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Research Article
Quality Assessment of Some Spring Bread Wheat Cultivars

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Abstract

Background and Objective: Wheat products are long known as a pioneer main food, where it considered a calories source along with a considerable nutrients amount. The objective was to explain how the variation of extraction rate affected wheat variety along with its impact on the quality of wheat products. **Materials and Methods:** Several wheat types (Yecora Rojo, Sakha 93, Pavon76, KSU 102 and Sama) were evaluated chemically, rheological and microstructure using farinograph and extensograph. The statistical analysis were done using SPSS 16.0 (at p = 0.05). **Results:** Yecora Rojo was higher in protein, fat and phosphorus, it reached 13.16, 2.66% and 215 mg/100 g, respectively. Sakha 93 was also higher in fiber, calcium and zinc (2.35%, 85 and 4.17 mg/100 g), while Pavon76 was higher in ash (2.0%). Wet gluten content was significantly higher (at p = 0.05) in whole meal wheat flour than in wheat flour 72%. Rheological, whole meal of each wheat type characterized with higher water absorption than its 72% flour but dough stability was declined. Wheat flour 72% of Sama differentiated with its great in rank of arrival time (2.0 min). Resistance to extension of whole meal dough ranged between 600-550 BU, while wheat flour 72% decreased to 510-400 BU. **Conclusion:** The quality of wheat varieties varied according to its type, in comparison between three varieties of wheat, wheat grain cracks and partial disruption of native starch granule which constitute one of the most difficult defects to detect, affect on the quality and value of wheat products. Yecora Rojo, KSU 102, Sama and (Sakha 93) wheat flour could be recommended to use as a durum, hard and soft wheat, respectively.

Key words: Wheat flour, wheat extraction rate, flour characteristics, rheological properties, farinograph, amylograph

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Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Wheat products are long famous as a major staple food, where it is source of calories and contains significant quantities of nutrients i.e. vitamins, minerals and dietary fiber[1]. Whole grains contain a wide range of nutrients and biologically active compounds, i.e. dietary fiber, vitamins, minerals and phytochemical compounds, which may reduce the incidence of various chronic diseases[2].

Wheat flour 72 or 82% is the most extraction rate that used in bakery products. Several investigators studied the possibility of increasing flour yield to reach 100% in several products (Shouk)[3-5]. Wheat variety (soft or hard wheat) as well as the rate of flour milling and particle size, make the differences usually noted in the wheat flour products. On the other hand, whole meal flour have the whole of the product resulted from the milling of cleaned wheat.

The amount of flour derived from wheat after milling is known as the extraction rate[6]. White flour is a refined form with an extraction rate range from 60-75%. More bran characterized the brown flour (extraction rate 85%) and responsible for the dark color, strong flavor and aroma of the final products. Protein content as well as fiber, lipids, minerals and sugars are increase with the rise in exaction rate, on the contrary, the starch decreases[7]. Additionally, gluten strength and water absorption are affected by the extraction rate[8]. As a result, the extraction rate affected markedly the nutritional content of wheat flour based on its rate. According to Matthews and Workman[9] the nutrient level of high extraction rate flour increases directly with increase in flour ash values, however, with lowering the extraction rate, the minerals content is reduced to 30% in comparison to the whole wheat flour and also the concentration of essential nutrients[10].

The quality of the technological properties of wheat varieties is depending on specific parameters i.e. protein content, wet gluten content, gluten strength, extensibility and resistance[11]. Gluten content is one of the most important parameter used to evaluate wheat quality. This study aimed to evaluate some wheat varieties at different extraction rate to identify its technological properties. It was targeted to classify these wheat types depends on characters which help to redirect the application of these varieties.

MATERIALS AND METHODS

Wheat grains varieties:

- Yecora Rojo (Recommended cultivars from USA)
- Sakha 93 (Field Crops Department, Agricultural Research Centre, Ministry of Agriculture, Giza, Egypt)
- Pavon76 (International Maize and Wheat Improvement Center (CIMMYT))
- KSU 102 (Wheat Breeding Program at the Plant Production Department, College of Food and Agriculture Sciences
- Sama (Local strains of Saudi Arabian wheat)

This study was performed in National Research Centre, Cairo, Egypt during spring season of year 2014

Milling: Wheat grains varieties were manually cleaned, tempered to 14% moisture content, then milled using Quadrumat Junior flour mill (Model MLV-202, Switzerland). The obtained flour represent whole flour mill (100% extraction), then sieved to obtain flours of 72% extraction.

Rheological properties: Dough characteristics (water absorption, dough development time, dough stability, weakening and mixing tolerance index) were evaluated according to AACC[12] using farinograph (model No: 81010, Duisburg, Germany). Dough elastic properties (resistance to extension, extensibility, proportional number and energy) were measured according to AACC[12] by using extensograph (Model No: 81010, ©Brabender, Duisburg, Germany). Falling number was determined according to AACC[12]. Viscoamylograph test was carried out according to Kim and d'Appolonia[13]. Wet and dry gluten contents of flour were estimated following the method No. 38-10[12].

Diffraction scanning colorimeter: Thermal properties of wheat varieties flour were measured by using a Shimadzu DSC-50. The heating rate was 10°C min^{-1} and the hold temperature was at 200°C. The melting temperature TM and (H) of the enthalpy was determined from the thermogram.

