Impact of pretreatment of garden cress seed on rheological properties for bread dough

ABSTRACT

The rheological properties of bread dough made with various ratios ofgarden cress seed (GCS) and refined wheat flour were investigated. The Brabender Farinograph E, Extensograph E and Amylograph E were used to determine rheological properties such as water absorption, development time, extensibility, proving time, tolerance index, and gelatinization.Refined wheat flour proportion was kept constant, whereas that of GCS had prior treatment of germinated ($_G$), grounded/untreated ($_U$), and roasted ($_R$) by 2%, 4%, and 6%, respectively. The values for water absorption (500 B.U.) ranged from 66.4% to 71.6%, whereas the values for water absorption (14.0%) ranged from 63.3% to 70.7%. The development times for the flour blend formulations ranged from 5.2 to 6.5 min for samples T_0, T_{10G} to T_{18R}. The tolerance index improved from sample T_0, T_{10G} to T_{18R} with the inclusion ofGCS flour, i.e. from 73 to 113 BU. Extensograph values were taken at curves corresponding to proving periods of 30, 60, and 90 minutes. The energy area declined and the extension resistance increased as the proving time increased. All of the sample ratio values were between 1.5 and 5.The dough obtained from mixes of roasted GCS and untreated i.e. powered GCS with refined wheat flour enhanced the amylographic parameters of the amylogram peak maximum, temperature, and gel viscosity. T16R attained the highest point at 59.5ºC, followed by T15U6, T14U4, and T13U2 at 58.4, 57.1, and 55.9ºC, respectively.The results demonstrated that combining GCSflour improved the rheological properties and quality of the flour dough. This dough can be used to manufacture bread and other bakery goods because to its high nutritional value and beneficial benefits on human health.

INTRODUCTION

The food industry in the process of developing new food products according to the demands of the consumer for improved quality; this is also a demand of the hour, to produce food products with health benefits to counteract increased incidences of non-communicable diseases all over the world (Oomah and Mazza, 1998). The bakery industry is among the few processed food segments whose production has been increasing steadily in the country in the last couple of years. There is growing demands for wheat based products in India and it is estimated that the Indian bakery market size reached US$ 11.3 Billion in 2022. Looking forward, the analyst expects the market to reach US$ 21.2 Billion by 2028, exhibiting a CAGR of 11.06% during 2022-2028. Bread incorporated with other functional compounds is on raise due to the demand by public for need of health and nutrition. Breads blended with garlic, multigrain and cereals are available in market.

Garden cress, (*Lepidiumsativum Linn)* an annual herb growing as a weed in and around cultivated fields throughout India commonly known in Sanskrit as "*Chandrashoor"* in various Ayurvedic texts of medieval India, It is highly reputed for various therapeutic properties and is prescribed in cases of cough, diarrhoea and also used as a tonic. The same text mentions it as one of the four ingredients of a compound substance called *caturbija*, which indicates that especially the seeds were esteemed for their medicinal properties. Doke and Guha. (2014) Hence this research was undertaken to study the rheological properties of bread dough blended with GCSflour with two different pre treatments.

MATERIALS AND METHODS

Materials

Refined wheat flour, garden cress seed (GCS)was procured from local market in prayagraj. GCS flour were obtained with pretreatment i.e.allowed for germination (took 42 to 48 Hrs), untreated i.e. powdered and roasted. After flour was prepared, flours were fortified according to 2%,4% and 6% ratio with refined wheat flour and this portion was kept constant.

Methods

Farinograph test

To determine the rheological qualities of the flour, the resistance of the dough to the action of the paddles for dough mixing measured using a Farinograph. A 300 g sample of flour with 13.2% moisture content was weighed and put to the accompanying farinograph mixing bowl. This flour was been mixed with water dispensed from a burette. The flour was blended with 2 /100 g salt, and the test was carried out using a 300 g Brabender Farinograph (Brabender GmbH & Co. KG, Germany) in compliance with the standard protocol (AACC, 2000). The Farinogram characteristics comprised the amount of water required to produce a consistency of water absorption for 500 BU (Brabender unit), the length of time required to achieve that consistency (development time), the amount of time the dough retained at that consistency (dough stability time), and the amount of softening which occurred after 7 minutes.

