Muffins and cookies produced from chickpea Flour

Ines C. Gonzales, Hilda L. Quindara, Fernando R. Gonzales and Esther T. Botangen

Abstract
Chickpea (Cicer arietanum L.) is a newly introduced crop in the Philippines particularly in Benguet. It is a cool season crop and initial results showed that higher yield was obtained under Benguet conditions which ranged from 800-1,200 kg/ha. It has high protein content and dietary fiber. Pre-treatment techniques for grits production has been identified to improve the acceptability of chickpea substituted muffins and cookies. Fermenting chickpea seeds in solution with lactic acid bacteria and boiling chickpea seeds for 10 minutes reduced beany flavor of chickpea grits. Likewise, grits from fermented chickpea seeds had smooth, elastic, fine and soft dough characteristics for the production of cookies and muffins. Chickpea grits were substituted at 40% for cookies. Acceptable substitution rate for muffins is 30%. Nutri- tionally, the substituted products contain considerable amount of energy, protein and carbohydrate.

Keywords: aerobic count, grits, lactic acid bacteria, milling steam, roasted

1 INTRODUCTION
Chickpea is a good source of minerals, protein and trace elements. Legumes contain almost 2 times more protein and minerals and 3 times more in dietary fiber than wheat flour (Satth e et al., 1984). Legume proteins are rich in lysine which is an important essential amino acid limited in cereal grains (Muller, 1985). Its anti-nutritional factor is the lowest of all legumes. At present, the supply of chickpea depends mainly on importation from India, Pa- kistan, Iran, Mexico, Australia and Canada. To help reduce importation, Chickpea production is being introduced in the Philippines. Initial results shows that the yield potential of 800 – 1,200 kg/ha is higher than the average global production of 700 – 800 kg/ha. Such findings imply that chickpea can be grown under Philippine conditions which can serve as an alternative high value crop for farmers. In a technological feasibility of incorporating legume flours (35 %) for pasta making, mutu et al. (2004) showed that legume flours contains high levels of fiber, vitamin B1, magnesium, phosphorous, protein, good balance of essential amino acids. Its glyce- amic index is also lower than that of durum wheat dough. Lowered glycemic in- dexes as a result adding legume flour is a positive characteristic of a wheat-legume food product.

Utilization of the crop is limited to “igado”, kaldereta” and halo-halo. Prod- uct development aims to explore alternative utilization techniques for the crop thereby increasing its product line in the market. Product development can pro- mote production, utilization, and marketing of the crop. This project can help enhance alternative livelihood options to farming households, reduce dollar drain and provide alternative nutritious and health pro- moting food products in the market.

2 General Objectives:
Develop suitable processing techniques for chickpea processed snack food products
Specifics:
1. Identify processing techniques to improve the functional properties and quality of chickpea substituted food products;
2. Develop organoleptically acceptable chickpea-wheat muffins and cookies
3. Evaluate nutritional content and microbial quality of chickpea grits substitut- ed muffin and cookies.

3 Review of Literature
3.1 Nutritional value and health benefits obtain from chickpea
Chickpea is an Asiatic herb cultivated for its short pod with one or two edible seeds. It is the most important food legume grown globally. It is valued for its nutritional seeds because of its high protein (25.3-28.9%), total carbohydrates (64%), and dietary fiber (19%). It also contains considerable amounts of phosphorous, calcium, magnesium, copper and zinc. It is low in fat and most of the fat content is the poly- unsaturated type.

The concentration of unavailable carbohydrate in chickpea is the highest among unsaturated type. Legume starches are slowly digested (Mwangwela&Minnaar, 2001, Micard (2004) reported that incorporating 35% of legume flour in pasta had improved the nutri- tional content and decreased the glyceamic index of starch.

Several methods are applied for legume flour production. To reduce beany flavor of cowpea flour, preliminary steaming is recommended prior dry roasting and milling (Phillips, 2003, Sales 1987). On the other hand, spraying and toasting seeds of cowpea prior to milling helped reduce beany flavor and help modify the functional quality of cowpea flour so that it could be used in the production of ready-to- eat products (Hallen, et, al, 2004). Soaking seeds of cowpea in acidified water solution flowed by blanching reduced beany flavor and produced highly acceptable loaf volume at 10 % substitution (Okakale, Potter, 2001).