Starch crystallinity: The crystallinity of starch was evaluated by X-ray diffraction patterns of samples using monochromatic Cuk radiation on a Philips X-ray diffract meter at 35 kv and 15 mA (Central Lab, National Research Centre, Egypt). Lyophilized samples were placed on the 1 cm^2 surface of a glass slide and equilibrated overnight at 91% RH and run at 2-32° (diffraction angle 2θ). The spacing was computed according to Bragg's law[14].

Chemical analysis

Gross chemical composition: Wheat varieties were analyzed for moisture, crude protein (% N×5.71), fat, total ash and crude fiber according to methods described in AOAC[15]. Total

carbohydrates were calculated by the difference (100-(fat+ protein+ash+fibers) on dry weight basis.

Minerals content: Sodium, potassium, phosphorus, calcium, iron, zinc and copper in all raw materials were determined according to AOAC[15].

Statistical analysis: All results were evaluated statistically using analysis of variance (one-way ANOVA) SPSS.16.0, (at $p = 0.05$) according to McClave and Benson[16].

RESULTS AND DISCUSSION

Chemical composition of wheat flour at extraction rate 100 and 72%: Moisture, protein, ether extract, fiber and ash were significantly higher (at $p = 0.05$) in whole meal wheat flour than that found in wheat flour (72% ext.) as shown by the data presented in Table 1. It could be regarded to the presence of higher amounts of bran layer and germ which possessed such components with higher amounts than the other layers, in the whole meal than the 72% extraction one.

Several studies declared that protein, fat and fiber of germ or bran was more than those found in endosperm[7,17]. Consumption of whole wheat increase the benefits of cereal fiber along with the other protective compounds, such as vitamins, minerals, antioxidants, phytosterols, unsaturated fatty acids and lignans[18,19]. Consumption of whole grains was decreased the risk of all-cause mortality and cancer death, cardiovascular disease, diabetes, respiratory disease and other causes[20,21]. On converse, total carbohydrates were significantly less in the former than the latter. In liken study, Yecora Rojo found that whole meal characterized with its high protein and fat, while Sakha 93 was altitude ratio in fiber and Pavon 76 was higher in ash and total carbohydrate.

Minerals content of raw materials and their mixtures: Conventional milling of wheat grains is based on separating the endosperm (which produces white flour when milled) from the bran layers and embryo. The aleurone cells, along with the other bran layers and the embryo, are removed to form the bran fraction. Sodium, potassium, phosphorus, calcium, iron, zinc and cupper contents in whole meal. The bioavailability of minerals in wheat bran only without the flour presence is under discussion related to the foundation of the 'anti-nutrient' phytic acid[22,23]. Wheat flour were significantly higher (at $p = 0.05$) than that found in 72% extraction wheat flour as shown in Table 2. Such results was due to, as previously mentioned, the presence of the higher amounts of such minerals in germ and cover layer, which involved in the whole meal with a higher amounts than in 72% extraction wheat flour. In state of the contrasting mineral content including samples of whole meal variety, Yecora Rojo differentiate with its more content of phosphorus (215 mg/100 g), while Sakha 93 was higher in zinc (4.17 mg/100 g) and Sama was higher in calcium (85 mg/100 g).

Gluten content and falling number of wheat samples: Gluten content is one of the most important factors in wheat varieties, which is responsible for baking strength and quality of wheat flour[24,25]. Therefore, falling number and gluten were estimated in order to characterize the technological properties

Table 1: Chemical composition of whole meal and 72% extraction wheat flour (on dry weight basis)

Wheat varieties (%)	Moisture (%)	Protein (%)	Fat (%)	Fiber (%)	Ash (%)	TC (%)
Yecora Rojo						
100	11.78±0.35^{b}	13.16±0.29^{a}	2.66±0.09^{a}	2.14±0.11^{a}	1.55±0.04	80.49±0.92^{c}
72	11.13±0.18^{b}	12.48±0.46^{ab}	1.42±0.06^{b}	0.40±0.04^{c}	0.56±0.05	85.14±0.86^{a}
Sakha 93						
100	12.17±0.12^{ab}	11.53±0.26^{b}	2.56±0.11^{a}	2.35±0.09^{a}	1.82±0.09	81.74±1.02^{c}
72	11.30±0.22^{b}	10.95±0.08^{c}	1.45±0.03^{b}	0.45±0.02^{c}	0.75±0.05	86.40±1.18^{a}
Pavon76						
100	12.42±0.28^{ab}	11.35±0.41^{b}	1.83±0.05^{ab}	1.50±0.06^{b}	2.00±0.11	83.32±1.00^{b}
72	11.25±0.36^{b}	10.70±0.18^{c}	1.35±0.08^{b}	0.18±0.01^{c}	0.82±0.03	86.95±0.68^{a}
KSU 102						
100	10.31±0.25^{bc}	12.52±0.52^{ab}	2.44±0.07^{a}	1.62±0.10^{b}	1.21±0.07	82.21±0.77^{c}
72	9.86±0.32^{c}	11.48±0.35^{b}	1.92±0.01^{ab}	1.06±0.08^{b}	0.86±0.04	84.68±0.65^{b}
Sama						
100	13.12±0.42^{a}	12.05±0.13^{ab}	2.37±0.02^{a}	2.22±0.16^{a}	1.68±0.09	81.68±0.69^{c}
72	12.18±0.33^{ab}	11.22±0.62^{b}	1.48±0.05^{b}	0.38±0.05^{c}	0.72±0.02	86.20±0.75^{a}
LSD at 5	1.06	1.16	0.86	0.78	1.03	2.06