Extensiograph test

An Extensograph measures the stretching properties of dough, which include extensibility and resistance to extension, through determining the force required to extend the dough with a hook until it breaks. The characteristics of bread dough incorporated withgerminated, roasted and powderedflour were investigated in this study making use of an Extensograph-E (Brabender GmbH & Co. KG). This provided information on the energy value (area under the curve, cm2), the resistance to extension (R, BU), the dough extensibility (E, mm), and the R/E value at 30, 60, and 90 minutes in accordance with the standard procedure (AACC, 2000).Brabender extensiograph was used wtih 300gm of sample was placed in farinograph for 10 min for dough prepration and provung time of dough was 30, 60 and 90 minutes respectively. Extensiograph helps to asses the parameters like resistance to extension, extensibility, energy(cm^2), maximum(BU), Ratio number and ratio number (max)

Amylograph test

The Amylograph test is another popular method for determining the quality of dough, particularly bread dough. It evaluates the viscosity of a dough sample as it is heated and cooled, providing information about the gelatinization qualities and starch quality of the dough. 80 gram sample of flour was mixed with 450 ml of water and heated in special Amylograph equipment. The Amylograph (Brabender GmbH & Co. KG, Germany) measured the viscosity of the dough as it heats and cools, and the resulting graph depicts the viscosity variations over time. In the amylograph test, gelatinization refers to the process through which starch granules absorb water and swell, causing the starch paste to thicken and gel. The amylograph measures the commencement of gelatinization, which is used to judge flour quality. The gelatinization temperature in the amylograph is the temperature at which the viscosity of the starch paste begins to increase significantly due to water absorption and swelling of the starch granules. This temperature is a critical parameter in the amylograph test since it indicates the gelatinization capabilities of the flour. Lower gelatinization temperature flours have better gelatinization properties, whereas higher gelatinization temperature flours may be limited in their ability to absorb water and form a stable starch paste. Lower temperatures are preferred for items requiring good moisture absorption and a stable starch gel, whereas higher temperatures are preferred for products requiring great moisture absorption and a stable starch gel.

Statistical Evaluation

Each analysis was carried out in triplicates. Tukey's test was used to determine the statistical significance. It is a statistical test and a single-step multiple comparison process. It was used to identify the means that differ significantly from one another.

Results and Discussion

Farinographic Characteristics

A farinograph is an appropriate tool for determining the ability of the dough to mix. It has also been used to evaluate the dough properties of flours in the bakery and milling industries. Characterising the rheological properties of dough is an efficient technique to foresee processing behaviour and maintain food quality. The rheological characteristics exhibited by flour during mixing at 13.2 % moisture content is tabulated in table 1. Water absorption for 500 B.U. was 64.1% and water absorption (14%) was 63.2% for T_0 sample, The water absorption properties of the flour blend vary with the addition of GCS flour fromT10G2 to T18R6. Overall water absorption for 500 B.U. is 69.7% to 71.6% and overall water absorption for (14%) is 68.8 to 70.7% Water absorption represents the amount of water required to produce normal dough with a consistency of 500 B.U. at the peak of the curve. The centre of the curve will not approach the 500 B.U. line with much additional water, but it will cross it with very little.

Trejo-Gonzallez et al., (2014) showed slightly similar rheological results when wheat flour was replaced with 10- 20 % sweet potato flour. Mucilage present in the GCS acts as hydrocolloid and it can absorb many times water than its weight Rosell et al.,(2001). Therefore, the increased water absorption observed.

The development time(DDT) is the stretch of time that occurs between the first water addition and the point at which the dough reaches its maximum torque. During this stage of mixing, the water hydrates the flour's constituent parts, causing the dough to form showed om table 1. The development period changes with the replacement of GCS flour, and it has an effect on flour blend formulations.(DDT) for GCS included dough was lower than the control (5.7 min), i.e. (5.2 min) in T12G6, T15U6, T18R6 due to an increase in GCS flour content, the germinates gsc integrated flour blend demonstrated the shortest time across all samples.The longest time measured was T16R (6.5) min, with gcs roasted 2%. DDT is 5.7, 5.4, 5.3, 5.2, 6.2, 5.2, 5.7, 6.5, 5.8, 5.2 min for samples T0, T10G, T11G, T12G, T13U, T14U, T15U, T16R, T17R, T18R, respectively.According to Awolu et al. (2016), the development time of the dough is influenced by the rate of water absorption of the flour. When the water absorption of the samples increased so did the development time.