The use of cowpea flour made from non-decorcticated (non-removal of seed coat) produced bread which was similar in quality to all wheat flour. However, increasing the level of substitution to 15 – 20 % produced breads with noticeable black specks, with beany flavor and compact texture (Mustafa, 1990). Dehulling consists of two steps: removal of seed coat and splitting of cotyledons. In India soaking in water for 2 – 14 hours followed by sun drying is a common practice before dehulling. Pre-heating seeds at a higher temperature also help loosen seed coat and increase dhal yield (Knoth, 2000).

Adaptability trials have shown that the Philippines can produce the Desi type chickpea which is well suited for processing into soups and breads. The crop has a wide range of adaptability from lowland to mid-lowland elevations and can grow better under drought conditions. Hence, an excellent alternative crop during drought conditions.

Preliminary studies indicated that chickpea grits can be utilized into puto and cook- ies (BSU -PCIEERD, 2009). However, sensory results showed that the product ac- ceptability is moderate to low because of the perceived beany flavor, hard and compact structure of the products.

To enhance the acceptability of chickpea substituted food products, there’s a need to improve the qualities (functional and flavor) of chickpea grits. Legumes contain unsaturated lipids that are susceptible to oxidation deterioration. Enzymatic and non-enzymatic deterioration of these lipids results in development of off-flavors. There are several techniques recommended and / or employed to in- hibit formation of off-flavor and improve the functional properties of legume flours. These methods include germination, fermentation, acidification, blanching in hot water, steaming and roasting.

Aside from inhibiting off-flavor formation, processing methods influences nutri- tional and functional properties of legume flours. Germination improves amino acid availability, increase availability of vitamins, decrease concentration of phytic acid and trypsin inhibitors (David & Verna, 1981). Fermentation solubilizes protein, in- activate anti-nutritional factors and improve the availability of water-soluble vitamins. Hence, processing treatments for chickpea grits production need to be standardized to improve the flavor, functional properties and nutritive value of chick pea grits.

4 Methodology
4.1 Product development of chickpea grits into muffins and cookies
Chickpea grits that exhibit acceptable qualities (less or no beany flavor) was devel- oped into muffins and cookies. Using a recipe for muffins, wheat flour was substi- tuted from 0, 10, 20, and 30 %.

Optimum formulation was identified based on results of sensory evaluation. Senso- ry evaluation was based on color, appearance, texture, lightness, tenderness, flavor and general acceptability. There were forty (40) panelists.

A very desirable muffin has the following characteristics: golden brown and sym- metrical exterior; rounded top with puffed surface; creamy white; slightly moist interior; fairly uniform cells and moderately thin cell walls. These desirable charac- teristics were used in formulating the score cards for muffins. For cookies, sensory evaluation were based on the appearance, volume, texture and flavor and general acceptability using hedonic 1 to 9 rating scale (1-dislike extreme- ly, 9-likes extremely).

Sensory data were analyzed using the analysis of variance. DMRT was used to lo- cate the significant differences among means of the different chickpea-wheat com- binations.

4.2 Nutritional content of chickpea based food products
Based on results of sensory evaluation, a potential processing technique or formula- tion was established. The chickpea substituted product was submitted to FNSRI- DCST for proximate analysis.

5 Results and Discussions
5.1 Evaluation of pre-processing techniques to improve quality of chick- pea
Milling and Grits Characteristics
Chickpea seeds soaked in lactic acid fermented milk (yakult or yogurt) had soft and easy milling characteristics. Grits that had smooth texture and good handling characteristics. Good dough handling characteristics can be attributed
to the finer and soft testural characteristics of grits. Soaked-oven dried seeds had moderate milling and the dough had soft and sticky handling characteristics. Soaking seeds did not reduce the beany flavor of grits. Roasted seeds were hard to roll and the resulting grits had moderate beany odor. Grits which were steamed followed by roasting had smooth and elastic dough handling characteristics while grits from seeds that were boiled then roasted had soft and sticky dough characteristics. Pre-sprouted seeds had moderate milling characteristics and beany odor but the dough tends to be dry and inclined to be lumpy. Hence, not suited for preparing breads.