TC: Total carbohydrates calculated by difference, Each value (an average of three replicates) within the same column, followed by the same letter are not significantly different at <0.05, Each value (an average of three replicates) is followed by the standard deviation

Table 2: Minerals content of whole meal and 72% extraction wheat flour

Wheat varieties (%)	Minerals (mg/100 g) Na	K	P	Ca	Fe	Zn	Cu
Yecora Rojo							
100	140.36±0.96^{b}	65.32±0.96^{a}	215±2.16^{a}	42±0.66^{c}	4. 84±0.65^{a}	2.56±0.16^{bc}	0.36±0.06^{b}
72	130.12±1.32^{c}	45.12±0.63^{b}	182±1.65^{c}	26±0.11^{e}	2.65±0.32^{b}	0.96±0.09^{c}	0.18±0.02^{c}
Sakha 93							
100	133.10±1.14^{c}	32.05±0.39^{c}	190±1.13^{b}	74±0.23^{b}	5.37±0. 53^{a}	4.17±0.14^{a}	0.62±0.03^{a}
72	122.90±1.42^{c}	45.30±0.28^{b}	130±1.06^{d}	67±0.141^{c}	1.53±0.04^{c}	2.20±0.11^{bc}	0.35±0.01^{b}
Pavon76							
100	125.00±1.01^{c}	50.00±0.26^{b}	210±1.85^{a}	65±0.03^{c}	5.22±0.35^{a}	3.16±0.13^{b}	0.65±0.04^{a}
72	110.00±0.86^{d}	35.00±0.45^{c}	170±1.36^{c}	45±0.03^{d}	2.36±0.23^{b}	1.09±0.17^{c}	0.32±0.02^{b}
KSU 102							
100	170.00±1.65^{a}	70.00±077^{a}	200±1.23^{b}	70±0.03^{b}	4.50±0.62^{a}	2.65±0.21^{bc}	0.56±0.01^{ab}
72	135.00±1.03^{c}	43.00±0.61^{b}	165±1.36^{c}	50±0.03^{d}	2.15±0.13^{b}	0.89±0.06^{c}	0.23±0.03^{c}
Sama							
100	180.00±1.96^{a}	68.00±0.69^{a}	180±2.65^{c}	85±0.03^{a}	5.06±0.22^{a}	3.09±0.19^{b}	0.48±0.02^{b}
72	140.00±1.13^{b}	42.00±0.56^{b}	156±1.22^{d}	55±0.03^{d}	1.86±0.18^{c}	1.12±0.11^{c}	0.22±0.01^{c}
LSD at 5	18.25	15.36	15.01	5.62	2.15	1.03	0.22

Each value (an average of three replicates) within the same column, followed by the same letter are not significantly different at <0.05, Each value (an average of three replicates) is followed by the standard deviation

Table 3: Falling number and gluten content of wheat varieties

Wheat varieties (%)	Falling number (sec)	Gluten (%) Wet	Dry
Yecora Rojo			
100	220±2.8	35±0.17^{a}	20.52±0.46
72	302±3.5	33±0.13	19.35±0.32
Sakha 93			
100	267±3.4	29±0.19^{e}	18.00±0.16
72	318±3.6	27±0.28	16.50±0.22
Pavon76			
100	450±2.5	31±0.21^{d}	18.50±0.18
72	484±2.6	28±0.26	17.80±0.14
KSU 102			
100	415±3.2	33±0.32^{b}	19.50±0.21
72	622±2.3	31±0.35	18.30±0.15
Sama			
100	611±3.6	32±0.41^{c}	19.05±0.13
72	680±2.5	29±0.39	18.00±0.22

Each value (an average of three replicates) within the same column, followed by the same letter are not significantly different at <0.05, Each value (an average of three replicates) is followed by the standard deviation

of wheat products and given in Table 3. According to the obtained data, great wet gluten content was significantly higher (at p = 0.05) in whole meal wheat flour than that exist in wheat flour (72% extract.). The finding recorded significant differences between wheat species. In the same parallel way, that the protein content has been elevated to a higher level correlated to the elevation of gluten content[26,27]. The contrasting in wet and dry gluten ingredient of every wheat varieties are reflected by the difference in moisture and exist protein ratio[28].

The present results documented the obtained result of Farooq *et al.*[29]. The previous study noticed significant effect of wheat varieties on wet and dry gluten contents. The highest wet gluten content was found in wheat flour of Yecora Rojo, while KSU 102 and Sama recorded lower ratio. The less gluten content was reached to in Sakha 93. This result announced that Yecora Rojo, KSU 102 and Sama and (Sakha 93) varieties could be used as a hard and soft wheat, respectively. Therefore, it could be recommended to use Yecora Rojo, KSU 102 and Sam in bread and Sakha 93 in biscuit product. The decline in gluten ratio of wheat species may be due to the ecosystem conditions i.e. temperature and genotype differences[30].

Falling number was evaluated to assess α-amylase which expressed as enzyme activity of wheat flour varieties, elevate in falling number means that lower will be enzyme activity. Falling number of 72% extraction wheat flour was significantly higher (at p = 0.05) than that found in whole meal. Falling number of wheat varieties found in the following order, Sama, KSU 102, Pavon76, Sakha 93 and Yecora Rojo as shown in Table 3.

