 51 use mixer grinder and 11 use table top wet grinder as shown in Figure 4.

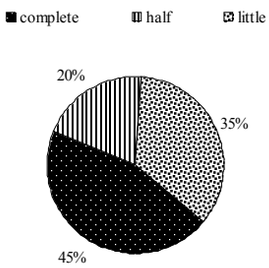

Figure 3. Removal of seed coat during dehulling

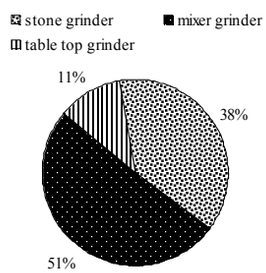

Figure 4. Use of different grinders

From the survey it was found that, 28% used mustard oil, 32% used sunflower oil and 40% used soybean oil as shown in Figure 5.

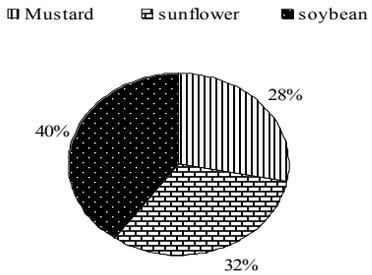

Figure 5. Use of different frying mediums

Woh was consumed by 65% people during festivals, 13% frequently, 12% sometimes and 10% respondents fail to response about consumption frequency. *Woh* can be eaten differently and if taken with meat gravy was liked by the majority people as presented in Figure 7.

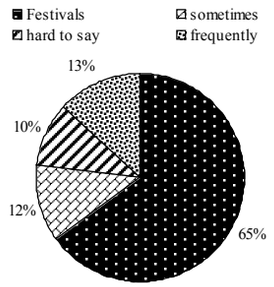

Figure 6. Consumption pattern of "woh"

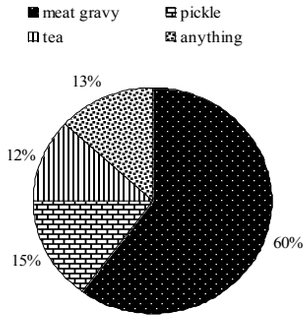

Figure 7. Food taken with "Woh"

Particle size analysis

The average particle size was obtained as 94 µm and 103 µm for mixer grinder and stone grinder as shown in Table 3. Flow of batter in the grinding systems affects the effective exposure of particles to the grinding zone and thereby the duration of grinding. Finer particle in stone grinder can be attributed to duration of grinding (Sharma *et al.,* 2008).

Table 3. Particle size analysis

Sample description	Sieve analysis	
	Particle size(µm)	Weight fraction(%)
Wet grinding		
Mixer grinder	>225	10.1
	150-225	-
	100-150	7.7
	75-100	-
	<75	79.9
	94 (average)	
Stone grinder	>225	7.4
	150-225	6.6
	100-150	4.3
	75-100	53.8
	<75	26.3
	103 (average)	

Table 4. Sensory scores of product

Variation	Sample	Quality Attributes			
		Colour	Texture	Taste	Overall acceptance
Formulation	A	7.6 ± 1.07 [a]	7.5 ± 0.70 [a]	7.6 ± 0.96 [b]	7.4 ± 1.26 [a]
	B	6.4 ± 0.69 [a]	6.3 ± 1.25 [c]	6.7 ± 0.67 [c]	6.6 ± 1.07 [c]
	C	7.8 ± 0.91 [a]	8.2 ± 0.63 [b]	8.3 ± 0.48 [a]	7.7 ± 0.82 [b]
	D	7.2 ± 1.13 [a]	6.5 ± 1.17 [c]	6.9 ± 1.10 [c]	6.9 ± 0.56 [d]
	A*	6.1 ± 0.73 [a]	6.3± 0.48 [b]	6.4 ± 0.96 [b]	6.7 ± 0.82 [b]
	B*	6.6 ± 0.96 [a]	5.5 ± 1.08 [a]	6.1 ± 0.87 [a]	6.4 ± 0.84 [a]
	C*	7.8 ± 0.91 [a]	6.9 ± 0.87 [c]	6.9 ± 0.99 [d]	7.1 ± 1.10 [c]
	D*	6.8 ± 1.13 [a]	6.6 ± 0.51 [c]	6.7 ± 0.94 [c]	6.7 ± 0.94 [a]
Particle size	M	7.9 ± 0.85 [a]	7.12 ± 0.78 [a]	7.38 ± 0.78 [a]	7.15 ± 0.78 [a]
	N	7.7 ± 0.84 [a]	6.32 ± 0.62 [b]	6.53 ± 0.84 [b]	6.72 ± 0.69 [b]
Frying medium	R	7.1 ± 0.87 [a]	6.8 ± 1.13 [a]	7.1 ± 0.99 [a]	6.5 ± 0.84 [a]
	S	7.1 ± 0.87 [a]	8.0 ± 0.81 [b]	7.3 ± 0.97 [a]	7.2 ± 0.86 [a]
	T	6.9 ± 0.85 [a]	6.4 ± 0.96 [c]	6.9 ± 0.96 [a]	6.0 ± 0.83 [a]

Quality evaluation of "Woh"

Formulation C got the highest mean sensory score for color, texture, taste and overall acceptance. From analysis of variance, color was not significantly different ($p \geq 0.05$) whereas texture, taste and overall acceptance were significantly different ($p \leq 0.05$). This may be due to different ratio of green gram and black gram used during formulation. Similarly, formulation C ground on stone grinder having average particle size 103µm scored highest for mean sensory score. Color was found not significantly different ($p \geq 0.05$) whereas texture, taste and overall acceptance were found significantly different ($p \leq 0.05$). The reason behind this may be due to different particle size affecting the texture and taste of the product. In the same way, formulation C having average particle size 103µm deep fried on soybean oil indicated higher mean sensory score. From analysis of variance, color, taste and overall acceptance were found not significantly different ($p \geq 0.05$) whereas texture was found to be significantly different ($p \leq 0.05$). Similarly, Subba and Katawal (2013) reported very fine particle size (<120 µ) *Sel-roti* made from rice flour becomes leathery in texture after cooling.