Table 1. The milling and dough characteristics of chickpea grits

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Milling</th>
<th>Beany odor</th>
<th>Dough Handling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-sprouted</td>
<td>Moderate</td>
<td>Dry, hard and inclined to be lumpy</td>
<td></td>
</tr>
<tr>
<td>Seaked-dried</td>
<td>Moderate</td>
<td>Soft and sticky</td>
<td></td>
</tr>
<tr>
<td>Steam toasted</td>
<td>Hard</td>
<td>Smooth and elastic</td>
<td></td>
</tr>
<tr>
<td>Boiled toasted</td>
<td>Hard</td>
<td>Soft and sticky</td>
<td></td>
</tr>
<tr>
<td>Fermented (lactic acid)</td>
<td>Soft and easy</td>
<td>Smooth and elastic</td>
<td></td>
</tr>
</tbody>
</table>

5.2 Influence of the different pre-treatment techniques on the sensory characteristics of wheat-chickpea cookies (40 % substitution rate)

Cookies made from grits which were soaked then oven-dried had the lowest acceptability rating of 1.8 (unacceptable ~ poor) which can be attributed to the beany flavor of the product. Highest acceptability rating of 4.5 (like a lot ~ dislike a lot) was obtained from grits fermented by lactic acid which were pre-sprouted and steam-toasted prior to milling had poor texture (more resistance when bitten). Grits processed by boiling then toasting and fermenting in lactic acid gave better texture (little resistance to bite).

The different pre-treatment techniques did not influence significantly the appearance of cookies. However, the highest rating for appearance was gathered from fermented grits (4.5) closely followed by boiled and toasted grits.

5.3 Influence of the different pre-treatment techniques on the sensory qualities and acceptability of wheat – chickpea muffins

Significant differences among treatments were observed (Fig 2 e3). The acceptability rating (3.7) however is quite low at 40% substitution rate. To improve the quality and acceptability of chickpea muffins, the substitution rate was lowered from 40 to 30%.

At 30 % substitution rate there was an improvement in the acceptability rating.

Results showed that muffins from grits on fermented lactic acid had the highest acceptability rating which is comparable with those from boiled then roasted. Muffins from this treatment had moderately thin cell walls with fairly uniform cells.

![Fig. 1. Sensory characteristics of cookies substituted with pre-treated chickpea grits](image)

![Fig. 2. The influence of the different pre-treatment techniques on the sensory qualities and acceptability of wheat-chickpea muffins (40%)](image)

6 Summary and Conclusion

Beany flavor of legumes is one of the factors that influence the quality as well as acceptability of legume products. To reduce beany flavor of grits, several pre-treatment techniques and its influence on the functional properties and nutritional quality has been evaluated.

The pre-treatment techniques had significantly influenced the beany flavor of chickpea grits. Soaking followed by oven drying was not effective in reducing the beany odor of grits. Pre-sprouting, boiling, toasting and fermenting in lactic acid bacteria were more effective in reducing the beany characteristics of chickpea grits. Fermenting chickpea seeds prior to milling produced the most acceptable cookies quality and acceptability of wheat-chickpea muffins (30 %).
and muffins. Acceptable muffins are prepared from 30% level of substitution. Chickpea substituted cookies and muffins are nutri-packed safe products. A 60g pack of cookies contains 300cal, 39g carbohydrate, 5g protein and 140g sodium. On the other hand, a 36g muffin contains 125-135 calories, 15g carbohydrate, 3g protein and 72–77g sodium.

7 Recommendation
To reduce beany odor characteristics of chickpea grits pre-treatment of chick pea seeds in lactic acid bacteria fermentation and boiled, toasted is recom-mended. Chickpea grits with 30-40% substitution of wheat flour for cookies and muffins is recommended for a nutritious safe product.

8 References

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