The elevation of enzymatic activity of Sama and KSU 102 wheat species revealed that the starch is destroying very quickly during gelatinization compared to other studied subjects[31]. Furthermore, Zahoor analyzed 44 Pakistani wheat species with a falling number ranged between of 277.83-1065 sec and stated that the variation in falling number values in wheat varieties is due to the variation in moisture and protein ratio[28].

Rheological properties of whole meal and wheat flour's dough: The Rheological methodology is helpful in the research of dough properties and to determined characterization dough. Rheometry assesses most important

Table 4: Farinograph parameters of whole meal and 72% extraction wheat flour

Wheat varieties (%)	Water absorption (%)	Arrival time (min)	Dough development time (min)	Dough stability (min)	Mixing tolerance index (BU)	Dough weakening (BU)
Yecora Rojo						
100	72.0	1.8	4.2	15.0	40	70
72	67.5	1.5	6.0	12.0	50	90
Sakha 93						
100	76.0	1.7	2.5	14.0	50	90
72	69.0	1.2	4.5	11.0	65	120
Pavon76						
100	73.0	2.2	2.0	9.0	25	55
72	66.0	1.5	3.5	6.5	30	70
KSU 102						
100	72.5	1.9	2.5	12.0	30	75
72	65.5	1.6	4.0	8.0	45	95
Sama						
100	72.0	2.5	4.0	12.5	35	90
72	67.0	2.0	6.0	9.0	50	110

Table 5: Extensograph parameters of whole meal and 72% extraction wheat flour

Wheat varieties (%)	Extensibility (E) (mm)	Resistance to extension (R) (BU)	Proportional number (R/E)	Dough energy (cm^2)
Yecora Rojo				
100	120	560	4.66	115
72	110	500	4.55	85
Sakha 93				
100	115	550	4.78	95
72	100	420	4.20	77
Pavon76				
100	140	600	4.29	88
72	120	400	3.33	70
KSU 102				
100	130	560	4.31	83
72	110	510	4.64	75
Sama				
100	110	550	5.00	90
72	90	490	5.44	80

functional properties of flour, i.e. viscosity that related to dough characterization during preparing and up to end product quality[32].

Rheological properties of five wheat varieties were evaluated using farinograph. Water absorption and dough stability of whole meal wheat species are more than wheat flours (72%) probably due to bran particles that presented in whole meal, consequently may intermediate in rapid development of gluten as shown in Table 4. The score of the dough stability are in the same line with those found by Corbellini *et al.*[28]. Arrival time of wheat meal species was found to be at the highest ratio in Sama (2.5 min). Also, wheat flour (72%) of Sama characterized with its more arrival time (2.0 min) compared to wheat flour 72% of other species. The same score noticed in dough stability time of wheat meal and wheat flour 72% of the five studied varieties. Dough development time and mixing tolerance index of whole meal decline compared to wheat flour 72% as influenced by bran fiber. The above results are in agreement with previous studies showed a decline in dough stability with increasing in arrival time and water absorption as flour extraction elevate[3,33].

The extensibility of wheat varieties was assessed by extensograph, whole meal dough were lower values than wheat flour dough 72% values as shown in Table 5. This trend observed in all species of wheat types. Resistance to extension of the whole meal dough varieties ranged between 600-550 BU, while it was reduced in wheat flour 72% as indicated in Table 5. The same findings were reported by Shouk[3], Mousa *et al.*[34] and Kamil *et al.*[35], who reported that flour extraction elevate extensibility but resistance to extension reduced. Moreover, Table 5 showed that, dough energy of wheat type 72% induced to be ranged between (85-70 cm^2), while it's whole meal declined 120-85 cm^2. This score could lead to the higher component of fiber in whole meal than wheat flour 72% or by reduce ratio of (dilution) gluten with fiber[36].

The viscosity of a flour water suspension was evaluated using amylograph by a change in the temperature is

increased at a steady rate. The top of the amylogram peak is indicate to the gelatinization properties of the starch and the a-amylase activity[37].

The rheological properties of wheat varieties were evaluated by heat of transition, maximum viscosity and temperature of maximum viscosity as presented in Table 6. Data reported that wheat flour value ranged between (55.5-66°C), (75-93°C) and (450-850 BU) for heat of transition and maximum viscosity, respectively. The transition temperatures and temperature of maximum viscosity were significantly higher (at p = 0.05) of whole meal wheat flour than that found in wheat flour (72% extract), while the maximum viscosity was significantly lower of whole meal wheat flour (100% extraction) than that found in wheat flour (72% extract).

Thermal properties of wheat varieties: The differential scanning colorimeter (DSC) of Yecora Rojo, Sakha 93, Pavon76, KSU 102 and Sama as shown in Fig. 1(a-j). The overall gelatinization temperature of the flour samples were 72.63, 3.23, 61.50, 10.63 and 38.74 J g^{-1} in whole meal of Yecora Rojo, Sakha 93, Pavon76, KSU 102 and Sama, while in 72% extraction of same varieties were 45.56, 8.50, 45.26, 52.38 and 21.63 J g^{-1}, respectively. Lowest H enthalpy was found in Sakha 93 that could be due to the enthalpy of amylase lipid complex formulate during induce temperature. It is well known that starch gelatinization is affected by the limit of milling and the ratio of non-starch lipids presented in sample Champagne *et al.*[38] and Hussein *et al.*[5].