Dough stability time (DST)decreases in germinated and powderd/ untreated garden cress sample dough but increases in roasted GCS sample dough. From the table 1. it is evidant that,GCS incorporated dough showed minimum DST than control T0 (6.8 min) at T15 (4.2 min), and highest DST was recorded in roasted garden cress incorporated bread dough at T16 (7.0 min).The stability rating indicates the strength of our dough, with larger values indicating stronger dough. Dough containing hydroxypropylmethylcellulose (HPMC) or k-carrageenan was less stable than the control. In contrast, the addition of alginate or xanthan resulted in the strongest dough, with great stability and low MTI. Rosell et al., (2001)

The mixing tolerance index (MTI) is the change in brabender units recorded 5 minutes after the curve's peak is reached. As seen in Table 1, tolaranceIndex (BU)of bread dough ranged between, 73 to 113 BU tolerance index is higher for Tolerance index was higher for GCS germinate, according to Table 1. With the inclusion of GCS, MTI climbed from sample T10G2 to T12G6, or from 79 to 113 BU. According to Vernaza (2011), adding green banana flour resulted in a considerable rise in MTI. This is because the inclusion of green banana flour reduces the tolerance of other flours to mechanical action during long mixing times. The MTI value of flour should be greater than 50 B.U. since it signals more obstacles, less mechanical manipulation, and a distinct dough composition. While investigating the effect of dietary fibres on the farinographic properties of control wheat flour, Almeida et al. (2007) stated an increase in MTI values, concluding that fibre enrichment and gluten dilution reduce dough tolerance to mixing.

The breakdown time was determined by calculating how long it takes for the torque to diminish by a given percentage from its peak value. From table 1, sample T16R2 has the highest breakdown time of 8.8 minutes and T13U2 has the shortest breakdown time of 8.0 minutes, whereas germinated GCS samples had the shortest breakdown times of 7.0, 6.6, and 6.6 minutes for T10G2, T11G4, and T12G6, respectively.A longer breakdown time suggests a stronger, more stable dough, whereas a shorter breakdown time indicates a weaker, less stable dough.According to Iqbal et al., (2022) red rice flour replacement had no effect on the composites' dough stability. While the substitution at 15% increased the MTI of the composite dough and decreased the TBD (time to breakdown).

The Brabender TM Company created a popular indication known as the farinograph quality number. The farinograph quality number (FQM) was higher for samples T13U2 (80) and T16R2 (88) in relation to breakdown time as shown inTable 1, whereas germinated GCS samples had the lowest FQN of for, T11G4 (66), and T12G6 (66), respectively.The farinograph quality number (FQN) summarises flour quality in a single value weak flour has a low FQN, whereas stronger wheat samples have a higher FQN. Rather than calculating many indicators in farinograph tests, this single figure can be used to report the quality of flour or flour blends, identifying the final utilisation purpose for the creation of various types of cereal goods. To put it simply, the FQN might be understood as the extended dough stability. However, in terms of practical implementation, the aforementioned feature has yet to find a home. Nonetheless, Fu et al. (2008) demonstrated a strong link between this measure and the other farinograph parameters. As previously stated, there is a clear relationship between the FQN and the quality of flour samples.