Ground on *silauta* (A: 100% green gram, B: 50% green gram + 50% black gram, C: 60% green gram + 40% black gram, D: 70%green gram + 30% black gram).
Ground on mixer grinder (A*: 100% green gram, B*: 50% green gram + 50% black gram, C*: 60% green gram + 40% black gram, D*: 70%green gram + 30% black gram).
M: (60% green gram + 40% black gram) ground on silauta
N: (60% green gram + 40% black gram) ground on mixer grinder
R: (60% green gram + 40% black gram) ground on silauta fried on mustard oil
S: (60% green gram + 40% black gram) ground on silauta fried on soyabean oil
T: (60% green gram + 40% black gram) ground on silauta fried on sunflower oil
Values represent mean ± standard deviation of sensory responses of 10 panelists. Mean in the same column with same superscript are non significantly different ($p > 0.05$).

Thus, from sensory evaluation *Woh* made from formulation C which was ground on stone grinder having particle size 103 µm and fried on soybean oil was found to be the best formulation (Sample S).

Proximate composition of woh

Table 5. Proximate composition of Woh

Parameters	% (wb)
Moisture	55.37 ± 0.18
Protein	2.9 ± 0.1
Carbohydrate	21.11 ± 0.45
Fat	16.53 ± 0.35
Fiber	1.87 ± 0.11
Ash	2.22 ± 0.11

Values are mean ± standard deviation

The result shown in Table 5 is in close agreement with *medhu vada* (an Indian traditional deep fried product) having protein 2.8g, fat 15g, moisture 60% and carbohydrate 15g respectively (Solanki, 2003). The proximate composition of another product *Akara* (West African deep fried food prepared from cowpea paste) is moisture 49.4%, fat 18.81% , ash 5.75% and carbohydrate 56.19% respectively (Plahar, 2004).

Oil uptake capacity

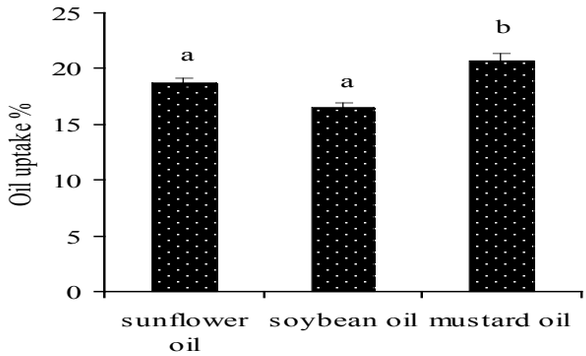

Figure 8. Variation of oil uptake of "Woh" using different frying oil

Woh was fried using different frying medium: sunflower oil, soybean oil and mustard oil. The oil uptake was found to be 18.73%, 16.53% and 20.76% w. b. (Figure 8) for frying medium sunflower oil, soybean oil and mustard oil, respectively. Similar findings were found by various authors as well. *Sel-roti* deep fried Nepalese snack made from finer rice particles absorb more oil (Subba and Katawal, 2013). Thick and battered products are shown to have oil content of around 15-20% w.b. (Monoj, 2005). The oil is absorbed into the voids formed due to changes in the cellular structure of the food product and water evaporation during frying (Moreira *et al.,* 1997). As long as steam is generated, it prevents the oil from filling the voids due to pressure gradient. Upon cooling, internal vapor pressure decreases due to condensation results in

Table 6. Changes in anti-nutritional factors

Samples	Anti- nutritional factors*		
	Tannin g/100g	Oxalate g/100g	Phytic acid (mg/100g)
Fresh	0.60±0.0007 [a]	0.0085±0.0004[a]	882.20 ±4.91[a]
12 hr Soaked	0.58 ±0.0060 [a]	0.0075±0.0005[b]	695.55±5.93[b]
Fried	0.50±0.0001 [b]	0.0060 ±0.0001[c]	608.25 ±2.61[c]

*Mean ± standard deviation in the same column with same superscript are not significantly different (p>0.05).

oil on crust drawn into the product (Saguy *et al.,* 1998).

Changes in anti-nutritional factors

Anti-nutrients (tannin, oxalate and phytic acid) were analysed from raw, soaked pulses and deep fried product. As shown in the Table 6, tannin, oxalate and phytic acid content of raw, soaked pulses and deep fried product was found to be significantly different ($p \leq 0.05$). Highest amount of tannin was present in unprocessed (control) seeds which significantly decreased with subsequent soaking, dehulling, and deep frying process. Due to their predominance in seed coats and being water soluble consequently, leach into the liquid medium (Kumar, 1992). This decrease could also be related to the fact that these compounds are heat labile and degrade upon heat treatment.

Phytate being water-soluble, a considerable amount is removed into the water during soaking. In addition, this process also enhances the action of naturally occurring phytase in legumes (Kumar, 1992).

Conclusions

The traditional information regarding ingredients, recipe, method of preparation, equipments and quality characteristics of were documented. *Woh* prepared from green and black gram were preferred by consumers. Anti-nutritional factors (tannin, oxalate and phytic acid) in raw pulse decreased with subsequent treatments soaking, dehulling and deep frying. The oil uptake was the lowest in *Woh* fried on soybean oil.

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