Effect of extract rate on starch crystallinity: The crystalline raw starch granules of wheat type changes with different extractions are estimated by X-ray technique. Crystal form, extent of amylopectin branching and proportion of amylose and amylopectin, characterize starch granules[36], as a result, X-ray diffraction patterns of such granules are subsequently varied. According to X-ray diffraction data, the structure of starch can be arranged into four types, A, B, C and V[39].

X-ray diffractograms of different wheat varieties: X-ray diffraction trace of Yecora Rojo, Sakha 93, Pavon 76, KSU 102 and Sama (100% extraction). Sharp diffraction peaks around 2θ value of 100, 100, 95.76, 100 and 42.26% according to d-spacing of about 2.36, 2.03, 2.039, 2.029 and 2.03A respectively as shown in Fig. 2(a-j). This style closely matches reported values of A-type cereal starches[39]. The diffractogram of extraction 72% of whole samples (Fig. 2) illustrate similar peaks with some shifting. Partially disruption with a less

Table 6: Viscoamylograph parameters of whole meal and 72% extraction wheat flour

Sample (%)	Transition temp (°C)	Temp. at maximum viscosity (°C)	Maximum viscosity (BU)
Yecora Rojo			
100	66	89	450
72	60.5	85	650
Sakha 93			
100	60	93	600
72	57.5	90	850
Pavon76			
100	62	90	480
72	55.5	87	580
KSU 102			
100	61	88	720
72	57	85.5	850
Sama			
100	63	82	510
72	57	75	600