Table 1Farinographic investigations of GCS infused bread dough

Sample	Moisture content	Water Absorption 500 (BU)	Water Absorption (14%)	Devolopment Time (min)	Stability (min)	Tolarance Index (BU)	Time to breakdown (min)	Farinograph Quality number
T_0	13.2	64.1±0.14^a	63.2±0.69^a	5.7±0.24^b	6.8±0.32^a	74±0.47^a	7.8±0.27^a	78±0.27^a
T_{10G2}	13.2	69.7±0.31^b	68.8±0.23^b	5.4±0.25^b	5.8±0.67^b	79±0.65^a	7.3±0.41^a	73±0.41^a
T_{11G4}	13.2	70.2±0.54^b	69.3±0.55^b	5.3±0.35^b	5.2±0.35^b	100±0.35^c	6.6±0.93^b	66±0.93^b
T_{12G6}	13.2	70.9±0.29^b	70.0±0.27^c	5.2±0.44^a	4.2±0.25^c	113±0.61^c	6.6±0.45^b	66±0.45^b
T_{13U2}	13.2	70.5±0.75^b	69.6±0.32^b	6.2±0.69^c	6.0±0.65^a	76±0.31^a	8.0±0.17^c	80±0.17^c
T_{14U4}	13.2	71.5±0.24^c	70.6±0.92^c	5.7±0.45^b	4.4±0.30^c	104±0.67^c	7.0±0.67^a	70±0.67^a
T_{15U6}	13.2	71.6±0.85^c	70.7±0.46^c	5.2±0.32^a	4.2±0.46^c	88±0.20^b	7.0±0.24^a	70±0.24^a
T_{16R2}	13.2	70.5±0.41^b	69.6±0.45^b	6.5±0.64^c	7.0±0.80^a	60±0.95^a	8.8±0.87^c	88±0.87^c
T_{17R4}	13.2	70.5±0.45^b	69.2±0.25^b	5.8±0.57^b	5.7±0.44^b	83±0.74^b	7.3±0.47^a	73±0.47^a
T_{18R6}	13.2	71.6±0.25^c	70.7±0.53^c	5.2±0.64^a	5.3±0.23^b	73±0.15^a	7.4±0.98^a	74±0.98^a

(*$_G$ = Germinated, $_U$ = Untreated/powdered, $_R$ = Roasted, BU = Brabender unit. Different letter in each column a,b,c indicates a significant difference $p < 0.05$).

Extensiographic characterstics

Extensibility is a sign of good dough handling abilities since it is an unaxial load extension curve of the dough test piece subjected to measured stretching of the dough. Extensograph study provides information on the viscoelastic behaviour of dough and evaluates its extensibility and stretching resistance. Dough with desirable qualities is produced by combining good resistance with good flexibility. The extensograph (Brabender, Duisburg, Germany) was used to assess the rheological parameters of the dough samples, including their resistance to extension (BU), extensibility (mm), and maximum energy required for dough extension. The ratio number can be calculated using a variety of factors.

Table 2 shows the results ofextensographic measurements ofthe samples. This extensogram shows the curves at 30, 60, and 90 minutes of proving time. For samples T0, the area beneath the curve, or energy value (cm^2), ranged from

57 to 67 cm2. In all samples, the energy area decreases as the proving time increases.Dough energy, defined as the area under the extensogram, represents the energy required to stretch the dough to rip it or the mechanical work element in the dough; it is a good measure of the bakery's technological potential (in bakers' vernacular, flour strength; Balestra, 2009).The increasing energy consumption could be attributed to increases in dough extensibility

T11 had the highest resistance to extension, 387 BU, at a resting duration of 30 minutes.It is greater for sample T14, with values of 380, 350, and 365BU at 30 minutes, 60 minutes, and 90 minutes of proving time, respectively. With respect to all proving times indicated, the resistance to extension increased as gsc rose.The ratio number (R/E) is a complete indicator of flour extensibility and resistance, with a higher value indicating greater resistance and lower extensibility. The smaller the expansion, the harder the dough.Dough tension enhancement resulted in increased water- and gas-holding capacity of dough, which had a significant influence on reducing hardness and increasing bread freshness. The aforementioned observation is not accordance with the findings of Naghavi et al. (2011).who studied the substitution of wheat flour by PLP, too. The extensograph tests for different doughs containing amaranth were not greatly affected by adding amaranth meal. Concluded, the amaranth meal seemed to have an improvement nature like strong wheat flour Sharoba et al., (2009). `Table 2 shows that the ratio number for all samples ranged between 1.5 and 3.6. The ratio number decreased at 60 minutes and then climbed again at 90 minutes of proving time in samples T0 to T18.