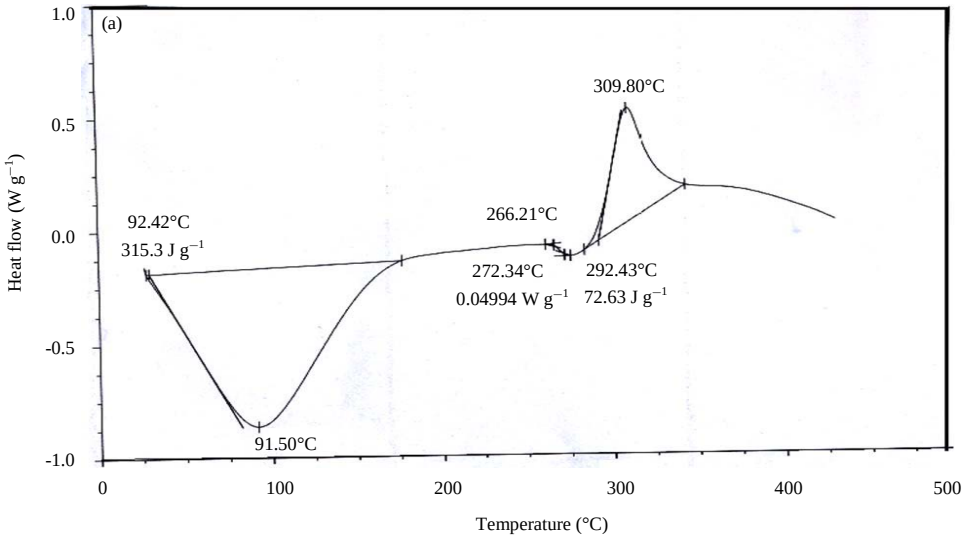


Fig. 1(a-j): Continued

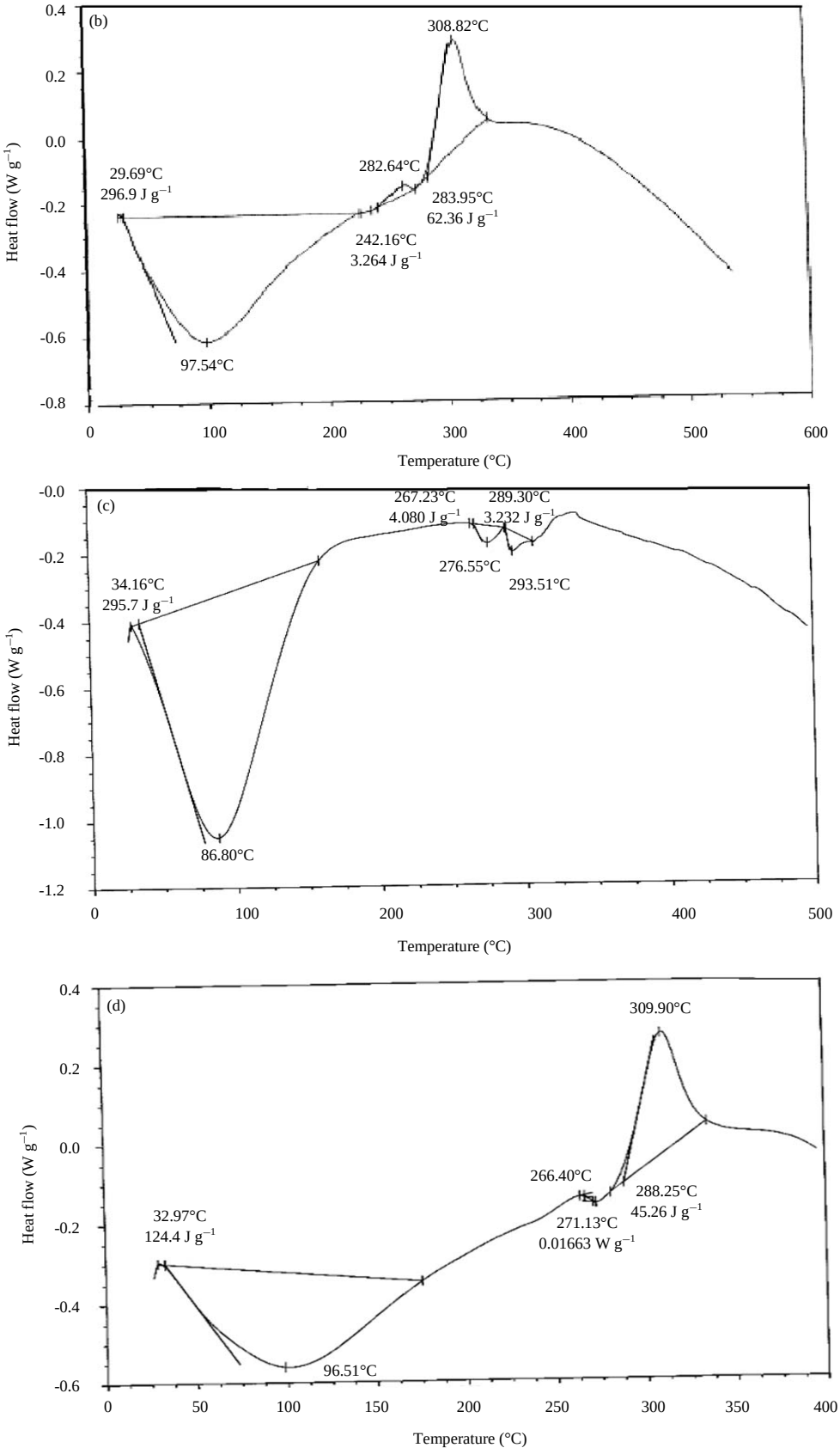
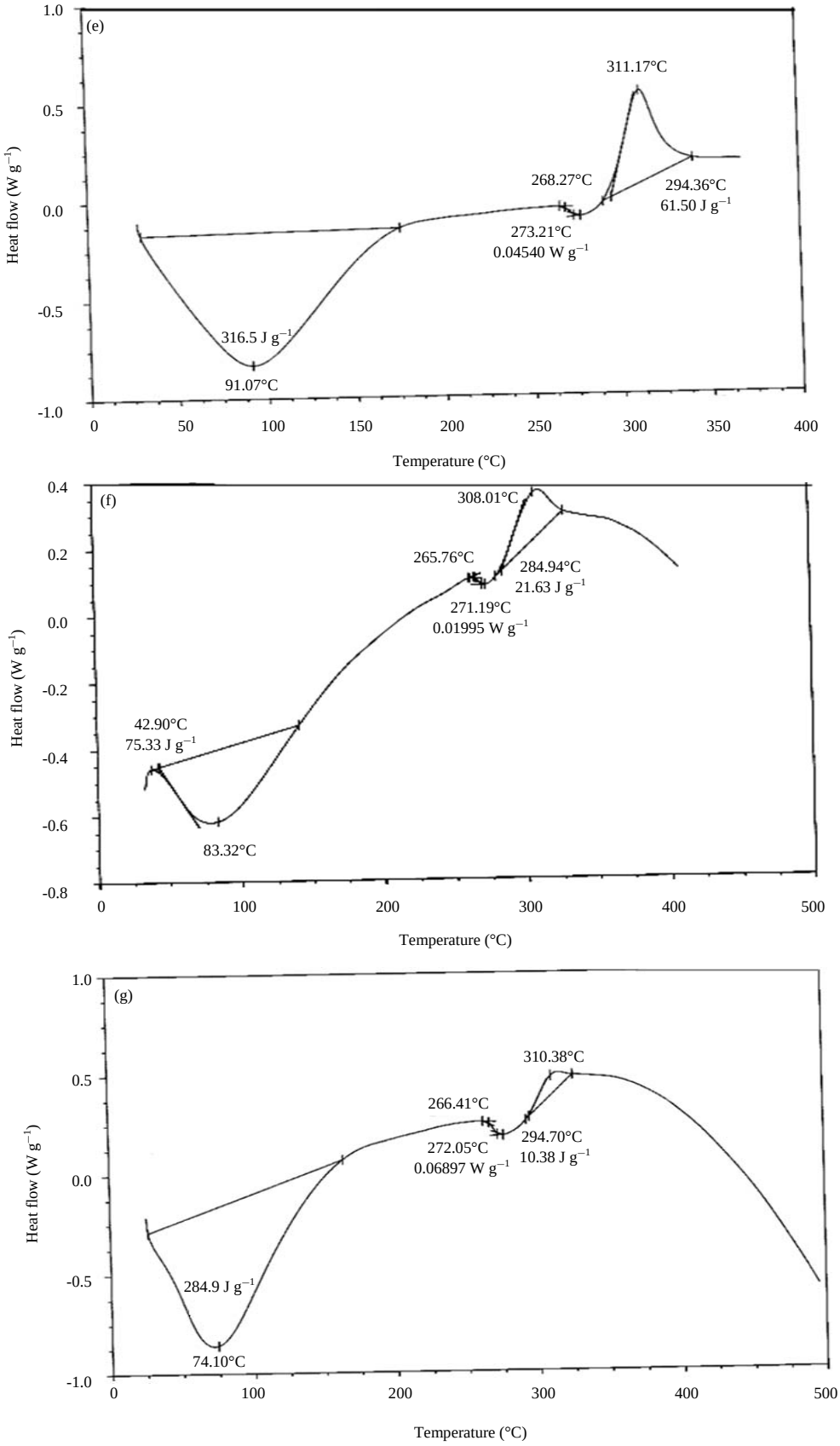


Fig. 1(a-j): Continued



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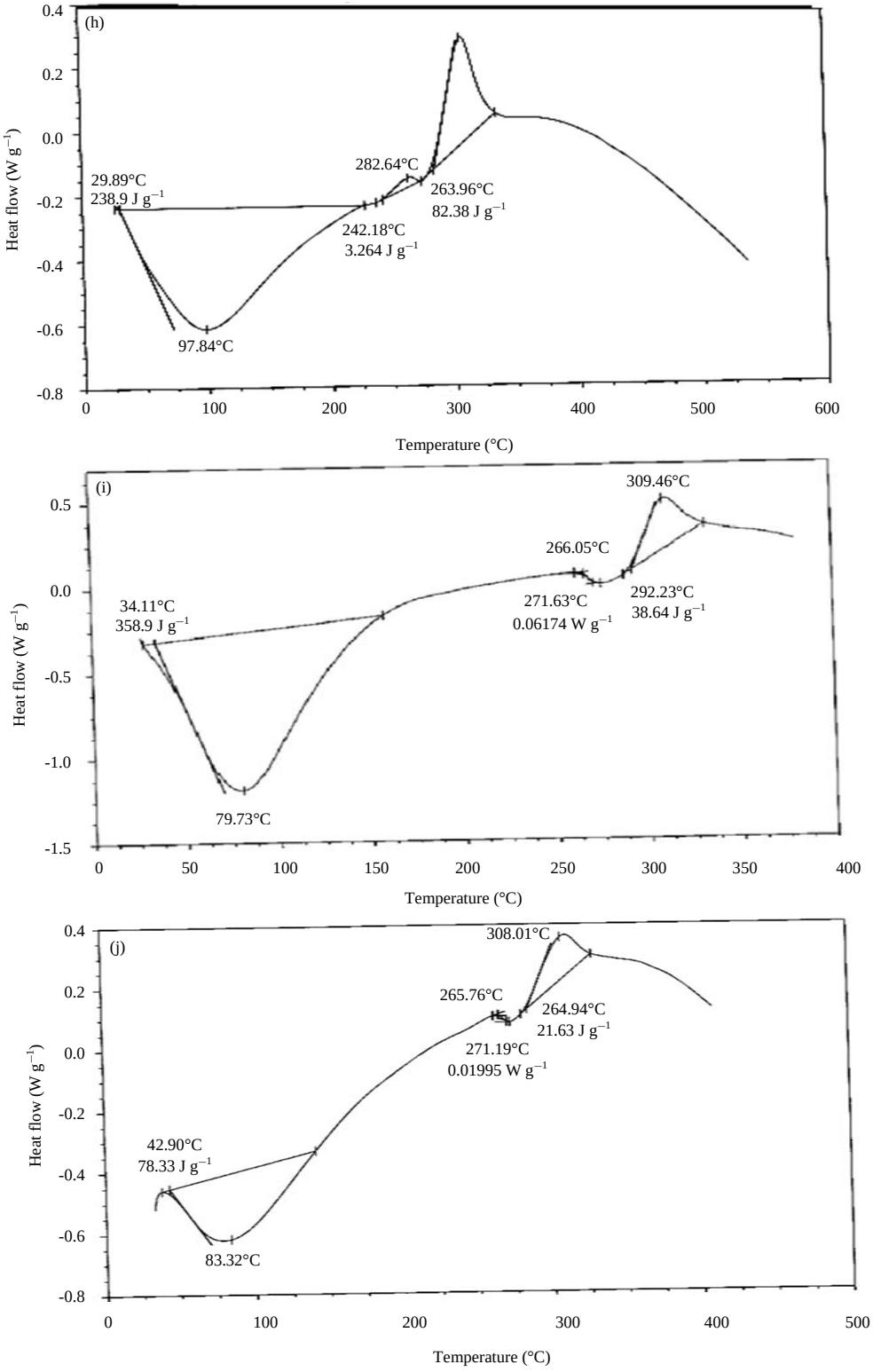

Fig. 1(a-j): DSC of wheat varieties with different extraction, (a) Yecora Rojo (100% extraction), (b) Yecora Rojo (72% extraction), (c) Sakha 93 (100% extraction), (d) Sakha 93 (72% extraction), (e) Pavon 76 (100% extraction), (f) Pavon 76 (72% extraction), (g) KSU 102 (100% extraction), (h) KSU 102 (72% extraction), (i) Sama (100% extraction) and (j) Sama (72% extraction)