Table 2 Extensographic investigations of GCS infused bread dough

Sample	**Proving Time (min)**	**Energy (cm^2)**	**Ressistance to extension (BU)**	**Extensibility (mm)**	**Extensibility Maximum (BU)**	**Ratio number**	**Ratio number max**
T_0	30	67 ± 0.25^a	316 ± 0.15^a	114 ± 0.47^a	344 ± 0.41^a	2.2 ± 0.10^a	2.4
	60	64 ± 0.62^a	312 ± 0.62^a	138 ± 0.40^b	330 ± 0.52^a	2.3 ± 0.15^a	2.4
	90	57 ± 0.15^b	298 ± 0.24^a	130 ± 0.25^b	306 ± 0.65^a	2.3 ± 0.35^a	2.4
T_{10G2}	30	59 ± 0.74^b	311 ± 0.74^a	131 ± 0.87^b	314 ± 0.62^a	2.4 ± 0.41^a	2.4
	60	57 ± 0.63^b	289 ± 0.47^b	130 ± 0.62^b	291 ± 0.20^a	2.2 ± 0.74^a	2.2
	90	58 ± 0.45^b	287 ± 0.45^b	134 ± 0.71^b	290 ± 0.54^a	2.1 ± 0.62^a	2.2
T_{11G4}	30	75 ± 0.27^a	387 ± 0.57^c	145 ± 0.23^b	389 ± 0.63^b	2.7 ± 0.55^a	2.7
	60	58 ± 0.32^b	328 ± 0.95^c	127 ± 0.52^a	345 ± 0.15^a	2.6 ± 0.74^a	2.7
	90	49 ± 0.89^c	276 ± 0.68^b	124 ± 0.14^a	303 ± 0.35^a	2.2 ± 0.12^a	2.4
T_{12G6}	30	53 ± 0.45^b	293 ± 0.62^b	126 ± 0.77^a	322 ± 0.17^a	2.3 ± 0.20^a	2.5
	60	48 ± 0.43^c	270 ± 0.27^b	124 ± 0.85^a	308 ± 0.65^a	2.2 ± 0.12^a	2.5
	90	44 ± 0.12^c	248 ± 0.60^b	121 ± 0.62^a	296 ± 0.30^a	2.0 ± 0.32^a	2.4
T_{13U2}	30	56 ± 0.78^b	314 ± 0.36^a	127 ± 0.36^a	315 ± 0.78^a	2.5 ± 0.54^a	2.5
	60	55 ± 0.95^b	286 ± 0.10^b	131 ± 0.87^b	286 ± 0.32^a	2.2 ± 0.74^a	2.2
	90	50 ± 0.35^c	261 ± 0.19^b	130 ± 0.15^b	261 ± 0.54^c	2.0 ± 0.15^a	2.0
T_{14U4}	30	62 ± 0.42^a	380 ± 0.45^c	121 ± 0.63^a	406 ± 0.25^b	3.1 ± 0.41^b	3.3
	60	55 ± 0.48^b	350 ± 0.32^c	114 ± 0.40^a	388 ± 0.10^b	3.1 ± 0.17^b	3.4
	90	58 ± 0.26^b	365 ± 0.74^c	107 ± 0.17^a	423 ± 0.62^b	3.4 ± 0.41^b	4.0
T_{15U6}	30	47 ± 0.48^c	281 ± 0.75^b	118 ± 0.47^a	325 ± 0.30^a	2.4 ± 0.13^a	2.8
	60	45 ± 0.75^c	302 ± 0.30^a	109 ± 0.25^c	357 ± 0.32^b	2.8 ± 0.62^a	3.3
	90	43 ± 0.12^c	287 ± 0.47^b	98 ± 0.91^c	379 ± 0.62^b	2.9 ± 0.30^a	3.9
T_{16R2}	30	56 ± 0.14^b	223 ± 0.31^b	153 ± 0.30^b	245 ± 0.36^c	1.5 ± 0.14^c	1.6
	60	52 ± 0.35^b	244 ± 0.41^b	142 ± 0.44^b	260 ± 0.10^c	1.7 ± 0.10^c	1.8
	90	46 ± 0.74^c	222 ± 0.32^b	134 ± 0.36^b	229 ± 0.31^c	1.7 ± 0.13^c	1.7

T_{17R4}	30	57±0.62[b]	342±0.14[c]	135±0.75[b]	354±0.45[b]	2.5±0.23[a]	2.6
	60	44±0.32[c]	254±0.69[b]	120±0.41[a]	274±0.30[c]	2.1±0.45[a]	2.3
	90	58±0.45[b]	347±0.67[c]	121±0.68[a]	353±0.41[b]	2.9±0.20[a]	2.9
T_{18R6}	30	53±0.26[b]	350±0.58[c]	107±0.21[a]	389±0.31[b]	3.3±0.32[b]	3.6
	60	48±0.10[c]	328±0.36[c]	106±0.85[c]	375±0.74[b]	3.1±0.21[b]	3.5
	90	55±0.32[b]	366±0.74[c]	103±0.14[c]	406±0.16[b]	3.6±0.41[b]	3.9

(*$_G$ = Germinated, $_U$ = Untreated/powdered, $_R$ = Roasted, BU = Brabender unit. Different letters a,b,c in each column for each dough resting time indicates a significant difference ($p < 0.05$).