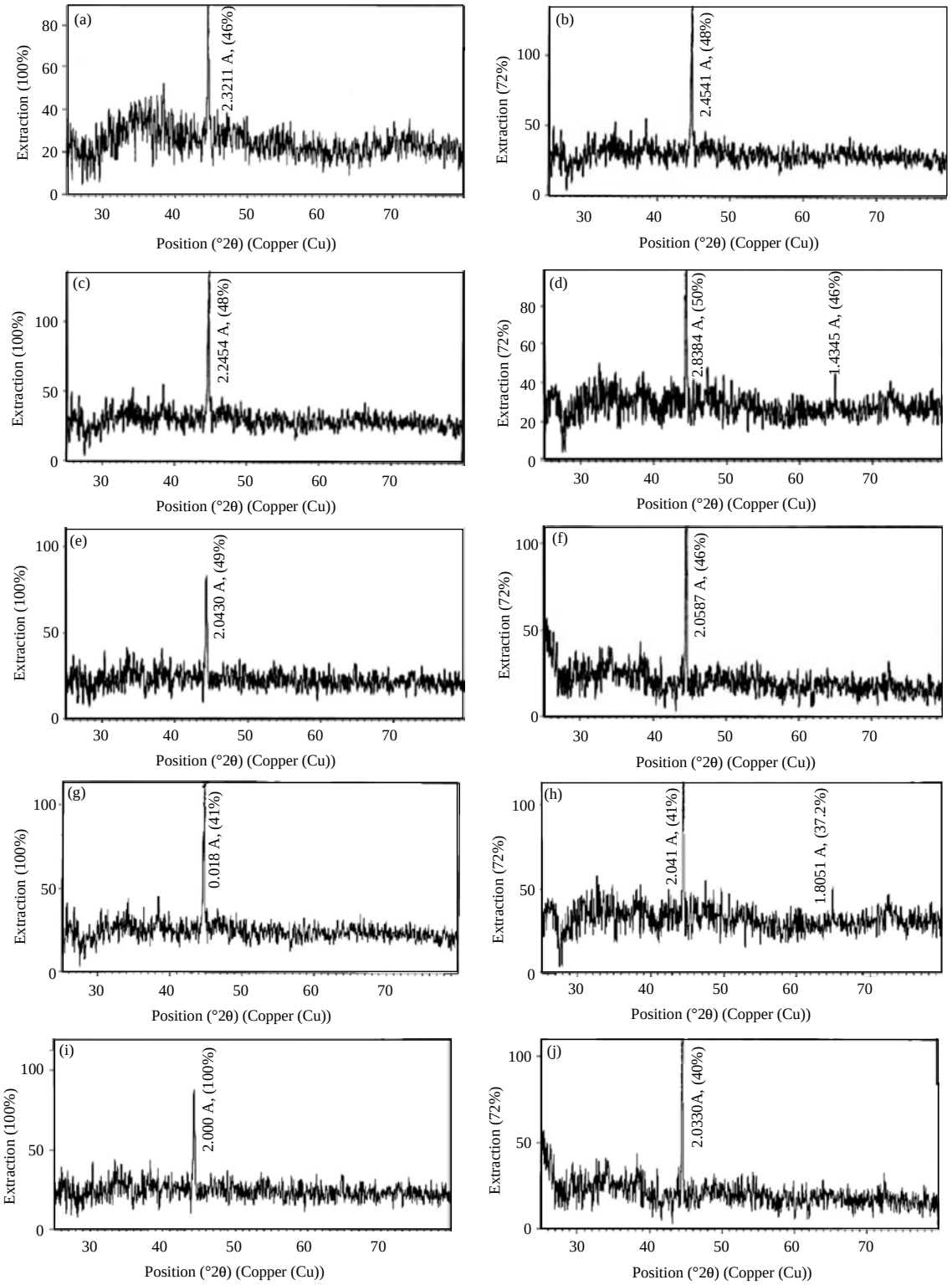

Fig. 2(a-j): X-ray diffractograms of wheat varieties with different extraction, (a-b) Yecora Rojo wheat variety (100% extraction and 72% extraction), (c-d) Sakha 93 wheat variety (100% extraction and 72% extraction), (e-f) Pavon 76 wheat variety (100% extraction and 72% extraction), (g-h) KSU 102 wheat variety (100% extraction and 72% extraction) and (i-j) Sama wheat variety (100% extraction and 72% extraction)

A: D spacing, (%) is the relative intensity value, X-axis: Count

organized X-ray pattern along could be noted in the diffractogram of native starch (Fig. 2), with a development of diffractogram peak at about 2.9 Å (35 Å d-spacing value), which distinguished v-type starch[37]. Blends 2 to blends 5 displayed another amorphous X-ray pattern with a peak around 5.9-2.6 Å. With respect to the above findings, the material exhibits the properties of a liquid rather than a rigid Chakraverty and Kaleemulla[40]. The location of this peak was slightly displaced from the strong 4.4 Å peak characteristic of the v-type amylose-lipid complex pattern[14].

CONCLUSION

X-ray diffraction detect successfully wheat grain cracks and partial disruption of native starch granule, that constitute one of the most difficult defects to detect, affecting on the quality and value of wheat products. On the other hand, DSC could be used to identify wheat type (durum, hard or soft) or gelatinization temperature of the flour samples. Furthermore, rheological properties, gluten content of wheat species and falling number suggested using Yecora Rojo; KSU 102 and Sam in bread and Sakha 93 in biscuit product.

SIGNIFICANCE STATEMENT

This study help the researchers to uncover the critical areas of differentiation of wheat varieties on quality characters of the flour product that many researchers were need to explore. Depending on the analysis and the differentiation characters that were explored in this study, the wheat variety can be classified as pasta variety, that using in pasta processing, or bread variety and patisserie variety. Thus, new theory developed on making a relation between the variety and the quality characters. Also, it will help to redirect the wheat flour for the suitable application uses.

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