Amylographic characteristics

The findings of the amylographic test were produced by the Brabender Amylograph E equipment in the form of an amylogram featuring a curve representing the fluctuation of the viscosity of the flour gel created against time and temperature in amylographic units (AU). Table 3 displays the values of the gel's important rheological parameters. It evaluates the viscosity of a dough sample as it is heated and cooled, providing information about the gelatinization qualities and starch quality of the dough. . In the works mentioned, a standard amylographic curve was plotted with the peak viscosity under the heating of slurry. The peak viscosity of crumb decreased continuously during the post-baking storage of bread and was also decreased by additions of malt to the bread formula. Some authors obtained seemingly contradicting results when either decreases (Yasunaga et al. 1968) or increases (Xu 1985) in viscosity with storage times.

The amylograph accurately measures the gelatinization of starch and its enzyme activity in bread flour. Gelatinization begins at 59.5 for T0 (control) sample. amylographic parameters of the amylogram peak maximum, temperature and gel viscosity increased for the dough obtained from mixtures of roasted GCS as well as untreated i.e. powered GCS with refined wheat flour. Peak point obtained by T_{16R} at 59.5 followed by $T_{15U6,}$ $T_{14U4,}$ T_{13U2} at 58.4, 57.1, 55.9ºC respectively begin of gelatinization found lowest for T_{12G6} at 32.9 followed by $T_{11G4,}$ T_{10G2}at 33.5 and 38ºC respectively. Temperature drop in begin of gelatinization for these found due to germination The activity of enzymes involved in starch, lipid, protein, hemicellulose, and phosphate digestion increases rapidly as germination occurs. These hydrolytic enzymes convert complicated food components into simpler ones that the embryo can easily consume and transfer.f. a. guzmán-ortiz et al., (2018)

Table 3 Amylographicinvestigations of GCS infused bread dough

Sample	**Begin of gelatinization (ºC)**	**Gelatinization Temp(ºC)**	**Gelatinization max (AU)**
T_0	59.5±0.27[a]	90.3±0.19[a]	1716±0.17[a]
T_{10G2}	38±0.64[b]	90.8±0.67[a]	2084±0.27[a]
T_{11G4}	33.5±0.37[b]	89.9±0.41[a]	2315±0.86[b]
T_{12G6}	32.9±0.21[b]	89.0±0.52[a]	2524±0.75[c]
T_{13U2}	55.9±0.32[a]	90.6±0.74[a]	2005±0.50[a]
T_{14U4}	57.1±0.78[a]	90.1±0.13[a]	2147±0.96[b]
T_{15U6}	58.4±0.60[a]	89.6±0.64[a]	2253±0.78[b]
T_{16R2}	59.5±0.97[a]	90.3±0.70[a]	1947±0.44[a]

T_{17R4}	54.3 ± 0.45^{a}	90.0 ± 0.42^{a}	2075 ± 0.25^{a}
T_{18R6}	44.3 ± 0.15^{c}	89.6 ± 0.85^{a}	2120 ± 0.76^{b}

(*$_{G}$ = Germinated, $_{U}$ = Untreated/powdered, $_{R}$ = Roasted, BU = Brabender unit. Different letter in each columna,b,c, indicates a significant difference ($p < 0.05$).

CONCLUSION

The effect of combining GCS with refined wheat flour on dough rheological parameters and quality was explored. The inclusion of GCS flour had a substantial effect on dough rheological features as determined by farinograph, extensograph, and amylograph. According to the farinograph analysis, the stability time was between 5.2 and 6.0 minutes compared to the controlled sample.The tolerance index and time to breakdown of dough rose as the amount of GCS flour in the dough increased. However, the inclusion of GCS flour had a higher positive influence on the rheological properties of the dough.According to the extensograph, the inclusion of garden cress flour improves the rheological features and quality of dough by increasing resistance to extension and extensibility values during the 90-minute proving time as compared to the control sample. The data in this study clearly revealed that the inclusion of garden cress flour increased the rheological qualities and quality of the blended flour dough.

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